MathsWatch

GCSE Double Award Syllabus (WJEC)

Worksheets
Questions and Answers Interleaved

Grades G to A*

Grade G	Grade F	Grade E	Grade D
Grade C	Grade B	Grade A	Grade A*

Instructions for use

Click on **Grade G** to be taken to the list of clips for Grade G.

Click on **Names of Angles. . . . . . 6** to be taken to clip 6's worksheet.

Click on

©MathsWatch	Clip 6
Grade G questions	

to be taken back to the list of clips for Grade G.

![MathsWatch]

Take me to...

Grade G   Foundation

Take me to...

Grade G	Grade F	Grade E	Grade D

Grade C	Grade B	Grade A	Grade A*

Grade F	Foundation

Take me to...

Grade G	Grade F	Grade E	Grade D

Grade C	Grade B	Grade A	Grade A*

Grade E   Foundation

![MathsWatch]

Take me to...

Grade G   Grade F   Grade E   Grade D

Grade C   Grade B   Grade A   Grade A*

Grade D   Foundation and Higher

MathsWatch

Take me to...

Grade D   Foundation and Higher

MathsWatch

Take me to...

Grade G   Grade F   Grade E   Grade D

Grade C   Grade B   Grade A   Grade A*

Grade C   Foundation and Higher

Take me to...

Grade C   Foundation and Higher

MathsWatch

Take me to...

Grade G	Grade F	Grade E	Grade D
Grade C	Grade B	Grade A	Grade A*

Grade B   Higher

Take me to...

Grade G	Grade F	Grade E	Grade D

Grade C	Grade B	Grade A	Grade A*

Grade A	Grade A*	Higher

Integers and Even/Odd Numbers

1) Here is a list of numbers.   7   50   0   –4   1.2

     Circle the number in the list that is **not** an integer.

2) Write down all the odd numbers between 0 and 14.

3) Here are some numbers.   3   7

     Circle **all** the even numbers.   140

                             8   1   42

4) Here are some numbers.   6   9

     Circle **all** the odd numbers.   150

                         23   71   48

5) Write down all the even numbers between 15 and 25.

6) What is the next odd number after 59?

7) What is the next even number after 88?

8) Here is a list of numbers.   3.5   32   0   –8 $\dfrac{1}{5}$

     Circle **all** the integers in the list.

9) Here is a list of numbers.   14   –9   –12.5   111   2050 $\dfrac{1}{4}$

     a) Write **all the integers** in the list.

     b) Write **all** the **odd** numbers in the list.

     c) Write **all** the **even** numbers in the list.

10) a) How many **odd** numbers are there between 100 and 200?

     b) How many **even** numbers are there between 1 and 99?

Integers and Even/Odd Numbers

1) Here is a list of numbers.   7   50   0   –4   (1.2)

    Circle the number in the list that is **not** an integer.

2) Write down all the odd numbers between 0 and 14.   1, 3, 5, 7, 9, 11, 13

3) Here are some numbers.   3   7

    Circle **all** the even numbers.   (8)   (140)   1   (42)

4) Here are some numbers.   6   (9)

    Circle **all** the odd numbers.   (23)   150   (71)   48

5) Write down all the even numbers between 15 and 25.   16, 18, 20, 22, 24

6) What is the next odd number after 59?   61

7) What is the next even number after 88?   90

8) Here is a list of numbers.   3.5   (32)   (0)   (–8) $\dfrac{1}{5}$

    Circle **all** the integers in the list.

9) Here is a list of numbers.   14   –9   –12.5   111   2050 $\dfrac{1}{4}$

    a) Write **all** the **integers** in the list.   14, –9, 111, 2050

    b) Write **all** the **odd** numbers in the list.   –9, 111

    c) Write **all** the **even** numbers in the list.   14, 2050

10) a) How many **odd** numbers are there between 100 and 200?   50

     b) How many **even** numbers are there between 1 and 99?   49

Place Value

1) a) Write the number forty five thousand, two hundred and seventy three in figures.

   b) Write the number five thousand, one hundred and three in figures.

   c) Write the number three hundred thousand, seven hundred and ninety one in figures.

   d) Write the number two and a half million in figures.

   e) Write the number one and three quarter million in figures.

2) Write the following numbers in words

   a) 1 250

   b) 3 502

   c) 72 067

   d) 192 040

   e) 30 000 000

3) a) Write down the value of the 7 in the number 3 752.

   b) Write down the value of the 6 in the number 56 025.

   c) Write down the value of the 2 in the number 99 723.

   d) Write down the value of the 5 in the number 258 610.

   e) Write down the value of the 2 in the number 1 253 549.

4) What is the value of the digit 7 in 38.1472?

   Choose, and circle, the correct answer from the following:

   $$\frac{7}{10} \qquad \frac{7}{100} \qquad \frac{7}{1000} \qquad \frac{7}{10000}$$

1) a) Write the number forty five thousand, two hundred and seventy three in figures. **45 273**

    b) Write the number five thousand, one hundred and three in figures. **5 103**

    c) Write the number three hundred thousand, seven hundred and ninety one in figures. **300 791**

    d) Write the number two and a half million in figures. **2 500 000**

    e) Write the number one and three quarter million in figures. **1 750 000**

2) Write the following numbers in words

    a) 1 250 **One thousand, two hundred and fifty**

    b) 3 502 **Three thousand, five hundred and two**

    c) 72 067 **Seventy two thousand and sixty seven**

    d) 192 040 **One hundred and ninety two thousand and forty**

    e) 30 000 000 **Thirty million**

3) a) Write down the value of the 7 in the number 3 752. **700 or seven hundred**

    b) Write down the value of the 6 in the number 56 025. **6 000 or six thousand**

    c) Write down the value of the 2 in the number 99 723. **20 or twenty**

    d) Write down the value of the 5 in the number 258 610. **50 000 or fifty thousand**

    e) Write down the value of the 2 in the number 1 253 549. **200 000 or two hundred thousand**

4) What is the value of the digit 7 in 38.1472?

    Choose, and circle, the correct answer from the following:

    $$\frac{7}{10} \qquad \frac{7}{100} \qquad \boxed{\frac{7}{1000}} \qquad \frac{7}{10000}$$

1) Round these numbers to the nearest 10:

   a) 26

   b) 62

   c) 75

   d) 231

   e) 797

   f) 5 842

   g) 9 875

   h) 13 758

2) Round these numbers to the nearest 100:

   a) 78

   b) 223

   c) 549

   d) 1 450

   e) 1 382

   f) 4 537

   g) 9 193

   h) 17 625

3) Round these numbers to the nearest 1000:

   a) 850

   b) 1 455

   c) 3 230

   d) 7 500

   e) 8 455

   f) 9 690

   g) 12 390

   h) 28 910

1) Round these numbers to the nearest 10:

   a) 26   30
   b) 62   60
   c) 75   80
   d) 231   230
   e) 797   800
   f) 5 842   5 840
   g) 9 875   9 880
   h) 13 758   13 760

2) Round these numbers to the nearest 100:

   a) 78   100
   b) 223   200
   c) 549   500
   d) 1 450   1 500
   e) 1 382   1 400
   f) 4 537   4 500
   g) 9 193   9 200
   h) 17 625   17 600

3) Round these numbers to the nearest 1000:

   a) 850   1 000
   b) 1 455   1 000
   c) 3 230   3 000
   d) 7 500   8 000
   e) 8 455   8 000
   f) 9 690   10 000
   g) 12 390   12 000
   h) 28 910   29 000

Ordering Integers

Put these numbers in order, starting with the smallest:

1) 74, 57, 38, 8, 61

2) 39, 84, 11, 128, 24

3) 76, 102, 12, 140, 73

4) 3, –2, –7, 10, –1

5) –3, –11, 1, –5, 7

6) –4, 6, 0, –6, –1

7) 205, 2005, 105, 55, 5005

8) 83, –61, –42, 65, –14

Ordering Integers

Put these numbers in order, starting with the smallest:

1) 74, 57, 38, 8, 61   8, 38, 57, 61, 74

2) 39, 84, 11, 128, 24   11, 24, 39, 84, 128

3) 76, 102, 12, 140, 73   12, 73, 76, 102, 140

4) 3, –2, –7, 10, –1   −7, −2, −1, 3, 10

5) –3, –11, 1, –5, 7   −11, −5, −3, 1, 7

6) –4, 6, 0, –6, –1   −6, −4, −1, 0, 6

7) 205, 2005, 105, 55, 5005   55, 105, 205, 2005, 5005

8) 83, –61, –42, 65, –14   −61, −42, −14, 65, 83

1) For each mathematical sign, below, write a brief description of the sign.
   The first one has already been done.

   a) <   less than _____

   b) ≥   _____

   c) >   _____

   d) ≤   _____

   e) ≠   _____

2) Insert one of the two symbols < or > to make the following statements true:

   a) 8 5

   b) -4 .... -6

   c) 2.08 .... 2.8

   d) 8 + 3 .... 2 + 7

   e) 2 ?7 .... 5 ?8

3) You must be at least 1.6 m tall to ride on a rollercoaster at Romy Park.
   Circle the correct description of this out of the following:

   Height < 1.6 m

   Height ≤ 1.6 m

   Height = 1.6 m

   Height ≥ 1.6 m

   Height > 1.6 m

Mathematical Notation - Introduction

1) For each mathematical sign, below, write a brief description of the sign.
The first one has already been done.

a) < <u>less than</u>

b) ≥ <u>more than or equal to</u>

c) > <u>more than</u>

d) ≤ <u>less than or equal to</u>

e) ≠ <u>not equal to</u>

2) Insert one of the two symbols < or > to make the following statements true:

a) 8 ..>.. 5

b) -4 ..>.. -6

c) 2.08 ..<.. 2.8

d) 8 + 3 ..>.. 2 + 7

e) 2 ?7 ..<.. 5 ?8

3) You must be at least 1.6 m tall to ride on a rollercoaster at Romy Park.
Circle the correct description of this out of the following:

Height < 1.6 m

Height ≤ 1.6 m

Height = 1.6 m

(Height ≥ 1.6 m)

Height > 1.6 m

1)   Write the name of each angle, below.
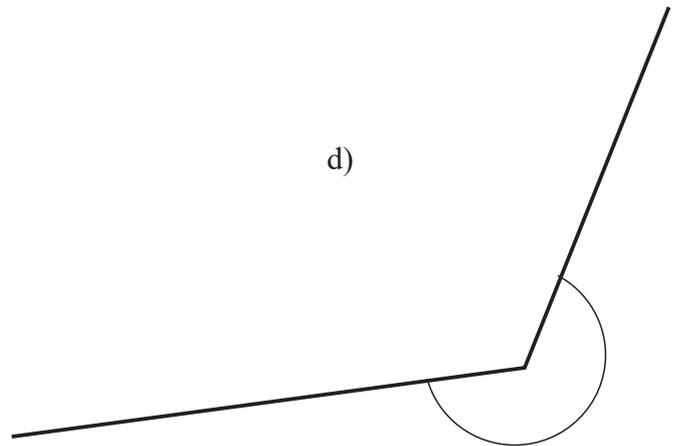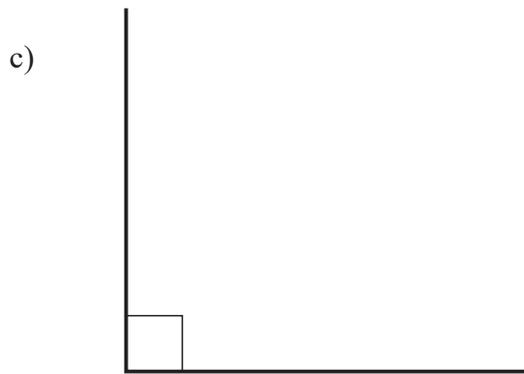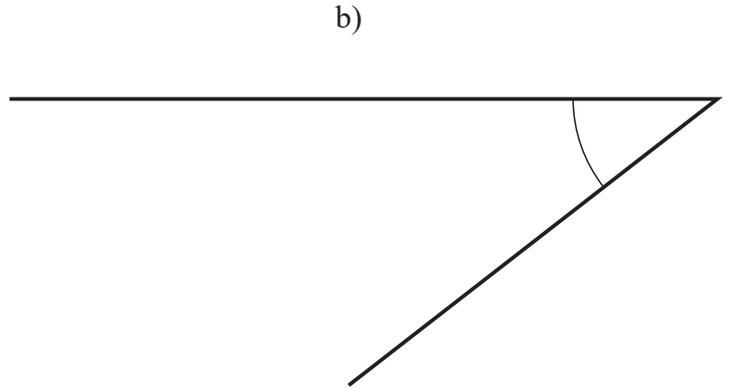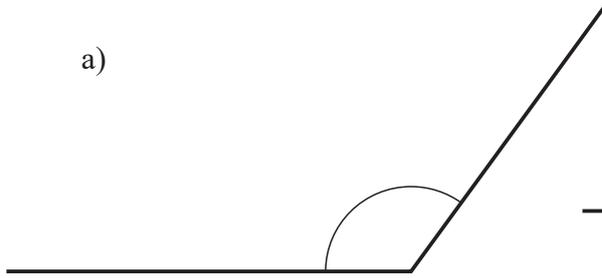
a)

b)

c)

d)

2)   Draw a triangle which contains:

a) Three acute angles.

b) One obtuse angle and two acute angles.

c) A right angle.

1) Write the name of each angle, below.

a) Obtuse angle
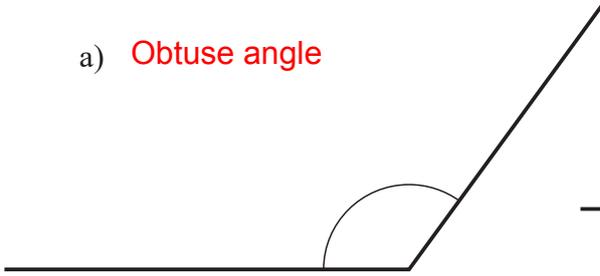
b) Acute angle
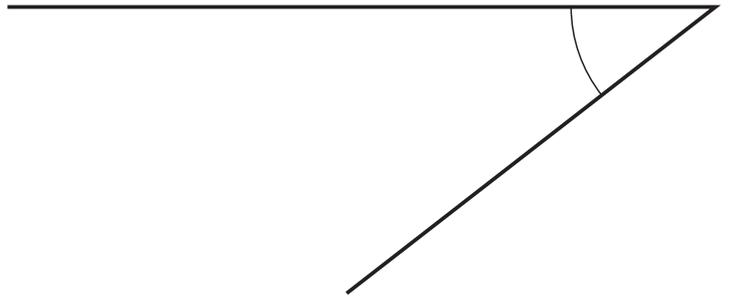
c) Right angle
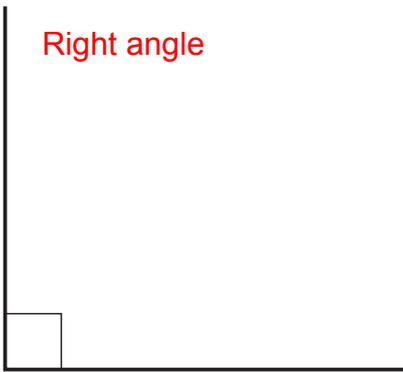
d)
Reflex angle
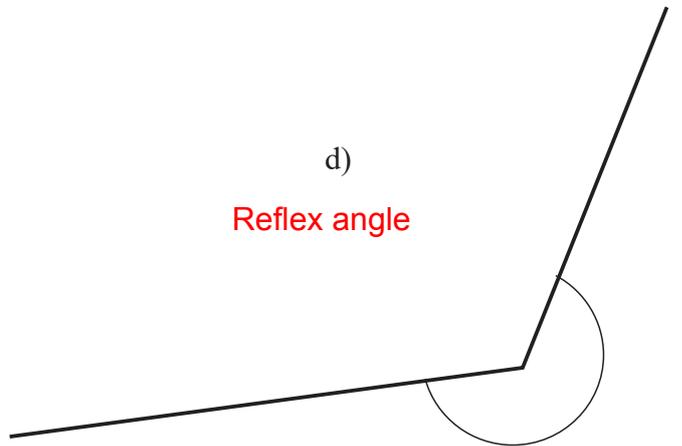
2) Draw a triangle which contains:

a) Three acute angles.
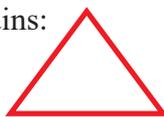
b) One obtuse angle and two acute angles.

Other triangles are possible

c) A right angle.

1)   Next to each of the shapes, write down its name.

a)

b)
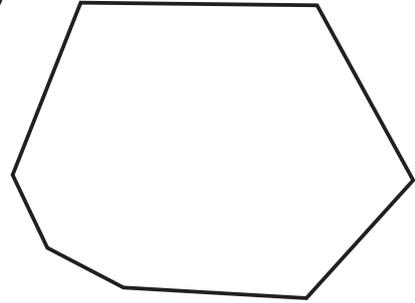
2)   a) What is the name given to a 10-sided shape?

b) What is the name given to an 8-sided shape?

3)   To be a regular polygon the shape must have equal _____ and equal _____.

Fill in the blanks.

4)   What are the names of these regular polygons?

a)
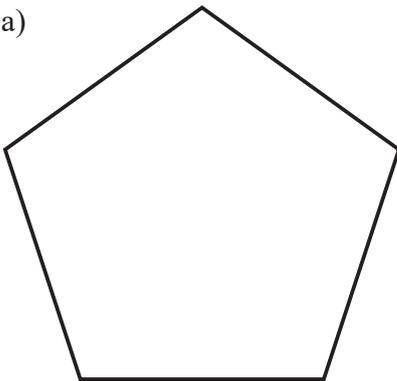
b)
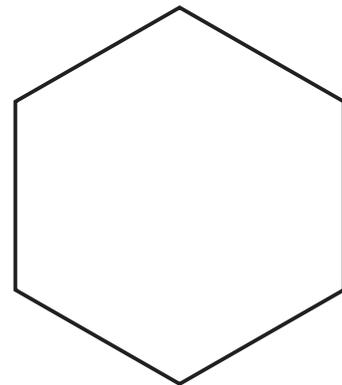
Polygons

1) Next to each of the shapes, write down its name.

a)
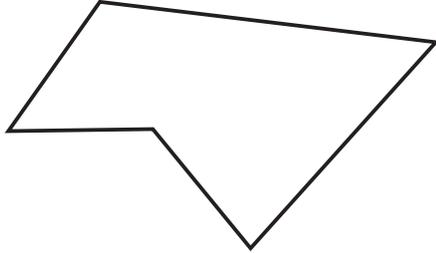
(Irregular) pentagon

b)
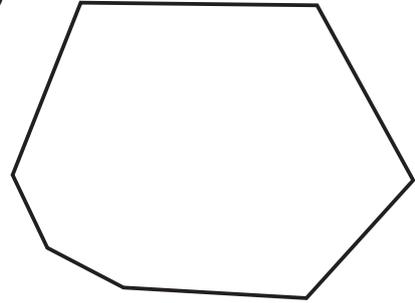
(Irregular) heptagon or septagon

2) a) What is the name given to a 10-sided shape? Decagon

   b) What is the name given to an 8-sided shape? Octagon

3) To be a regular polygon the shape must have equal __sides__ and equal __angles__.

   Fill in the blanks.
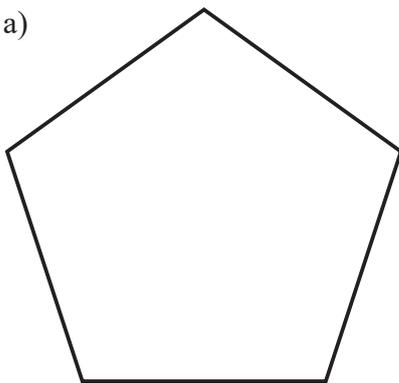
4) What are the names of these regular polygons?

a)

Pentagon

b)
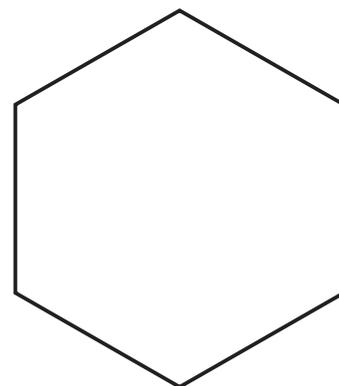
Hexagon

Reading Scales

1) Estimate the reading on each of these scales:

a) kg

b) kg

c) kg

d) kg

e) kg

f) kg

2) This scale shows degrees Centigrade.

°C   -20°   -10°   0°   10°   20°   30°   40°
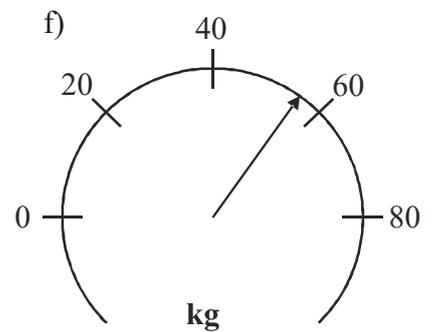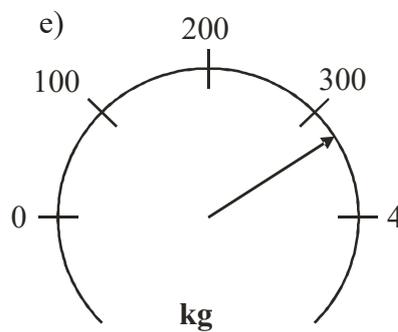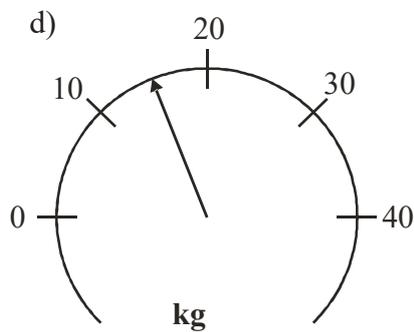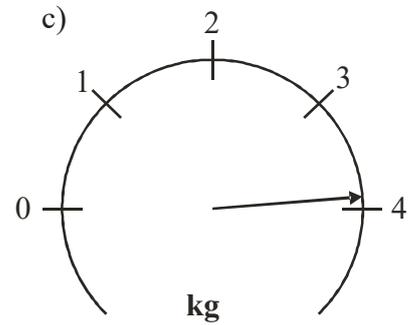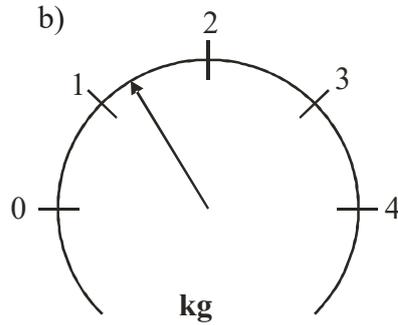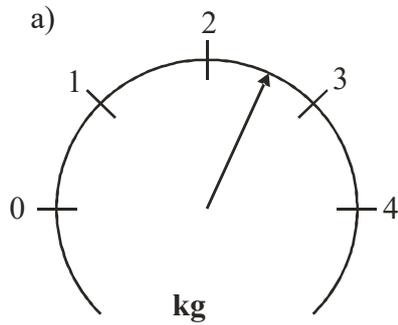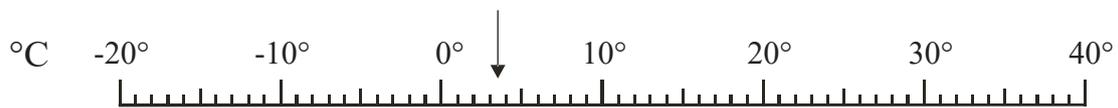
a) What temperature is the arrow pointing to?

b) Draw an arrow which points to -17°C.

3) This is a diagram for converting between gallons and litres.

Gallons   1   2   3   4   5

Litres   10   20
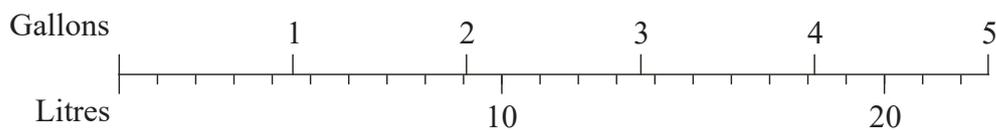
Use the diagram to convert

a) 3 gallons to litres.

b) 4.5 gallons to litres.

c) 6 litres to gallons.

Reading Scales

1)   Estimate the reading on each of these scales:

a) 2.5 kg

b) 1.4 kg

c) 3.9 kg

d) 16 kg

e) 325 kg

f) 55 kg

2)   This scale shows degrees Centigrade.

°C   -20°   -10°   0°   10°   20°   30°   40°
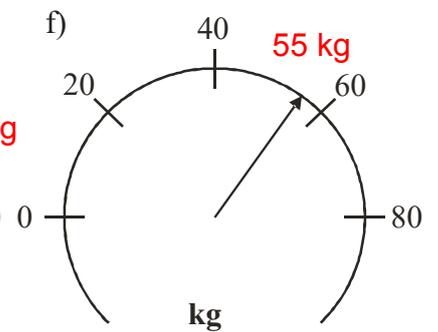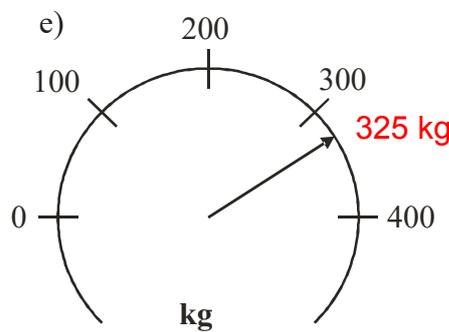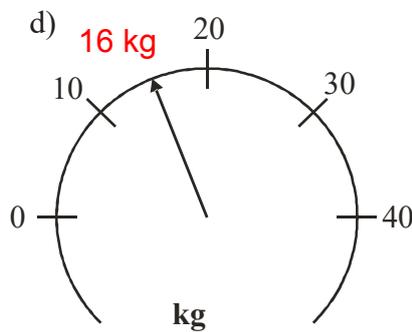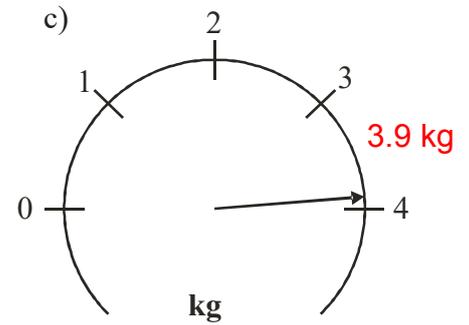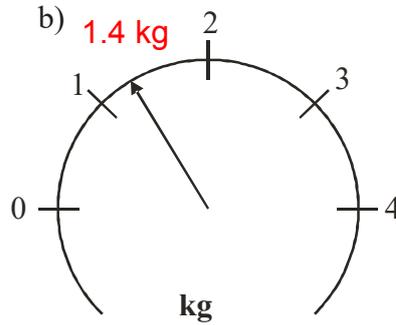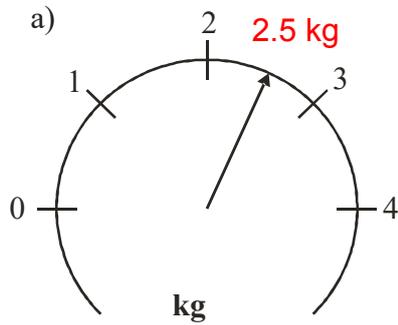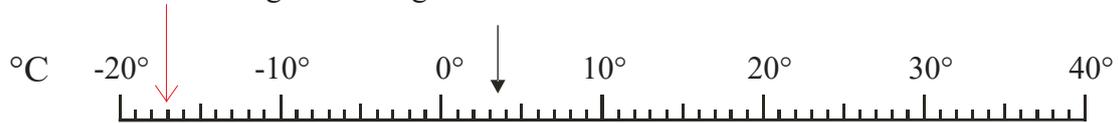
a) What temperature is the arrow pointing to?   3.5°C

b) Draw an arrow which points to -17°C.

3)   This is a diagram for converting between gallons and litres.

Gallons   1   2   3   4   5

Litres   10   20
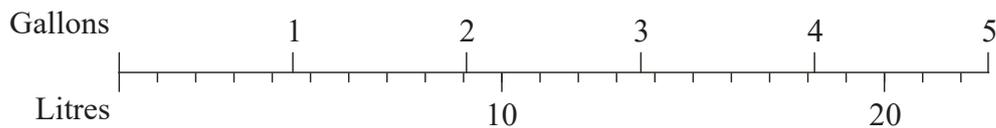
Use the diagram to convert

a) 3 gallons to litres.   13.7 litres

b) 4.5 gallons to litres.   20.5 litres

c) 6 litres to gallons.   1.3 gallons

1) Which shape is congruent to shape X?
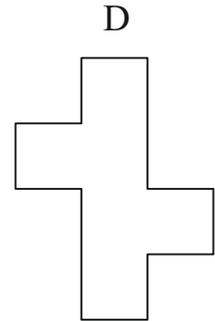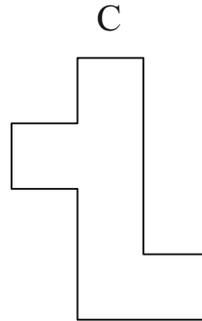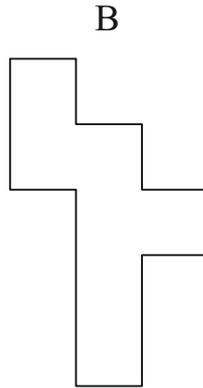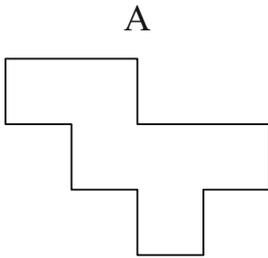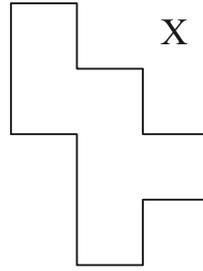
Circle your answer.

X

A   B   C   D

2) Two of these shapes are congruent.
   Which are they?

a)   b)   c)

e)

d)

1) Which shape is congruent to shape X?

Circle your answer.

X

A   B   C   D

2) Two of these shapes are congruent.
Which are they? **b and d**

a)

b)

c)

d)

e)
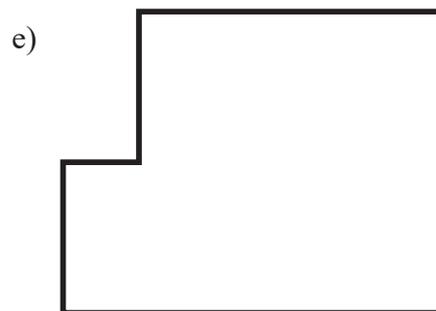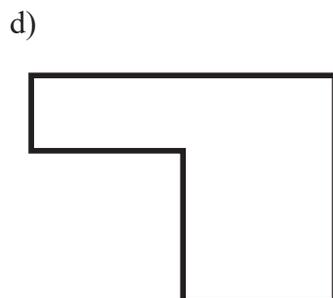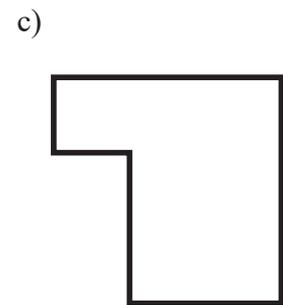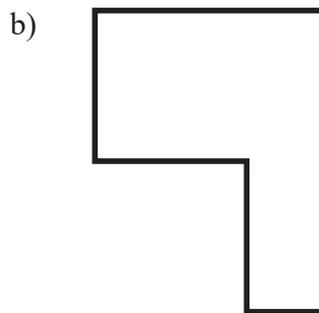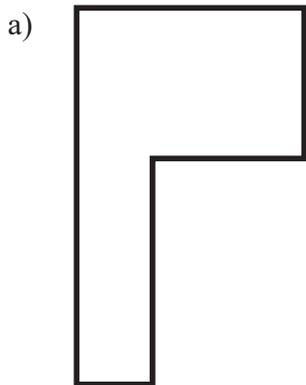
Congruent and Similar Shapes

Shape	Congruent to	Similar to
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		

Fill in the table on the left where possible.

You are allowed to use tracing paper to help get the correct answers.

A

B

C

D

E

F

G

H

I

J
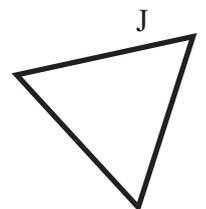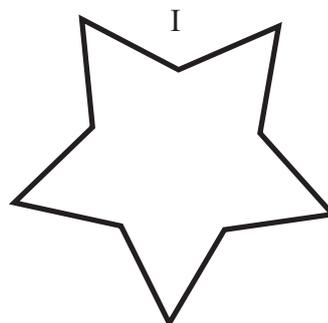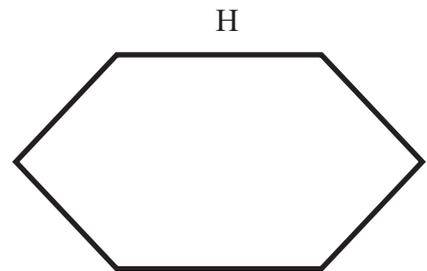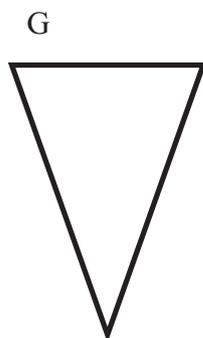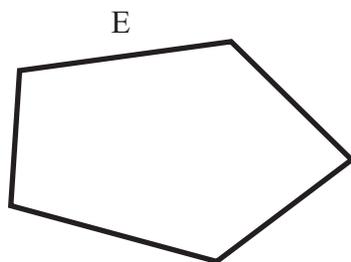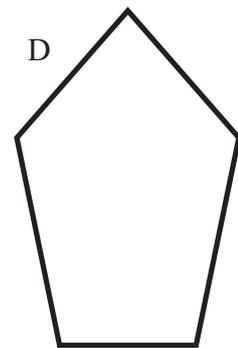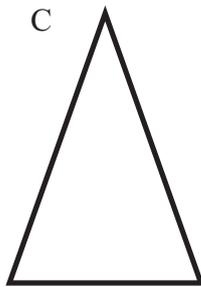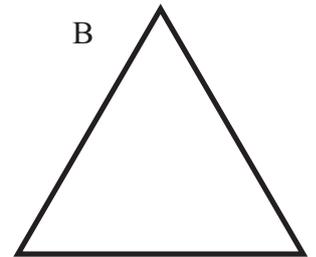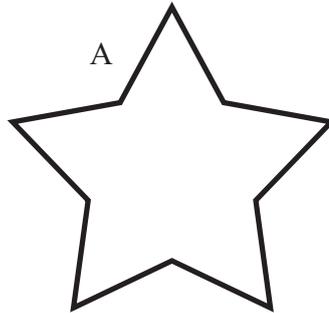
Congruent and Similar Shapes

Shape	Congruent to	Similar to
A	I	F
B		J
C	G	
D	E	
E	D	
F		A and I
G	C	
H		
I	A	F
J		B

Fill in the table on the left where possible.

You are allowed to use tracing paper to help get the correct answers.

A

B

C

D

E

F

G

H

I

J

Tally Charts and Bar Charts

1) Here is a list of coins in Yvonne's purse.

Coin	Tally	Frequency

5p   £1   20p   1p   50p

10p   £1   5p   50p   2p

5p   5p   £1   1p   5p

£1   2p   5p   5p   2p

Complete the table for this information.

2) Tim made a note of how many minutes he spent on the internet over the period of a week. His results are as follows:

Monday   20 mins

Tuesday   30 mins

Wednesday 60 mins

Thursday   40 mins

Friday   20 mins

Saturday   50 mins

Sunday   40 mins

Draw a bar chart to show this information.
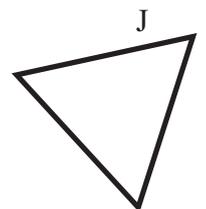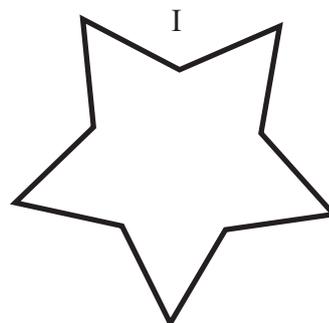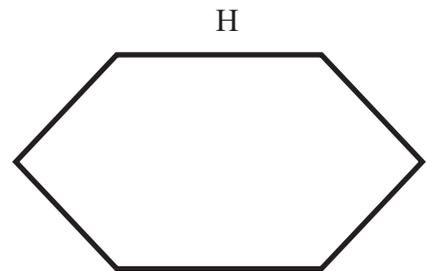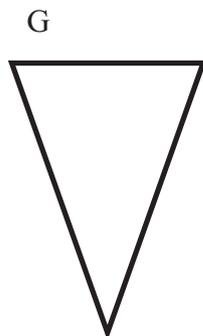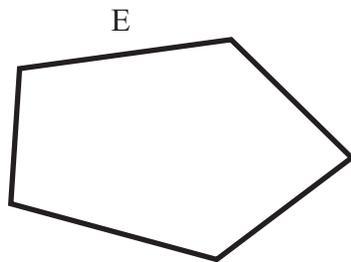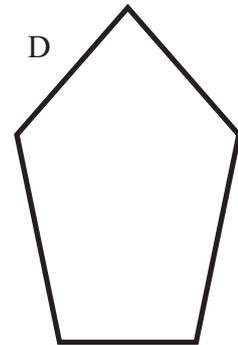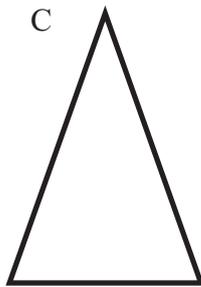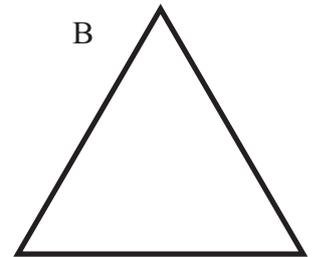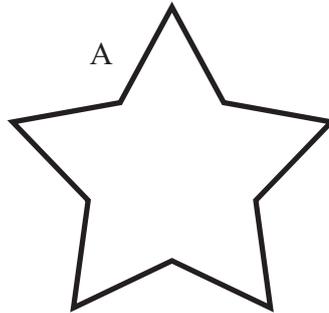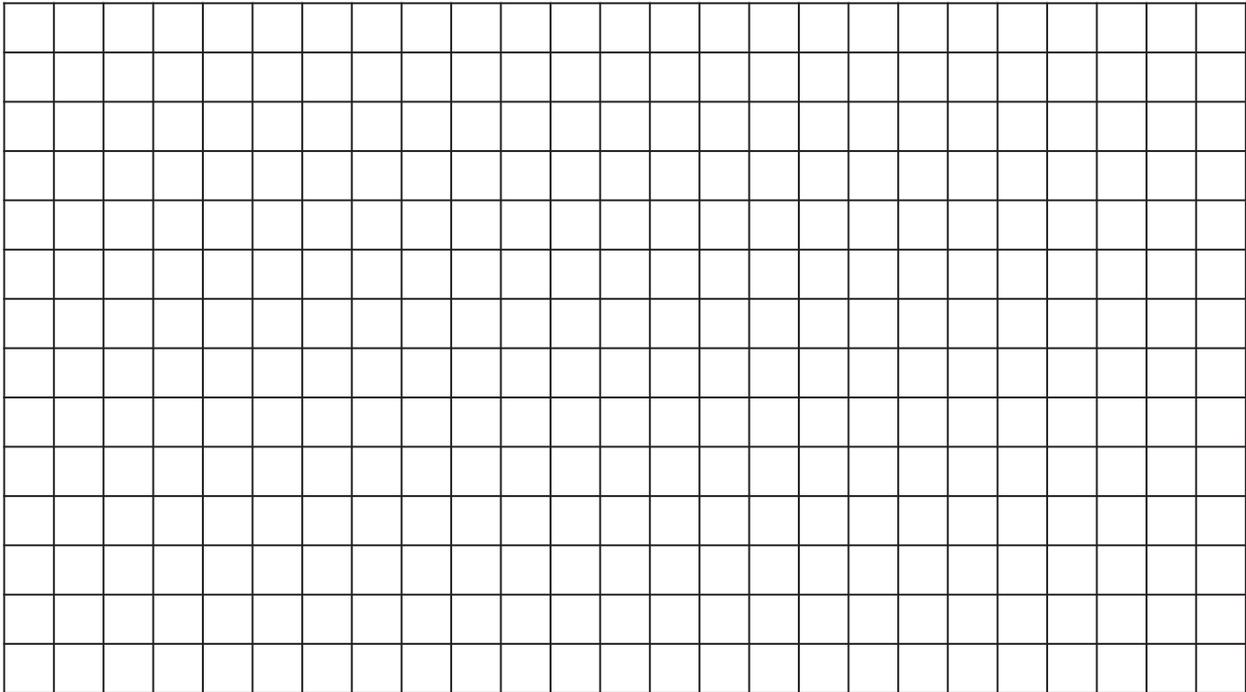
Tally Charts and Bar Charts

1) Here is a list of coins in Yvonne's purse.

5p £1 20p 1p 50p

10p £1 5p 50p 2p

5p 5p £1 1p 5p

£1 2p 5p 5p 2p

Complete the table for this information.

Coin	Tally	Frequency
1p	||	2
2p	|||	3
5p	ⅢⅡ ||	7
10p			1
20p			1
50p	||	2
£1	||||	4

2) Tim made a note of how many minutes he spent on the internet over the period of a week. His results are as follows:

Monday   20 mins

Tuesday   30 mins

Wednesday 60 mins

Thursday   40 mins

Friday   20 mins

Saturday   50 mins

Sunday   40 mins

Draw a bar chart to show this information.

Time spent on internet
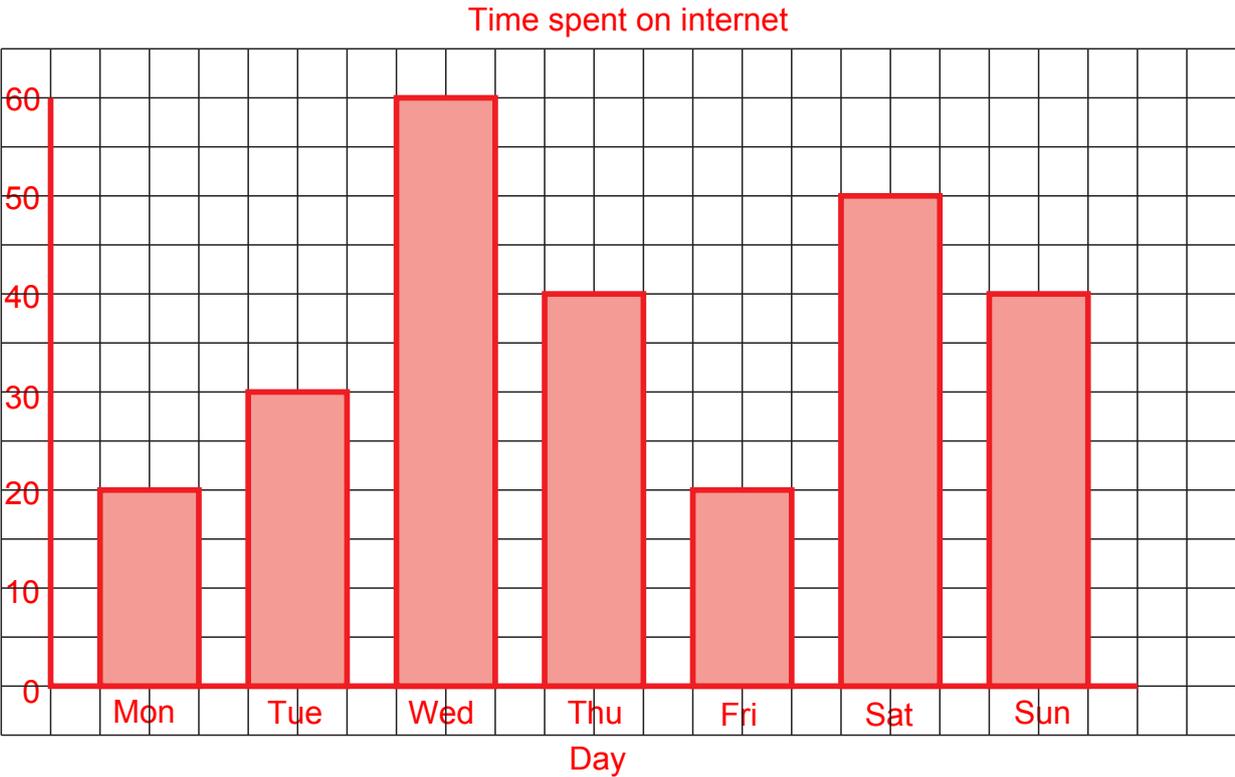
Pictograms

1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	⊕ ⊕ ⊕ ⊕
February	⊕ ◜
March	⊕ ⊕
April	
May	

Key ⊕ represents 4 watches.

a) How many watches were sold in January?

b) How many **more** watches were sold in March than in February?

19 watches were sold in April.
14 watches were sold in May.

c) Use this information to complete the pictogram.

2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	▫ ▫ ▫ ▫
Tuesday	▫ ▫ ◖
Wednesday	
Thursday	

Key ▫ represents 10 DVDs.

a) How many DVDs were borrowed on

   (i)   Monday?
   (ii)   Tuesday?

On Wednesday, 50 DVDs were borrowed.
On Thursday, 15 DVDs were borrowed.

b) Show this information in the pictogram.

1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	
February	
March	
April	
May	

Key ⊕ represents 4 watches.

a) How many watches were sold in January? 16

b) How many **more** watches were sold in March than in February? 3

19 watches were sold in April.
14 watches were sold in May.

c) Use this information to complete the pictogram.

2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	
Tuesday	
Wednesday	
Thursday	

Key ▫ represents 10 DVDs.

a) How many DVDs were borrowed on
   (i)   Monday? 40
   (ii) Tuesday? 25

On Wednesday, 50 DVDs were borrowed.
On Thursday, 15 DVDs were borrowed.

b) Show this information in the pictogram.

The Probability Scale

1) a) On the probability scale below, mark with a cross (×) the probability
       that it will snow in Birmingham in July.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

   b) On the probability scale below, mark with a cross (×) the probability
      that it will rain in Wales next year.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

   c) On the probability scale below, mark with a cross (×) the probability
      that you will get a tail when you flip a fair coin.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

   d) On the probability scale below, mark with a cross (×) the probability
      that you will get a number bigger than 4 when you roll an ordinary dice.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

2) 4 jelly babies are in a bag.
    2 are red, 1 is green and 1 is black.

    Without looking in the bag, a jelly baby is taken out.

    a) On the probability scale below, mark with a cross (×) the probability
       that the jelly baby taken from the bag is green.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

   b) On the probability scale below, mark with a cross (×) the probability
      that the jelly baby taken from the bag is green or black.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

   c) On the probability scale below, mark with a cross (×) the probability
      that the jelly baby taken from the bag is red or black.

```
├──────────────────┼──────────────────┤
0                   ½                  1
```

The Probability Scale

1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.

0          $\frac{1}{2}$ 1

b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.

0          $\frac{1}{2}$ 1

c) On the probability scale below, mark with a cross (×) the probability that you will get a tail when you flip a fair coin.

0          $\frac{1}{2}$ 1

d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.

0          $\frac{1}{2}$ 1

2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

Without looking in the bag, a jelly baby is taken out.

a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.

0          $\frac{1}{2}$ 1

b) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green or black.

0          $\frac{1}{2}$ 1

c) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is red or black.

0          $\frac{1}{2}$ 1

1) Write the factors of

a) 6   b) 16   c) 18   d) 30

2) In a pupil's book the factors of 12 are listed as

1   2   3   4   5   12

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed
30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

4) Write the first four multiples of

a) 3   b) 5   c) 10   d) 15

5) In a pupil's book the first 7 multiples of 8 are listed as

8   16   22   32   40   48   54

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed
 4:   4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

7) List the first five prime numbers

8) Using just this list of numbers:

11   18   1   4   21   24   9   3   12   2   19

find the following:

a) The prime numbers

b) The factors of 18

c) The multiples of 3

1) Write the factors of

a) 6
1, 2, 3, 6

b) 16
1, 2, 4, 8, 16

c) 18
1, 2, 3, 6, 9, 18

d) 30
1, 2, 3, 5, 6, 10, 15, 30

2) In a pupil's book the factors of 12 are listed as

1   2   3   4   ~~8~~   12
                6

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).
1, 2, 5, 10

4) Write the first four multiples of

a) 3
3, 6, 9, 12

b) 5
5, 10, 15, 20

c) 10
10, 20, 30, 40

d) 15
15, 30, 45, 60

5) In a pupil's book the first 7 multiples of 8 are listed as

8   16   ~~32~~   32   40   48   ~~54~~
         24   56

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4:   4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.
20

7) List the first five prime numbers
2, 3, 5, 7, 11

8) Using just this list of numbers:

11   18   1   4   21   24   9   3   12   2   19

find the following:

a) The prime numbers   11, 3, 2, 19

b) The factors of 18   18, 1, 9, 3, 2

c) The multiples of 3   18, 21, 24, 9, 3, 12

Ordering Decimals

1) Put these amounts of money in order, starting with the smallest:

a) £4.50, £3.82, £4.05, £3.99, £3.54

b) £1.25, £2.41, £1.24, £2.04, £1.99

c) £15.83, £24.18, £13.99, £46.01, £46.10

2) Circle the smallest number: 0.1, 0.09, 0.99, 0.15, 0.11

3) Put these numbers in order, starting with the smallest:

2.01, 2.45, 2.14, 2.006, 2.405

4) Put these numbers in order, starting with the smallest:

0.76, 0.668, 0.608, 0.099, 0.909

5) Put these numbers in order, starting with the smallest:

5.004, 4.889, 4.099, 5.002, 4.095

Ordering Decimals

1) Put these amounts of money in order, starting with the smallest:

   a) £4.50, £3.82, £4.05, £3.99, £3.54   £3.54, £3.82, £3.99, £4.05, £4.50

   b) £1.25, £2.41, £1.24, £2.04, £1.99   £1.24, £1.25, £1.99, £2.04, £2.41

   c) £15.83, £24.18, £13.99, £46.01, £46.10   £13.99, £15.83, £24.18, £46.01, £46.10

2) Circle the smallest number: 0.1, (0.09,) 0.99, 0.15, 0.11

3) Put these numbers in order, starting with the smallest:

   2.01, 2.45, 2.14, 2.006, 2.405   2.006, 2.01, 2.14, 2.405, 2.45

4) Put these numbers in order, starting with the smallest:

   0.76, 0.668, 0.608, 0.099, 0.909   0.099, 0.608, 0.668, 0.76, 0.909

5) Put these numbers in order, starting with the smallest:

   5.004, 4.889, 4.099, 5.002, 4.095   4.095, 4.099, 4.889, 5.002, 5.004
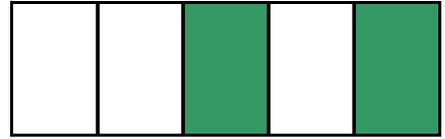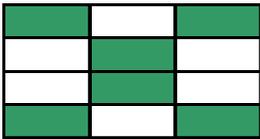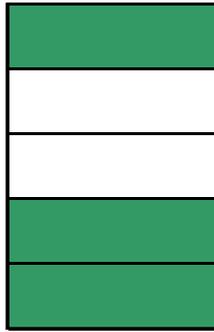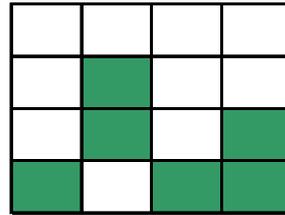
Fractions - Introduction

1) What fraction of each of the following shapes is shaded?

    a)

    b)

    c)

    d)

    e)

    f)

2) Shade the given fraction in the following grids.
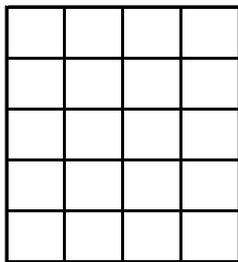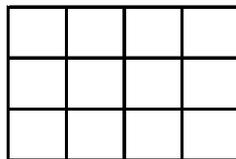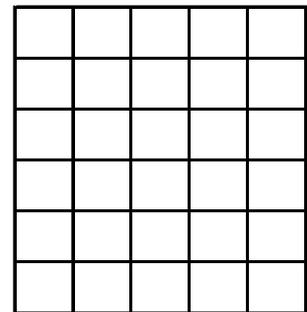
    $$\frac{3}{5}$$

    $$\frac{1}{4}$$

    $$\frac{4}{6}$$

3) Which of these fractions is the smallest? $\frac{5}{6}$ *or* $\frac{7}{9}$ *(use the grids to help)*

Fractions - Introduction

1) What fraction of each of the following shapes is shaded?

a) $\dfrac{1}{3}$

b) $\dfrac{1}{3}$

c) $\dfrac{2}{5}$

d) $\dfrac{1}{2}$

e) $\dfrac{3}{5}$

f) $\dfrac{3}{8}$

2) Shade the given fraction in the following grids.

$\dfrac{3}{5}$

$\dfrac{1}{4}$

$\dfrac{4}{6}$
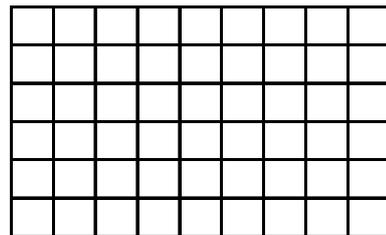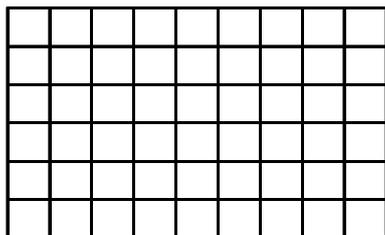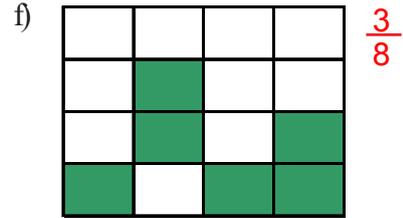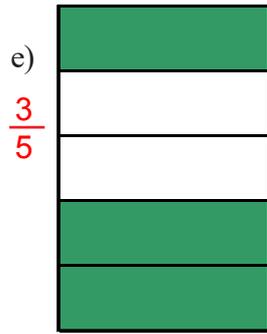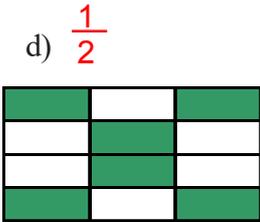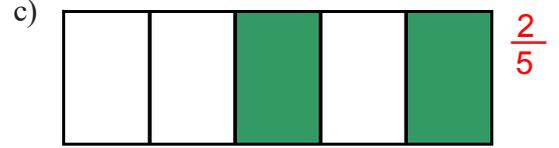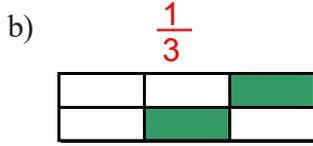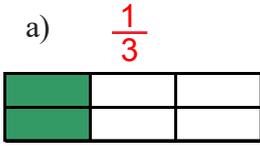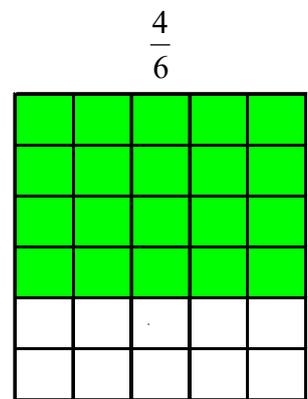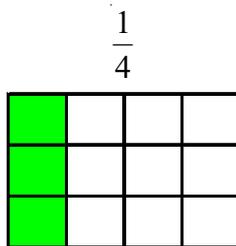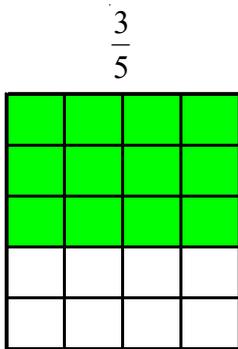
3) Which of these fractions is the smallest? $\dfrac{5}{6}$ *or* $\dfrac{7}{9}$ *(use the grids to help)*
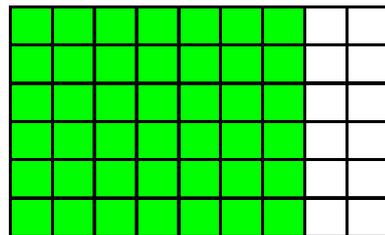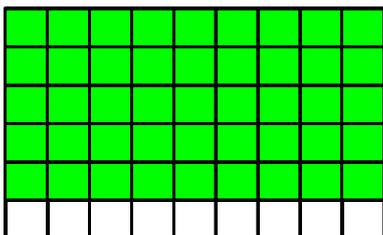
1) a) Which operation is the inverse of 'add'?

 b) Which operation is the inverse of 'divide'?

2) Use inverse operations to complete the second equation each time.

 a) $12 + 6 = 18$ ⟶ ☐ ? ☐ = 12

 b) $28 \ ?\,13 = 15$ ⟶ ☐ + ☐ = 28

3) Use inverse operations to complete the second equation each time.

 a) $14 \times 2 = 28$ ⟶ ☐ ÷ ☐ = 14

 b) $60 \div 12 = 5$ ⟶ ☐ × ☐ = 60

4) Use inverse operations to complete the second equation each time.

 a) $19 + 13 = 32$ ⟶ ☐ ☐ = 19

 b) $46 \ ?\,13 = 33$ ⟶ ☐ ☐ = 46

5) Use inverse operations to complete the second equation each time.

 a) $28 \div 7 = 4$ ⟶ ☐ ☐ = 28

 b) $16 \times 3 = 48$ ⟶ ☐ ☐ = 3

1) a) Which operation is the inverse of 'add'? Subtract

    b) Which operation is the inverse of 'divide'? Multiply

2) Use inverse operations to complete the second equation each time.

    a) $12 + 6 = 18$ ⟶ $\boxed{18}$? $\boxed{6}$ $= 12$

    b) $28 \ ? 13 = 15$ ⟶ $\boxed{15}$ + $\boxed{13}$ $= 28$

3) Use inverse operations to complete the second equation each time.

    a) $14 \times 2 = 28$ ⟶ $\boxed{28}$ ÷ $\boxed{2}$ $= 14$

    b) $60 \div 12 = 5$ ⟶ $\boxed{5}$ × $\boxed{12}$ $= 60$

4) Use inverse operations to complete the second equation each time.

    a) $19 + 13 = 32$ ⟶ $\boxed{32}$ – $\boxed{13}$ $= 19$

    b) $46 \ ? 13 = 33$ ⟶ $\boxed{33}$ + $\boxed{13}$ $= 46$

5) Use inverse operations to complete the second equation each time.

    a) $28 \div 7 = 4$ ⟶ $\boxed{4}$ × $\boxed{7}$ $= 28$

    b) $16 \times 3 = 48$ ⟶ $\boxed{48}$ ÷ $\boxed{16}$ $= 3$

Adding Integers and Decimals

1) a) 42
   +26

   b) 57
   +38

   c) 96
   +75

2) a) 637
   +961

   b) 983
   +442

   c) 969
   +758

3) a) 452 + 38   b) 147 + 763   c) 813 + 431 + 38

4) There were two exhibitions at the NEC one Sunday.
    3816 people went to one of the exhibitions and 13427 people
    went to the other exhibition.
    How many people went to the NEC, in total, on the Sunday?

5) a) 2.6 + 1.2   b) 2.74 + 6.81   c) 45.36 + 6.81

6) a) 23 + 1.5   b) 13.6 + 38   c) 13.2 + 17.82

Adding Integers and Decimals

1) a)   4 2   b)   5 7   c)   9 6
        + 2 6   + 3 8   + 7 5
        ───────   ───────   ───────
          6 8   9 5   1 7 1

2) a)   6 3 7   b)   9 8 3   c)   9 6 9
        + 9 6 1   + 4 4 2   + 7 5 8
        ───────   ───────   ───────
        1 5 9 8   1 4 2 5   1 7 2 7

3) a) 452 + 38   b) 147 + 763   c) 813 + 431 + 38
          490   910   1282

4) There were two exhibitions at the NEC one Sunday.
    3816 people went to one of the exhibitions and 13427 people
    went to the other exhibition.
    How many people went to the NEC, in total, on the Sunday?   17243

5) a) 2.6 + 1.2   b) 2.74 + 6.81   c) 45.36 + 6.81
          3.8   9.55   52.17

6) a) 23 + 1.5   b) 13.6 + 38   c) 13.2 + 17.82
          24.5   51.6   31.02

Subtracting Integers and Decimals

1) a)   7 8   b)   7 4   c)   6 2
      – 4 2   – 2 6   – 3 9

2) a)   4 8 5   b)   7 7 3   c)   1 0 0
      – 2 9 1   – 4 8 6   –   3 4

3) a) 653 – 48   b) 362 – 183   c) 2000 – 461

4)   There were two films showing at a cinema one Saturday.
      One of the films was shown in a large room and the other was
      in a smaller room.
      The film in the larger room was watched by a total of 3562 people.
      The film in the smaller room was watched by 1671 people.
      How many more people saw the film in the larger room?

5) a) 782 + 426 – 278   b) 8162 + 1149 – 799

Subtracting Integers and Decimals

1) a) $\begin{array}{r} 78 \\ -42 \\ \hline 36 \end{array}$ b) $\begin{array}{r} 74 \\ -26 \\ \hline 48 \end{array}$ c) $\begin{array}{r} 62 \\ -39 \\ \hline 23 \end{array}$

2) a) $\begin{array}{r} 485 \\ -291 \\ \hline 194 \end{array}$ b) $\begin{array}{r} 773 \\ -486 \\ \hline 287 \end{array}$ c) $\begin{array}{r} 100 \\ -\ \ 34 \\ \hline 66 \end{array}$

3) a) 653 – 48   b) 362 – 183   c) 2000 – 461
        605   179   1539

4)   There were two films showing at a cinema one Saturday.
      One of the films was shown in a large room and the other was
      in a smaller room.
      The film in the larger room was watched by a total of 3562 people.
      The film in the smaller room was watched by 1671 people.
      How many more people saw the film in the larger room?   1891

5) a) 782 + 426 – 278   b) 8162 + 1149 – 799
          930   8512

1) Work out

   a) 13 × 18

   b) 135 × 27

   c) 116 × 41

   d) 264 × 43

   e) 326 × 24

   f) 281 × 59

   g) 286 × 48

   h) 428 × 34

   i) 461 × 45

2) "MathsWatch Travel" has 36 coaches.
   Each of these coaches can carry 53 passengers.
   How many passengers in total can all the coaches carry?

3) "MathsWatch Tours" has a plane that will carry 47 passengers.
   To fly from Manchester to Lyon, each passenger pays £65
   Work out the total amount that the passengers pay.

4) A Science textbook costs £13.
   Mr Jones buys a class set of 34 books.
   How much do they cost him?

5) A graphical calculator costs £18.
   How much would 43 calculators cost?

Multiplying Integers

1) Work out

    a) 13×18 234

    b) 135×27 3645

    c) 116×41 4756

    d) 264×43 11352

    e) 326×24 7824

    f) 281×59 16579

    g) 286×48 13728

    h) 428×34 14552

    i) 461×45 20745

2) "MathsWatch Travel" has 36 coaches.
Each of these coaches can carry 53 passengers.
How many passengers in total can all the coaches carry?   1908

3) "MathsWatch Tours" has a plane that will carry 47 passengers.
To fly from Manchester to Lyon, each passenger pays £65
Work out the total amount that the passengers pay.   £3055

4) A Science textbook costs £13.
Mr Jones buys a class set of 34 books.
How much do they cost him?   £442

5) A graphical calculator costs £18.
How much would 43 calculators cost?   £774

1) Work out
   a) $325 \div 5$ d) $377 \div 29$ g) $75 \div 4$

   b) $448 \div 8$ e) $27 \div 6$ h) $135 \div 20$

   c) $221 \div 13$ f) $123 \div 15$ i) $381 \div 12$

2) A box can hold 19 books.
   Work out how many boxes will be needed to hold 646 books.

3) The distance from Glasgow to Paris is 1290 km.
   A flight from Glasgow to Paris lasts 3 hours.
   Given that

   $$Average\ speed\ =\ \frac{Distance}{Time}$$

   Work out the average speed of the aeroplane in km/h.

4) Pencils cost 25p each.
   Mr Smith spends £15 on pencils.
   Work out the number of pencils he gets.

5) Yesterday, Gino was paid £19.61 for delivering pizzas.
   He is paid 53p for each pizza he delivers.
   Work out how many pizzas Gino delivered yesterday.

6) Emma sold 38 teddy bears for a total of £513
   She sold each teddy bear for the same price.
   Work out the price at which Emma sold each teddy bear.

7)
   Canal boat for hire
   £1855.00
   for 14 days

   Work out the cost per day of hiring the canal boat.

8) A teacher has £539 to spend on books.
   Each book costs £26
   How many books can the teacher buy?

9) John delivers large wooden crates with his van.
   The weight of each crate is 68 kg.
   The greatest weight the van can hold is 980 kg.
   Work out the greatest number of crates that the van can hold.

Dividing Integers

1) Work out

   a) $325 \div 5$ 65

   b) $448 \div 8$ 56

   c) $221 \div 13$ 17

   d) $377 \div 29$ 13

   e) $27 \div 6$ 4.5

   f) $123 \div 15$ 8.2

   g) $75 \div 4$ 18.75

   h) $135 \div 20$ 6.75

   i) $381 \div 12$ 31.75

2) A box can hold 19 books.

   Work out how many boxes will be needed to hold 646 books. 34

3) The distance from Glasgow to Paris is 1290 km.

   A flight from Glasgow to Paris lasts 3 hours.

   Given that

   $$Average\ speed\ =\ \frac{Distance}{Time}$$

   Work out the average speed of the aeroplane in km/h. 430 km/h

4) Pencils cost 25p each.

   Mr Smith spends £15 on pencils.

   Work out the number of pencils he gets. 60

5) Yesterday, Gino was paid £19.61 for delivering pizzas.

   He is paid 53p for each pizza he delivers.

   Work out how many pizzas Gino delivered yesterday. 37

6) Emma sold 38 teddy bears for a total of £513

   She sold each teddy bear for the same price.

   Work out the price at which Emma sold each teddy bear. £13.50

7)
   > Canal boat for hire
   > £1855.00
   > for 14 days

   Work out the cost per day of hiring the canal boat. £132.50

8) A teacher has £539 to spend on books.

   Each book costs £26

   How many books can the teacher buy? 20

9) John delivers large wooden crates with his van.

   The weight of each crate is 68 kg.

   The greatest weight the van can hold is 980 kg.

   Work out the greatest number of crates that the van can hold. 14

1) Multiply the following numbers by 10, 100 and 1000:

	×10	×100	×1000
e.g. 21	210	2100	21000
9			
63			
845			
3.65			
0.4			
1.324			

2) Divide the following numbers by 10, 100 and 1000:

	÷10	÷100	÷1000
e.g. 21	2.1	0.21	0.021
9			
63			
845			
3.65			
0.4			
1.324			

3) Work out the following:

$3 \times 100 =$

$65 \times 10 =$

$17 \div 10 =$

$359 \times 10 =$

$0.5 \div 100 =$

$2.3 \times 1000 =$

$42 \div 100 =$

$3582 \div 100 =$

$0.9 \times 10 =$

$3.645 \times 100 =$

$88 \div 1000 =$

$39.62 \times 1000 =$

1)   Multiply the following numbers by 10, 100 and 1000:

		×10	**×100**	**×1000**
e.g.	*21*	*210*	*2100*	*21000*
	9	90	900	9 000
	63	630	6 300	63 000
	845	8 450	84 500	845 000
	3.65	36.5	365	3 650
	0.4	4	40	400
	1.324	13.24	132.4	1 324

2)   Divide the following numbers by 10, 100 and 1000:

		÷10	**÷100**	**÷1000**
e.g.	*21*	*2.1*	*0.21*	*0.021*
	9	0.9	0.09	0.009
	63	6.3	0.63	0.063
	845	84.5	8.45	0.845
	3.65	0.365	0.0365	0.00365
	0.4	0.04	0.004	0.0004
	1.324	0.1324	0.01324	0.001324

3)   Work out the following:

$3 \times 100 =$ 300

$65 \times 10 =$ 650

$17 \div 10 =$ 1.7

$359 \times 10 =$ 3 590

$0.5 \div 100 =$ 0.005

$2.3 \times 1000 =$ 2 300

$42 \div 100 =$ 0.42

$3582 \div 100 =$ 35.82

$0.9 \times 10 =$ 9

$3.645 \times 100 =$ 364.5

$88 \div 1000 =$ 0.088

$39.62 \times 1000 =$ 39 620

1) At midnight, the temperature was -7°C.

By 7am the next morning, the temperature had increased by 6°C.
a) Work out the temperature at 7am the next morning.

At midday, the temperature was 3°C.
b) Work out the difference between the temperature at midday and the temperature at midnight.

c) Work out the temperature which is halfway between -7°C and 3°C.

2) The table below gives the temperature recorded on 25th December in 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6 °C	0 °C	-15 °C	-23 °C	3 °C	5 °C	18 °C

a) Which city recorded the lowest temperature?

b) What is the difference in temperature between New York and Paris?

c) What is the difference in temperature between Cairo and Edinburgh?

d) The temperature in Madrid was 9°C lower than in Rome.
What was the temperature in Madrid?

e) The temperature in Mexico City was 6°C higher than in New York.
What was the temperature in Mexico City?

3) The table shows the temperature on the surface of each of five planets.

Planet	Temperature
Venus	210 °C
Jupiter	-150 °C
Saturn	-180 °C
Neptune	-210 °C
Pluto	-230 °C

a) Work out the difference in temperature between Jupiter and Pluto.

b) Work out the difference in temperature between Venus and Saturn.

c) Which planet has a temperature 30°C lower than Saturn?

The temperature on Mars is 90°C higher than the temperature on Jupiter.
d) Work out the temperature on Mars.

Negatives in Real Life

1) At midnight, the temperature was -7°C.

By 7am the next morning, the temperature had increased by 6°C.
a) Work out the temperature at 7am the next morning.   -1°C

At midday, the temperature was 3°C.
b) Work out the difference between the temperature at midday and the temperature at midnight.   10°C

c) Work out the temperature which is halfway between -7°C and 3°C.   -2°C

2) The table below gives the temperature recorded on 25th December in 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6 °C	0 °C	-15 °C	-23 °C	3 °C	5 °C	18 °C

a) Which city recorded the lowest temperature?   Moscow

b) What is the difference in temperature between New York and Paris?   18°C

c) What is the difference in temperature between Cairo and Edinburgh?   24°C

d) The temperature in Madrid was 9°C lower than in Rome.
What was the temperature in Madrid?   -4°C

e) The temperature in Mexico City was 6°C higher than in New York.
What was the temperature in Mexico City?   -9°C

3) The table shows the temperature on the surface of each of five planets.

Planet	Temperature
Venus	210 °C
Jupiter	-150 °C
Saturn	-180 °C
Neptune	-210 °C
Pluto	-230 °C

a) Work out the difference in temperature between Jupiter and Pluto. 80°C

b) Work out the difference in temperature between Venus and Saturn.   390°C

c) Which planet has a temperature 30°C lower than Saturn? Neptune

The temperature on Mars is 90°C higher than the temperature on Jupiter.
d) Work out the temperature on Mars.   -60°C

1) Calculate the difference in hours and minutes between 9.30 am and 2.45 pm.

2) Calculate the difference in hours and minutes between 11 35 and 13 25.

3) The table shows the distances in kilometres between some cities in the USA.

San Francisco

4827	New York			
4990	2132	Miami		
668	4541	4375	Los Angeles	
3493	1352	2183	3366	Chicago

a) Write down the distance between San Francisco and Miami.

One of the cities in the table is 4541 km from Los Angeles.

b) Write down the name of this city.

c) Write down the name of the city which is furthest from Chicago.

4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

a) Tim catches the 06 06 train from Manchester.

At what time should he expect to arrive at Euston?

b) Jenny arrives at the Stockport train station at 07 00

(i) How long should she expect to wait for a train to Stoke?

(ii) How long should her train journey take?

c) Sarah needs to travel to Euston from Macclesfield.

She has to arrive at Euston before 09 30.

What is the departure time of the latest train she can catch to get there on time?

1) Calculate the difference in hours and minutes between 9.30 am and 2.45 pm. **5 hours 15 minutes**

2) Calculate the difference in hours and minutes between 11 35 and 13 25. **1 hour 50 minutes**

3) The table shows the distances in kilometres between some cities in the USA.

San Francisco

4827	New York			
4990	2132	Miami		
668	4541	4375	Los Angeles	
3493	1352	2183	3366	Chicago

a) Write down the distance between San Francisco and Miami. **4990 km**

One of the cities in the table is 4541 km from Los Angeles.

b) Write down the name of this city. **New York**

c) Write down the name of the city which is furthest from Chicago. **San Francisco**

4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

a) Tim catches the 06 06 train from Manchester.

At what time should he expect to arrive at Euston? **08 26**

b) Jenny arrives at the Stockport train station at 07 00

(i) How long should she expect to wait for a train to Stoke? **25 minutes**

(ii) How long should her train journey take? **29 minutes**

c) Sarah needs to travel to Euston from Macclesfield.

She has to arrive at Euston before 09 30.

What is the departure time of the latest train she can catch to get there on time? **07 08**

1) Write the following in their simplest forms
   using algebraic notation:

   a) $r \times 5$

   b) $c \div 4$

   c) $x + x + x + x$

   d) $e \times 1$

2) Write the following using algebraic notation:

   a) I think of a number
      and multiply it by 4.

   b) I think of a number,
      multiply it by 6
      and then add 5.

   c) I think of a number,
      triple it
      and then subtract 7.

3) Write the following using algebraic notation:

   a) I think of a number,
      add 2
      and then multiply the result by 3.

   b) I think of a number,
      subtract 6
      and then divide the result by 2.

4) Write the following using algebraic notation:

   a) I think of a number,
      add 9,
      multiply the result by 4
      and then divide everything by 2.

   b) I think of a number,
      take away 5,
      divide the result by 3
      and then multiply the result by 2.

1) Write the following in their simplest forms
   using algebraic notation:

   a) $r \times 5$ $5r$

   b) $c \div 4$ $\dfrac{c}{4}$

   c) $x + x + x + x$ $4x$

   d) $e \times 1$ e

2) Write the following using algebraic notation:

   a) I think of a number
      and multiply it by 4. $4x$

   b) I think of a number,
      multiply it by 6
      and then add 5. $6x + 5$

   c) I think of a number,
      triple it
      and then subtract 7. $3x - 7$

3) Write the following using algebraic notation:

   a) I think of a number,
      add 2
      and then multiply the result by 3. $3(x + 2)$ or $3x + 6$

   b) I think of a number,
      subtract 6
      and then divide the result by 2. $\dfrac{x - 6}{2}$

4) Write the following using algebraic notation:

   a) I think of a number,
      add 9,
      multiply the result by 4
      and then divide everything by 2. $\dfrac{4(x + 9)}{2}$ or $\dfrac{4x + 36}{2}$

   b) I think of a number,
      take away 5,
      divide the result by 3
      and then multiply the result by 2. $2\left(\dfrac{x - 5}{3}\right)$

Coordinates

1) Write down the coordinates of the points *A* to *H*.
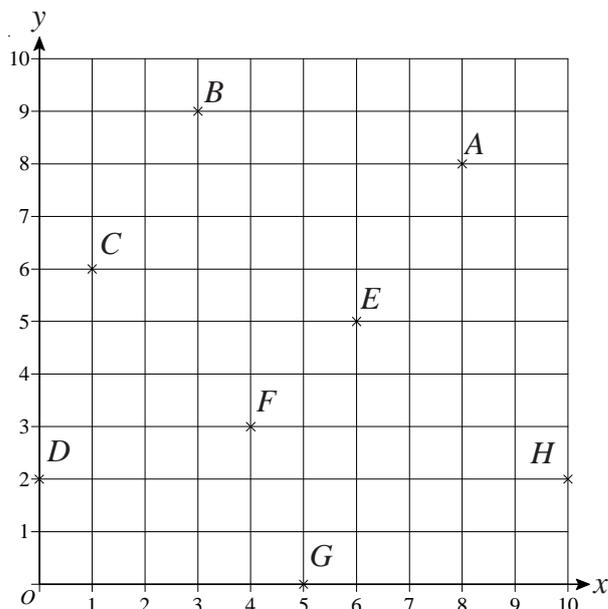
2) a) Write down the coordinates of: (i) *A* (ii) *B*

   b) Write down the coordinates of the midpoint of the line *AB*.
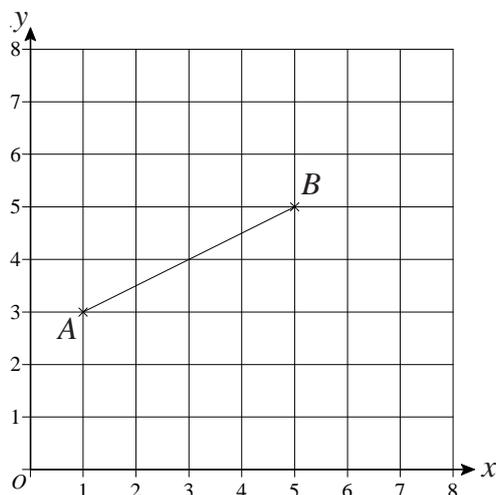
3) Using the pair of axes,
   a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

   b) Join the points in order, to form a shape and name the shape.

   M is the midpoint of the line segment *AC*.
   c) Find the coordinates of *M*.

4) Using the same pair of axes,
   a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).

   b) Join *R* to *S* and *S* to *T*.

   RSTU is a kite.
   c) Write the coordinates of point *U*.
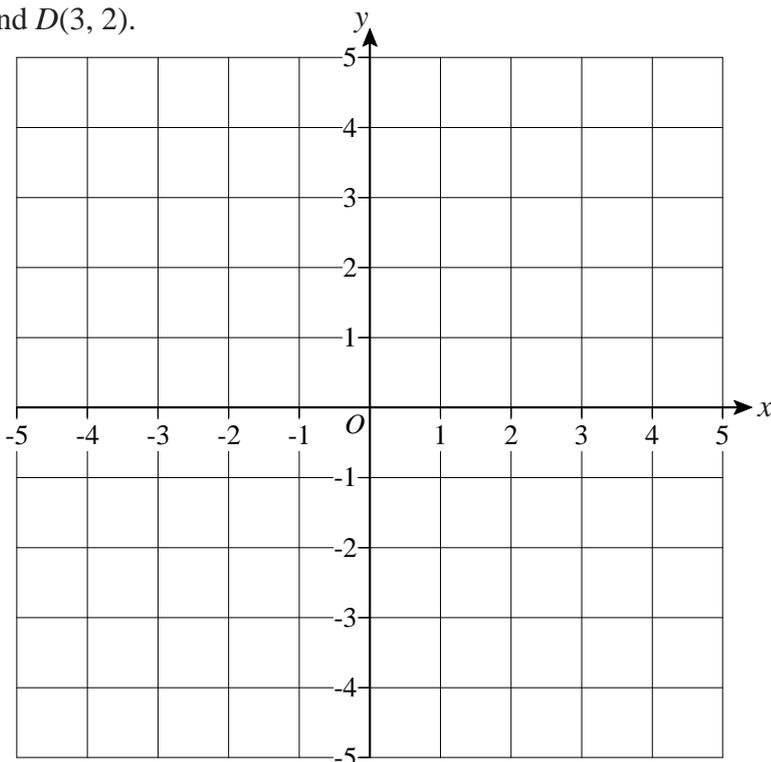
Coordinates

1) Write down the coordinates of the points *A* to *H*.

   A (8, 8)
   B (3, 9)
   C (1, 6)
   D (0, 2)
   E (6, 5)
   F (4, 3)
   G (5, 0)
   H (10, 2)
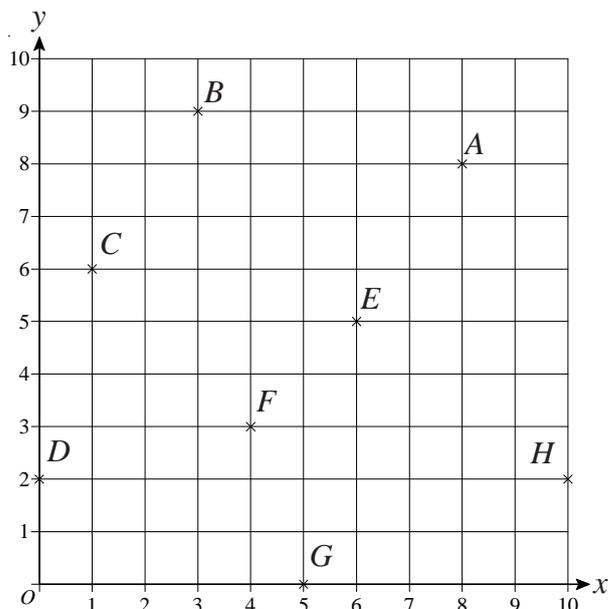
2) a) Write down the coordinates of: (i) *A* (ii) *B*
      (1, 3) (5, 5)

   b) Write down the coordinates of the midpoint of the line *AB*. (3, 4)
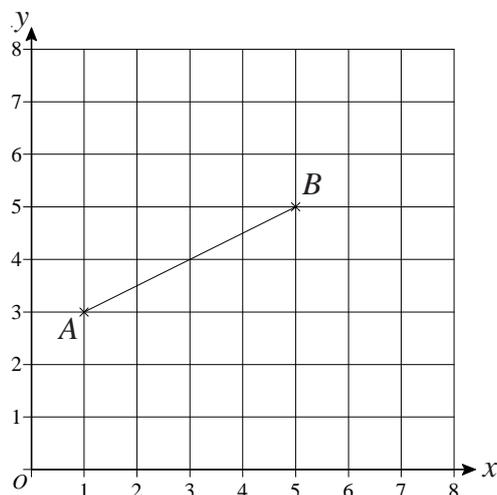
3) Using the pair of axes,
   a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

   b) Join the points in order, to form a shape and name the shape.
      Parallelogram

   M is the midpoint of the line segment *AC*.
   c) Find the coordinates of *M*. (3.5, 1)
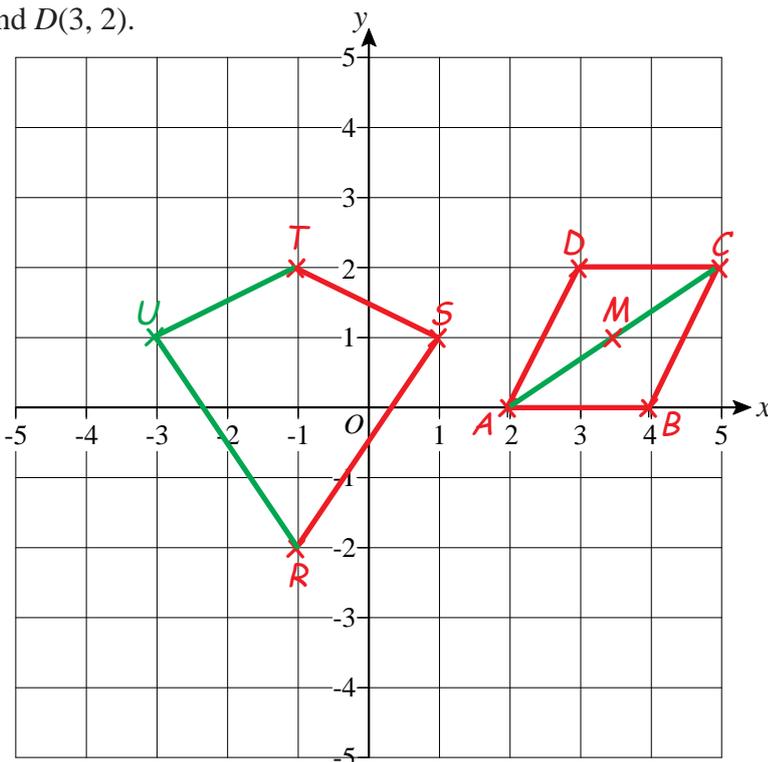
4) Using the same pair of axes,
   a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).

   b) Join *R* to *S* and *S* to *T*.

   RSTU is a kite.

   c) Write the coordinates of point *U*.
      (-3, 1)

1) Write one or two short sentences which say what the special features are of the triangles listed, below.
The first one has been done for you.

    a) An equilateral triangle All the sides are the same length.
All three angles are 60°

    b) A right-angled triangle

    c) A scalene triangle

    d) An isosceles triangle

2) Next to each of the quadrilaterals, write down its special name.
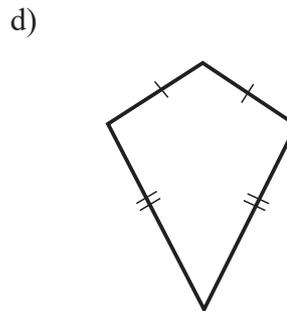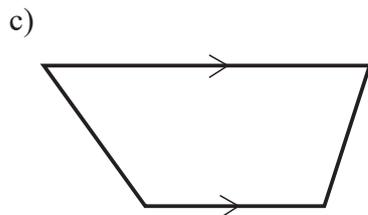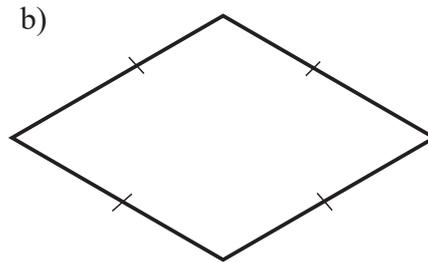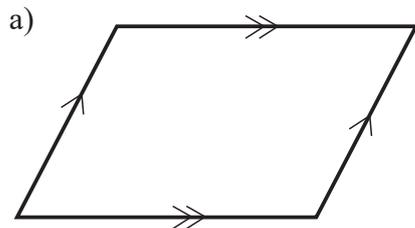
    a)

    b)

    c)

    d)

1) Write one or two short sentences which say what the special features are of the triangles listed, below.
The first one has been done for you.

    a) An equilateral triangle All the sides are the same length.
                                   All three angles are 60°

    b) A right-angled triangle Has one angle of 90°

    c) A scalene triangle All the sides are different lengths.
                             All the angles are different sizes.

    d) An isosceles triangle Two sides are the same length.
                             Two angles are the same size.

2) Next to each of the quadrilaterals, write down its special name.

a)

Parallelogram

b)

Rhombus

c)

Trapezium

d)
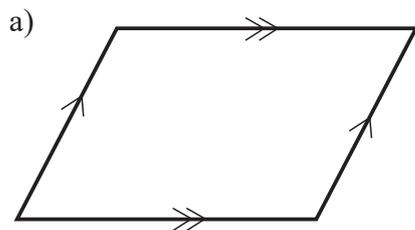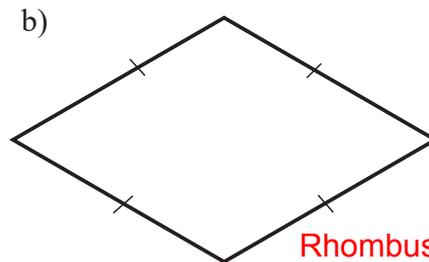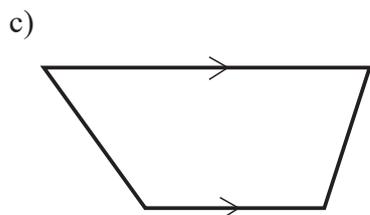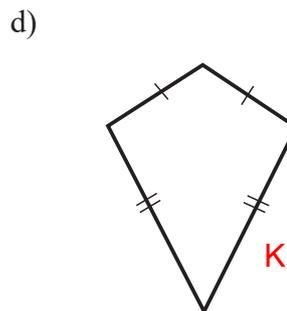
Kite

1) Draw a sketch of each of the following solids:

a) A cube.

b) A cylinder.

2) Write down the mathematical name of each of these 3-D shapes.

  a)

  b)

  c)
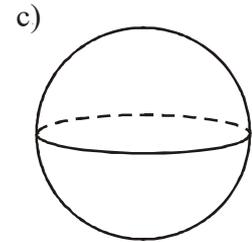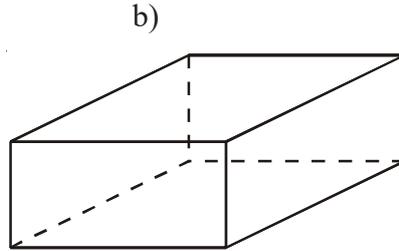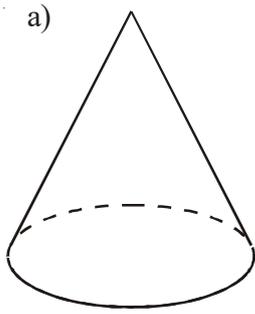
3) Look at this solid.
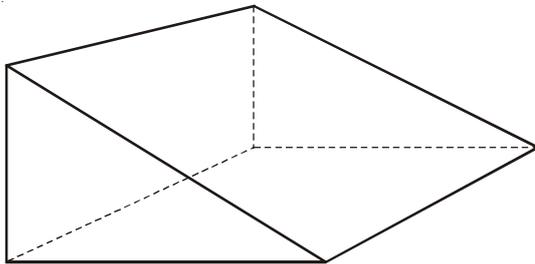
a) What is its name?

b) How many vertices does it have?

c) How many edges are there?

d) How many faces does it have?

4) This is a picture of a pentagonal prism.

  a) How many faces does it have?

  b) How many edges does it have?

  c) How many vertices does it have?

Properties of Solids
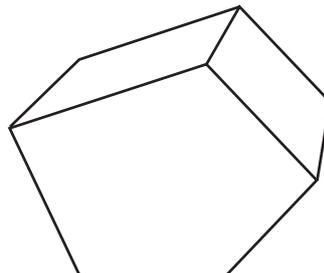
1) Draw a sketch of each of the following solids:

   a) A cube.

   b) A cylinder.

   Cube

   Cylinder

2) Write down the mathematical name of each of these 3-D shapes.

   a)

   Cone

   b)

   Cuboid

   c)
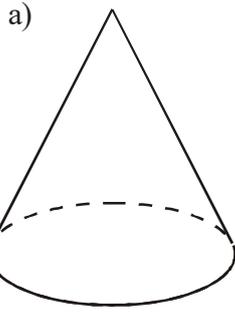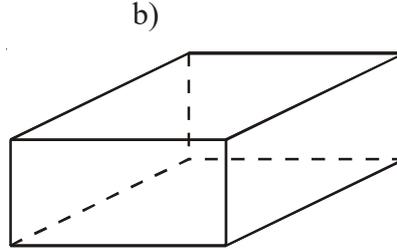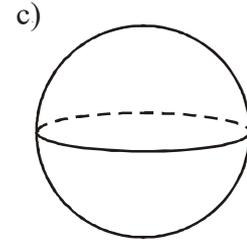
   Sphere

3) Look at this solid.
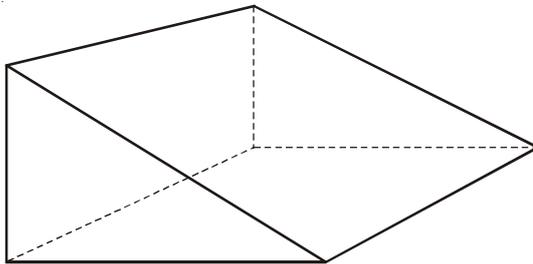
   a) What is its name? **Triangular prism**

   b) How many vertices does it have? **6**

   c) How many edges are there? **9**

   d) How many faces does it have? **5**

4) This is a picture of a pentagonal prism.

   a) How many faces does it have? **7**

   b) How many edges does it have? **15**

   c) How many vertices does it have? **10**
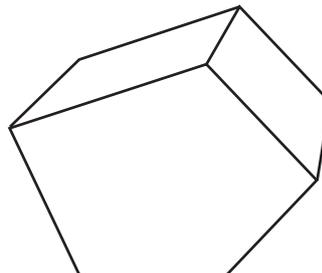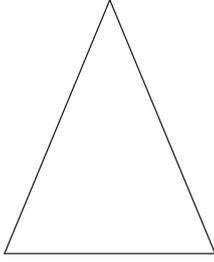
Symmetries

1) Draw all the lines of symmetry on the triangle and the rectangle.

2) What is the order of rotational symmetry of the two shapes below?

    S

3) The diagram below, shows part of a shape.

    P
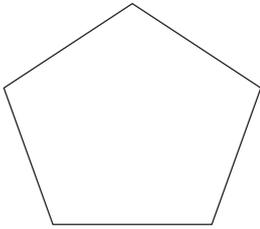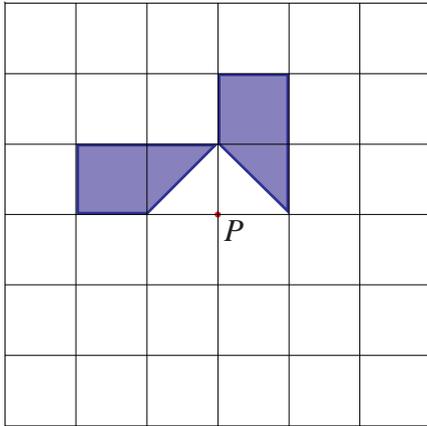
    The shape has rotational symmetry of order 4 about point *P*.

    Complete the shape.

1) Draw all the lines of symmetry on the triangle and the rectangle.
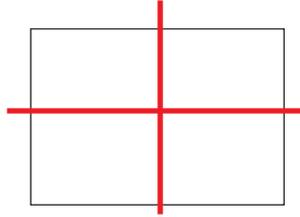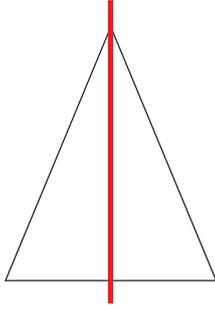
2) What is the order of rotational symmetry of the two shapes below?

5

S

2

3) The diagram below, shows part of a shape.

P
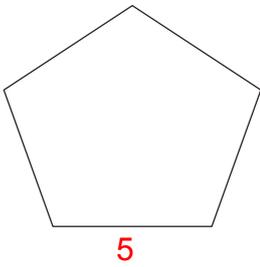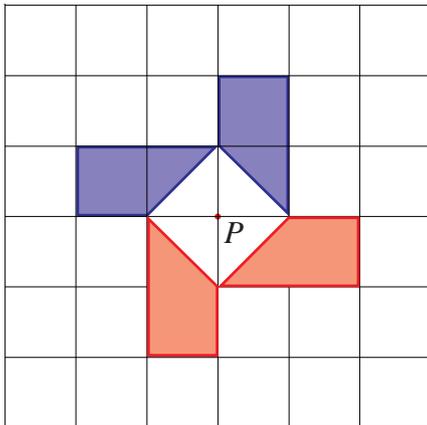
The shape has rotational symmetry of order 4 about point *P*.

Complete the shape.

1)   Out of the following types of data, decide which is continuous and which is discrete:

The lengths of some roads.

The number of 'cats eyes' on a one mile stretch of road.

The time it takes twenty students to complete an English essay.

The number of pages in twenty students English essays.

The weights of sacks of potatoes.

The number of potatoes in some sacks of potatoes.

The depth of water as the tide comes in and goes out.

The number of crackers in some packets of biscuits.

The weight of the crackers in some packs of bicuits.

2)   Write a short statement which explains what continuous data is.

3)   Write a short statement which explains what discrete data is.

Data - Discrete and Continuous

1) Out of the following types of data, decide which is continuous and which is discrete:

The lengths of some roads. Continuous

The number of 'cats eyes' on a one mile stretch of road. Discrete

The time it takes twenty students to complete an English essay. Continuous

The number of pages in twenty students English essays. Discrete

The weights of sacks of potatoes. Continuous

The number of potatoes in some sacks of potatoes. Discrete

The depth of water as the tide comes in and goes out. Continuous

The number of crackers in some packets of biscuits. Discrete

The weight of the crackers in some packs of bicuits. Continuous

2) Write a short statement which explains what continuous data is.
Continuous data is data that is measured using a continuous scale.

3) Write a short statement which explains what discrete data is.
Discrete data is data that is counted.

1) The line chart shows the test scores of pupils in class 10A.

Frequency

Test score (out of 10)
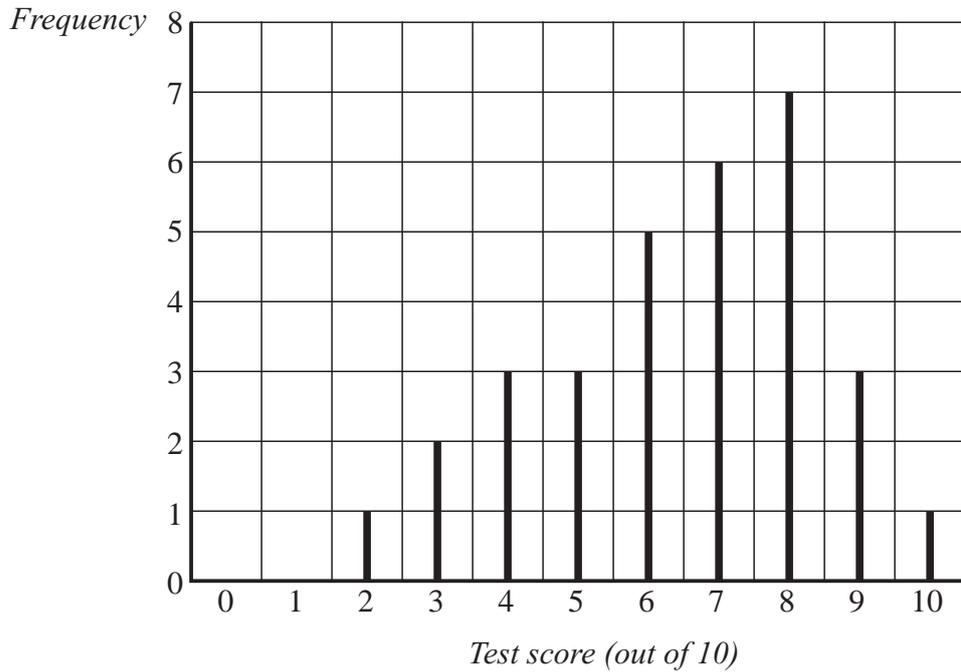
a) How many pupils sat the test in class 10A?

b) What was the modal test score?

c) What was the median test score?

2) The line chart shows the number of goals scored by a football team in their last 16 games.

Frequency

Number of goals scored
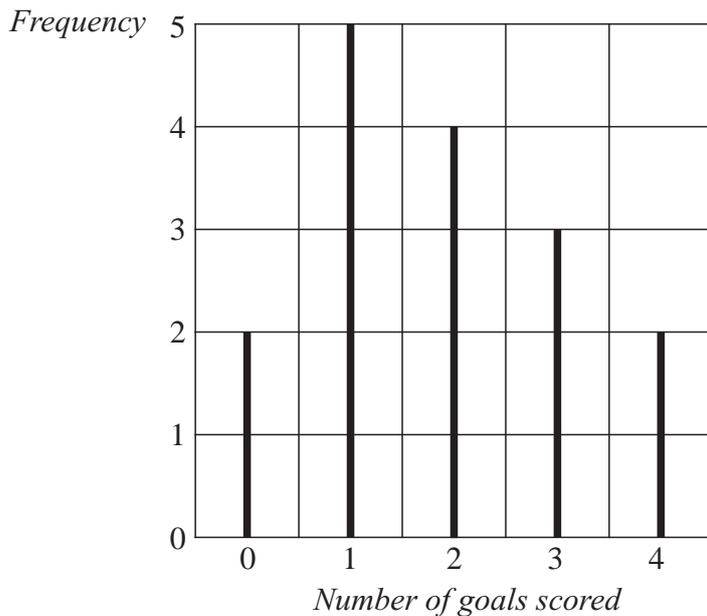
a) How many goals did they score altogether?

b) What was the median number of goals scored?

1) The line chart shows the test scores of pupils in class 10A.

Test score (out of 10)
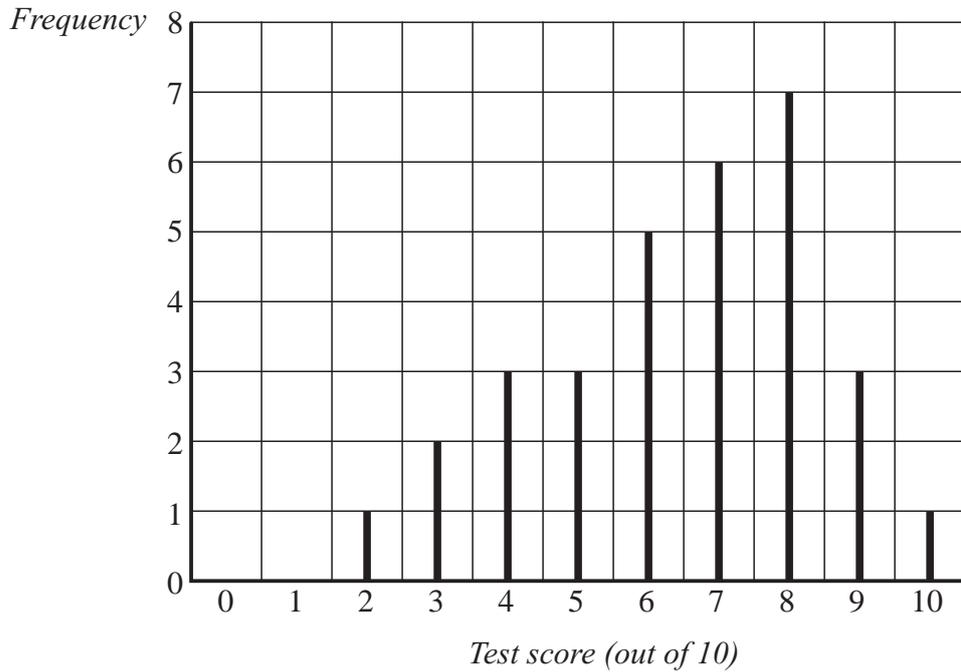
   a) How many pupils sat the test in class 10A? 31

   b) What was the modal test score? 8

   c) What was the median test score? 7

2) The line chart shows the number of goals scored by a football team in their last 16 games.

Number of goals scored
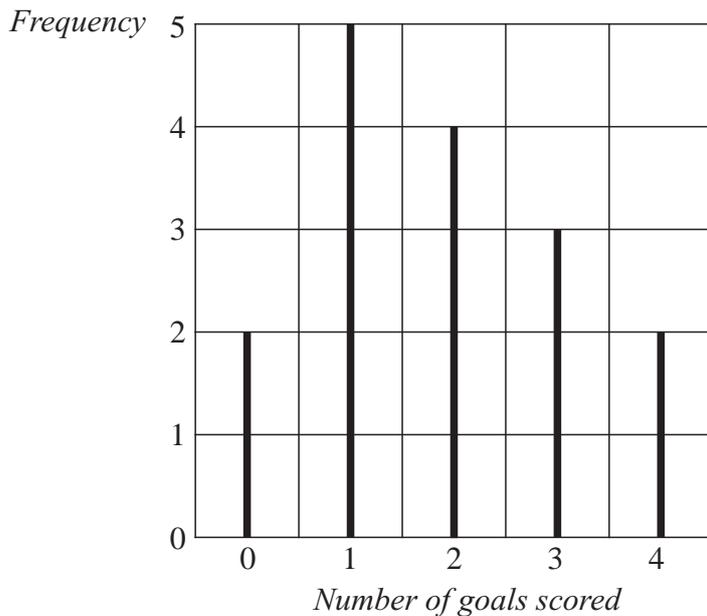
   a) How many goals did they score altogether? 30

   b) What was the median number of goals scored? 2

Rounding to Decimal Places

1) Round the following numbers to 1 decimal place

   a) 13.681   b) 344.7234   c) 0.76133

2) Round the following numbers to 2 decimal places

   a) 58.8136   b) 14.22731   c) 203.86884

3) Round the following numbers to 1 decimal place

   a) 48.9732   b) 163.9299   c) 19.952

4) Round the following numbers to 2 decimal places

   a) 10.697   b) 8.993   c) 14.9964

5) Work out the answer to 2.6882×14.71728 and give your answer correct to 2 decimal places.

6) Work out the answer to $64.2 \div 5.7$ and give your answer correct to 1 decimal place.

7) Work out the answer to 4.74^2 giving your answer correct to 2 decimal places.

8) Find the answer to $\sqrt{17.3}$ giving your answer correct to 1 decimal place.

1) Round the following numbers to 1 decimal place

 a) 13.681
 13.7

 b) 344.7234
 344.7

 c) 0.76133
 0.8

2) Round the following numbers to 2 decimal places

 a) 58.8136
 58.81

 b) 14.22731
 14.23

 c) 203.86884
 203.87

3) Round the following numbers to 1 decimal place

 a) 48.9732
 49.0

 b) 163.9299
 163.9

 c) 19.952
 20.0

4) Round the following numbers to 2 decimal places

 a) 10.697
 10.70

 b) 8.993
 8.99

 c) 14.9964
 15.00

5) Work out the answer to 2.6882×14.71728 and give your answer correct to 2 decimal places. 39.56

6) Work out the answer to $64.2 \div 5.7$ and give your answer correct to 1 decimal place. 11.3

7) Work out the answer to 4.74^2 giving your answer correct to 2 decimal places. 22.47

8) Find the answer to $\sqrt{17.3}$ giving your answer correct to 1 decimal place. 4.2

1) Write down the number which is in the middle of:

a) 3 and 9

b) 12 and 28

c) 11 and 22

d) 17 and 32

e) 72 and 108

f) 1 and 100

g) –6 and 2

2) Write down the number which is in the middle of:

a) 2.4 and 6.8

b) 5.9 and 12.5

c) -5 and 7.8

3) a) 7 is in the middle of 3 and which other number?

b) 16 is in the middle of 9 and which other number?

c) 2.4 is in the middle of 1.1 and which other number?

1) Write down the number which is in the middle of:

a) 3 and 9   6

b) 12 and 28   20

c) 11 and 22   16.5

d) 17 and 32   24.5

e) 72 and 108   90

f) 1 and 100   50.5

g) −6 and 2   −2

2) Write down the number which is in the middle of:

a) 2.4 and 6.8   4.6

b) 5.9 and 12.5   9.2

c) -5 and 7.8   1.4

3) a) 7 is in the middle of 3 and which other number?   11

b) 16 is in the middle of 9 and which other number?   23

c) 2.4 is in the middle of 1.1 and which other number?   3.7

1) Write the following using indices:
   eg. 3 × 3 × 3 × 3 = 3⁴

   a) $2 \times 2 \times 2 \times 2$

   b) $4 \times 4 \times 4$

   c) $5 \times 5 \times 5 \times 5 \times 5 \times 5$

   d) $12 \times 12 \times 12 \times 12 \times 12$

   e) 3.6×3.6

   f) $5.2 \times 5.2 \times 5.2$

2) Write each of the following as a single power:
   eg. 5² × 5⁴ = 5⁶

   a) $6^2 \times 6^3$

   b) $7^4 \times 7^2$

   c) $9^3 \times 9^6$

   d) $5^3 \times 5$

   e) $2^9 \times 2^3$

   f) $7.2^3 \times 7.2^2$

3) Write each of the following as a single power:
   eg. 7⁵ ÷ 7² = 7³

   a) $9^5 \div 9^3$

   b) $6^9 \div 6^5$

   c) $11^7 \div 11^2$

   d) $\dfrac{7^8}{7^3}$

   e) $\dfrac{3^6}{3}$

   f) $\dfrac{8^{15}}{8^4}$

4) Write each of the following as a single power:

   eg. $\dfrac{7^3 \times 7^8}{7^6} = \dfrac{7^{11}}{7^6} = 7^5$

   a) $\dfrac{4^7 \times 4^3}{4^6}$

   b) $\dfrac{9^2 \times 9^6}{9^4}$

5) Match together cards with the same answer

   | 5^7 | $5^{10} \div 5^6$ | $5^6 \times 5^2$ | 5^3 | 5^2 |

   | 5^8 | 5×5 | $\dfrac{5^2 \times 5^4}{5^3}$ | $5^2 \times 5^5$ | 5^4 |

1) Write the following using indices:
   eg. 3 × 3 × 3 × 3 = 3⁴

   a) $2 \times 2 \times 2 \times 2$ 2^4

   b) $4 \times 4 \times 4$ 4^3

   c) $5 \times 5 \times 5 \times 5 \times 5 \times 5$ 5^6

   d) $12 \times 12 \times 12 \times 12 \times 12$ 12^5

   e) 3.6×3.6 3.6^2

   f) $5.2 \times 5.2 \times 5.2$ 5.2^3

2) Write each of the following as a single power:
   eg. 5² × 5⁴ = 5⁶

   a) $6^2 \times 6^3$ 6^5

   b) $7^4 \times 7^2$ 7^6

   c) $9^3 \times 9^6$ 9^9

   d) $5^3 \times 5$ 5^4

   e) $2^9 \times 2^3$ 2^{12}

   f) $7.2^3 \times 7.2^2$ 7.2^5

3) Write each of the following as a single power:
   eg. 7⁵ ÷ 7² = 7³

   a) $9^5 \div 9^3$ 9^2

   b) $6^9 \div 6^5$ 6^4

   c) $11^7 \div 11^2$ 11^5

   d) $\dfrac{7^8}{7^3}$ 7^5

   e) $\dfrac{3^6}{3}$ 3^5

   f) $\dfrac{8^{15}}{8^4}$ 8^{11}

4) Write each of the following as a single power:

   eg. $\dfrac{7^3 \times 7^8}{7^6} = \dfrac{7^{11}}{7^6} = 7^5$

   a) $\dfrac{4^7 \times 4^3}{4^6}$ 4^4

   b) $\dfrac{9^2 \times 9^6}{9^4}$ 9^4

5) Match together cards with the same answer

   | 5^7 | $5^{10} \div 5^6$ | $5^6 \times 5^2$ | 5^3 | 5^2 |

   | 5^8 | 5×5 | $\dfrac{5^2 \times 5^4}{5^3}$ | $5^2 \times 5^5$ | 5^4 |

1) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\dfrac{8}{12}$

$\dfrac{4}{6}$

$\dfrac{2}{3}$

b) What do you notice about how many little squares are shaded in each grid?

2) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\dfrac{2}{5}$

$\dfrac{4}{10}$

$\dfrac{8}{20}$
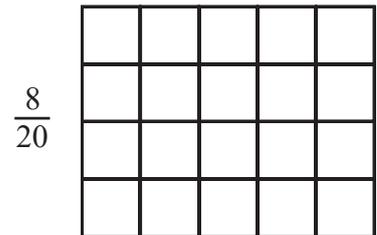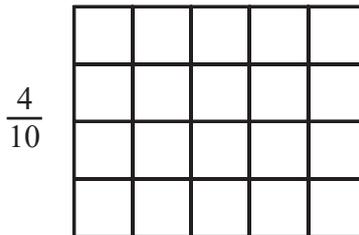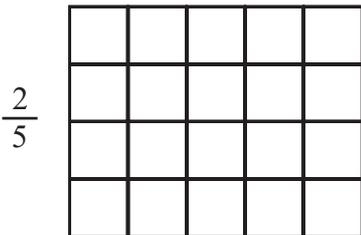
b) What do you notice about how many little squares are shaded in each grid?

3) Find the missing values in these equivalent fractions.

$$\dfrac{1}{2} = \dfrac{2}{\square} = \dfrac{3}{\square} = \dfrac{4}{\square}$$

4) Find the missing values in these equivalent fractions.

$$\dfrac{2}{5} = \dfrac{6}{\square} = \dfrac{\square}{30} = \dfrac{14}{\square}$$

5) How do you know that $\dfrac{3}{7}$ is not equivalent to $\dfrac{25}{56}$?

Equivalent Fractions

1) Each of the grids below has a fraction written at the side of it.

   a) Shade the grids to show these fractions.

   $\dfrac{8}{12}$ $\dfrac{4}{6}$ $\dfrac{2}{3}$
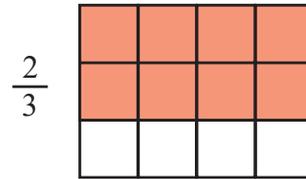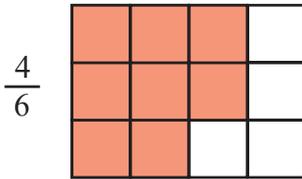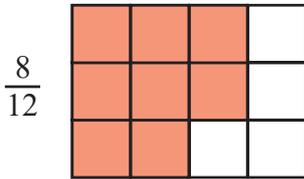
   b) What do you notice about how many little squares are shaded in each grid?

   It is always the same - 8 squares.

2) Each of the grids below has a fraction written at the side of it.

   a) Shade the grids to show these fractions.

   $\dfrac{2}{5}$ $\dfrac{4}{10}$ $\dfrac{8}{20}$
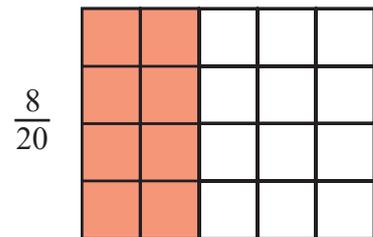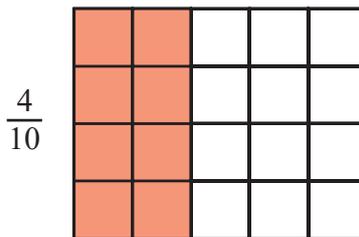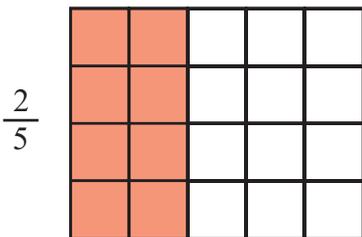
   b) What do you notice about how many little squares are shaded in each grid?

   It is always the same - 8 squares.

3) Find the missing values in these equivalent fractions.

   $$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$$

4) Find the missing values in these equivalent fractions.

   $$\frac{2}{5} = \frac{6}{15} = \frac{12}{30} = \frac{14}{35}$$

5) How do you know that $\dfrac{3}{7}$ is not equivalent to $\dfrac{25}{56}$?

   You have to multiply 7 by 8 to get 56, but when you mulitply 3 by 8 you get 24, not 25.

Simplifying Fractions

1) Write the following fractions in their simplest forms

a) $\dfrac{2}{4}$

b) $\dfrac{5}{10}$

c) $\dfrac{4}{6}$

d) $\dfrac{6}{9}$

e) $\dfrac{12}{15}$

f) $\dfrac{8}{12}$

g) $\dfrac{15}{20}$

2) Write the following fractions in their simplest forms

a) $\dfrac{9}{30}$

b) $\dfrac{14}{18}$

c) $\dfrac{7}{49}$

d) $\dfrac{48}{72}$

e) $\dfrac{60}{75}$

f) $\dfrac{15}{27}$

g) $\dfrac{72}{96}$

Simplifying Fractions

1) Write the following fractions in their simplest forms

    a) $\dfrac{2}{4}$ $\dfrac{1}{2}$

    b) $\dfrac{5}{10}$ $\dfrac{1}{2}$

    c) $\dfrac{4}{6}$ $\dfrac{2}{3}$

    d) $\dfrac{6}{9}$ $\dfrac{2}{3}$

    e) $\dfrac{12}{15}$ $\dfrac{4}{5}$

    f) $\dfrac{8}{12}$ $\dfrac{2}{3}$

    g) $\dfrac{15}{20}$ $\dfrac{3}{4}$

2) Write the following fractions in their simplest forms

    a) $\dfrac{9}{30}$ $\dfrac{3}{10}$

    b) $\dfrac{14}{18}$ $\dfrac{7}{9}$

    c) $\dfrac{7}{49}$ $\dfrac{1}{7}$

    d) $\dfrac{48}{72}$ $\dfrac{2}{3}$

    e) $\dfrac{60}{75}$ $\dfrac{4}{5}$

    f) $\dfrac{15}{27}$ $\dfrac{5}{9}$

    g) $\dfrac{72}{96}$ $\dfrac{3}{4}$

1) Write the following as improper fractions in their simplest form.

   a) $3\frac{1}{4}$

   b) $1\frac{2}{5}$

   c) $5\frac{2}{3}$

   d) $4\frac{5}{8}$

2) Write the following as mixed numbers in their simplest form.

   a) $\frac{8}{5}$

   b) $\frac{11}{4}$

   c) $\frac{16}{5}$

   d) $\frac{73}{10}$

3) Write the following as improper fractions in their simplest form.

   a) $7\frac{1}{13}$

   b) $15\frac{2}{5}$

   c) $23\frac{3}{4}$

   d) $9\frac{5}{12}$

4) Write the following as mixed numbers in their simplest form.

   a) $\frac{66}{5}$

   b) $\frac{87}{4}$

   c) $\frac{54}{11}$

   d) $\frac{98}{13}$

1) Write the following as improper fractions in their simplest form.

   a) $3\frac{1}{4}$ $\frac{13}{4}$

   b) $1\frac{2}{5}$ $\frac{7}{5}$

   c) $5\frac{2}{3}$ $\frac{17}{3}$

   d) $4\frac{5}{8}$ $\frac{37}{8}$

2) Write the following as mixed numbers in their simplest form.

   a) $\frac{8}{5}$ $1\frac{3}{5}$

   b) $\frac{11}{4}$ $2\frac{3}{4}$

   c) $\frac{16}{5}$ $3\frac{1}{5}$

   d) $\frac{73}{10}$ $7\frac{3}{10}$

3) Write the following as improper fractions in their simplest form.

   a) $7\frac{1}{13}$ $\frac{92}{13}$

   b) $15\frac{2}{5}$ $\frac{77}{5}$

   c) $23\frac{3}{4}$ $\frac{95}{4}$

   d) $9\frac{5}{12}$ $\frac{113}{12}$

4) Write the following as mixed numbers in their simplest form.

   a) $\frac{66}{5}$ $13\frac{1}{5}$

   b) $\frac{87}{4}$ $21\frac{3}{4}$

   c) $\frac{54}{11}$ $4\frac{10}{11}$

   d) $\frac{98}{13}$ $7\frac{7}{13}$

Comparing Fractions

1) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{1}{2}$ $\dfrac{1}{3}$

   b) $\dfrac{3}{5}$ $\dfrac{2}{3}$

   c) $\dfrac{1}{2}$ $\dfrac{3}{8}$

2) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{1}{2}$ $\dfrac{1}{4}$ $\dfrac{3}{8}$

   b) $\dfrac{3}{5}$ $\dfrac{1}{2}$ $\dfrac{3}{4}$

   c) $\dfrac{5}{6}$ $\dfrac{2}{3}$ $\dfrac{3}{4}$

3) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{2}{3}$ $\dfrac{7}{12}$ $\dfrac{3}{4}$ $\dfrac{5}{6}$

   b) $\dfrac{5}{8}$ $\dfrac{2}{3}$ $\dfrac{3}{24}$ $\dfrac{7}{12}$

   c) $\dfrac{6}{10}$ $\dfrac{4}{5}$ $\dfrac{5}{12}$ $\dfrac{8}{15}$

4) Ben spent his pocket money this way:

   $\dfrac{7}{20}$ on magazines

   $\dfrac{4}{10}$ on chocolates

   $\dfrac{1}{4}$ on games

   Order the items Ben bought by value, largest first.
   Show all your working.

Comparing Fractions

1) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{1}{2}$ $\dfrac{1}{3}$ $\dfrac{1}{3}$ $\dfrac{1}{2}$

   b) $\dfrac{3}{5}$ $\dfrac{2}{3}$ $\dfrac{3}{5}$ $\dfrac{2}{3}$

   c) $\dfrac{1}{2}$ $\dfrac{3}{8}$ $\dfrac{3}{8}$ $\dfrac{1}{2}$

2) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{1}{2}$ $\dfrac{1}{4}$ $\dfrac{3}{8}$ $\dfrac{1}{4}$ $\dfrac{3}{8}$ $\dfrac{1}{2}$

   b) $\dfrac{3}{5}$ $\dfrac{1}{2}$ $\dfrac{3}{4}$ $\dfrac{1}{2}$ $\dfrac{3}{5}$ $\dfrac{3}{4}$

   c) $\dfrac{5}{6}$ $\dfrac{2}{3}$ $\dfrac{3}{4}$ $\dfrac{2}{3}$ $\dfrac{3}{4}$ $\dfrac{5}{6}$

3) Put these fractions in order of size, smallest to largest.
   Show your working for each question.

   a) $\dfrac{2}{3}$ $\dfrac{7}{12}$ $\dfrac{3}{4}$ $\dfrac{5}{6}$ $\dfrac{7}{12}$ $\dfrac{2}{3}$ $\dfrac{3}{4}$ $\dfrac{5}{6}$

   b) $\dfrac{5}{8}$ $\dfrac{2}{3}$ $\dfrac{3}{24}$ $\dfrac{7}{12}$ $\dfrac{3}{24}$ $\dfrac{7}{12}$ $\dfrac{5}{8}$ $\dfrac{2}{3}$

   c) $\dfrac{6}{10}$ $\dfrac{4}{5}$ $\dfrac{5}{12}$ $\dfrac{8}{15}$ $\dfrac{5}{12}$ $\dfrac{8}{15}$ $\dfrac{6}{10}$ $\dfrac{4}{5}$

4) Ben spent his pocket money this way:

   $\dfrac{7}{20}$ on magazines

   $\dfrac{4}{10}$ on chocolates

   $\dfrac{1}{4}$ on games

   Order the items Ben bought by value, largest first.   Chocolates, magazines, games
   Show all your working.

Percentages - Introduction

1)   What percentage of this grid is shaded?
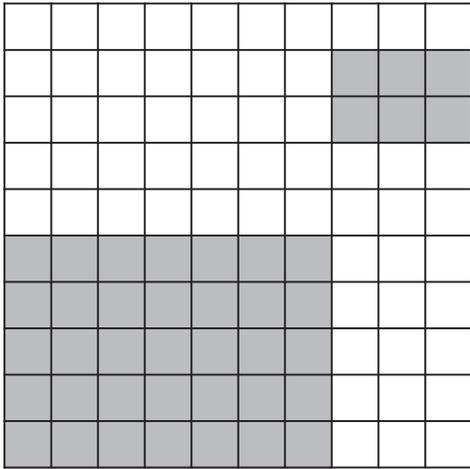
2)   What percentage of this grid is shaded?
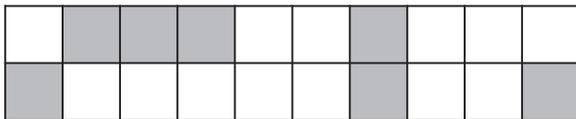
3)   a) What percentage of this grid is shaded?
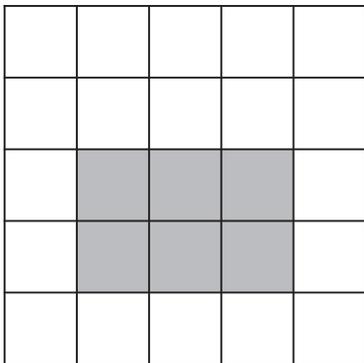
      b) How many more squares should be shaded to make 80% of the grid shaded?

4)   What percentage of this grid is shaded?
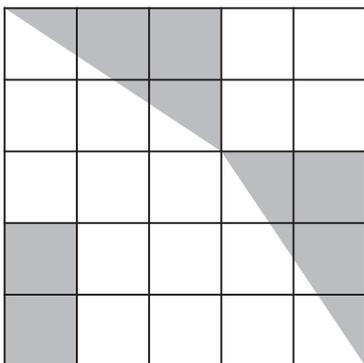
1)   What percentage of this grid is shaded?
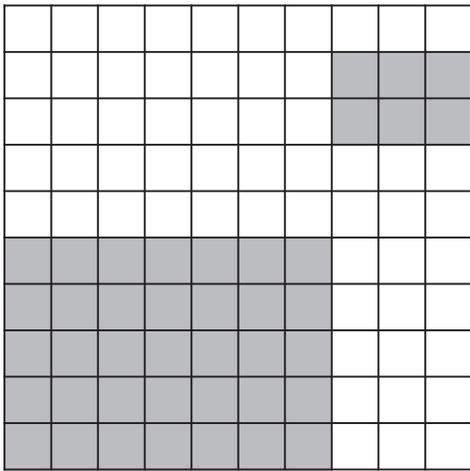
41%

2)   What percentage of this grid is shaded?
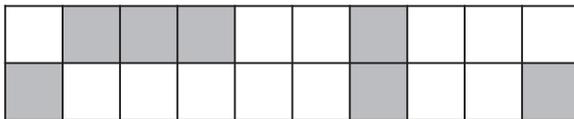
35%

3)   a) What percentage of this grid is shaded?
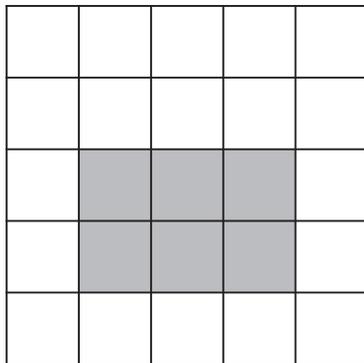
24%

   b) How many more squares should be shaded to make 80% of the grid shaded?   14

4)   What percentage of this grid is shaded?
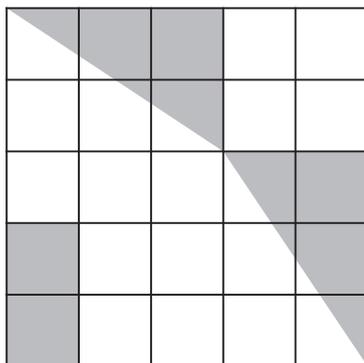
32%

1)   Work out

    a) 6 × 0.2

    b) 0.2 × 0.3

    c) 0.4 × 7

    d) 0.2 × 0.8

    e) 0.03 × 0.9

    f) 1.5 × 0.2

2)   A box contains 7 books, each weighing 2.5 kg.

    Work out the total weight of the box.

3)   Jim takes 13 boxes out of his van.

    The weight of each box is 25.5 kg.

    Work out the total weight of the 13 boxes.

4)   Tim has a job which pays £6.85 per hour.

    If he works for 34 hours, one week, how much does he earn?

5)   Sue has a part-time job and the hourly pay is £7.50 per hour.

    How much does she earn if she works for 8.5 hours, one week?

6)   Fencing costs £13.25 per metre.

    How much does 12.5 m cost?

Multiplying Decimals

1) Work out

 a) 6×0.2 **1.2**

 b) 0.2×0.3 **0.06**

 c) 0.4×7 **2.8**

 d) 0.2×0.8 **0.16**

 e) 0.03×0.9 **0.027**

 f) 1.5×0.2 **0.3**

2) A box contains 7 books, each weighing 2.5 kg.

 Work out the total weight of the box. **17.5 kg**

3) Jim takes 13 boxes out of his van.

 The weight of each box is 25.5 kg.

 Work out the total weight of the 13 boxes. **331.5 kg**

4) Tim has a job which pays £6.85 per hour.

 If he works for 34 hours, one week, how much does he earn? **£232.90**

5) Sue has a part-time job and the hourly pay is £7.50 per hour.

 How much does she earn if she works for 8.5 hours, one week? **£63.75**

6) Fencing costs £13.25 per metre.

 How much does 12.5 m cost? **£165.63**

Dividing Decimals

1) Work out

   a) $9 \div 0.3$

   b) $6 \div 0.1$

   c) $12 \div 0.4$

   d) $25 \div 0.5$

   e) $21 \div 0.3$

   f) $15 \div 0.2$

2) Work out

   a) $3.6 \div 0.4$

   b) $0.8 \div 0.2$

   c) $2.4 \div 0.4$

   d) $0.56 \div 0.08$

   e) $5.5 \div 0.05$

   f) $8.1 \div 0.09$

3) John takes boxes out of his van.
The total weight of the boxes is 4.9 kg
The weight of each box is 0.7 kg
Work out the number of boxes in John's van.

4) Mr Rogers bought a bag of elastic bands for £6
Each elastic band costs 12p.
Work out the number of elastic bands in the bag.

Dividing Decimals

1) Work out

   a) $9 \div 0.3$ 30

   b) $6 \div 0.1$ 60

   c) $12 \div 0.4$ 30

   d) $25 \div 0.5$ 50

   e) $21 \div 0.3$ 70

   f) $15 \div 0.2$ 75

2) Work out

   a) $3.6 \div 0.4$ 9

   b) $0.8 \div 0.2$ 4

   c) $2.4 \div 0.4$ 6

   d) $0.56 \div 0.08$ 7

   e) $5.5 \div 0.05$ 110

   f) $8.1 \div 0.09$ 90

3) John takes boxes out of his van.
   The total weight of the boxes is 4.9 kg
   The weight of each box is 0.7 kg
   Work out the number of boxes in John's van.   7

4) Mr Rogers bought a bag of elastic bands for £6
   Each elastic band costs 12p.
   Work out the number of elastic bands in the bag.   50

1) $6 \times 5 + 2$

2) $2 + 6 \times 5$

3) $35 - 4 \times 3$

4) $48 \div (14 - 2)$

5) $27 \div (3 + 6)$

6) $27 \div 3 + 6$

7) $(9 + 2) \times 2 + 5$

8) $4 \times (1 + 4) - 6$

9) $6 \times 4 - 3 \times 5$

10) $\dfrac{9 + 3}{4 + 2}$

11) $\dfrac{23 + 9}{7 - 3}$

12) $\dfrac{7 - 2^2}{4^2 - 15}$

13) $\dfrac{5^2 + 3}{2 \times 7}$

14) $\dfrac{5 \times 6 - 4}{13}$

15) $\dfrac{8 \times 2 - 4}{3 + 1^2}$

16) $\dfrac{12 - 3 \times 2}{14 \div 7}$

17) $\dfrac{20 - 3^2}{10 - (5 + 4)}$

18) $\dfrac{3 + 9 \times 8}{1 + 6 \times 4}$

1) $6 \times 5 + 2$ **32**

2) $2 + 6 \times 5$ **32**

3) $35 - 4 \times 3$ **23**

4) $48 \div (14 - 2)$ **4**

5) $27 \div (3 + 6)$ **3**

6) $27 \div 3 + 6$ **15**

7) $(9 + 2) \times 2 + 5$ **27**

8) $4 \times (1 + 4) - 6$ **14**

9) $6 \times 4 - 3 \times 5$ **9**

10) $\dfrac{9 + 3}{4 + 2}$ **2**

11) $\dfrac{23 + 9}{7 - 3}$ **8**

12) $\dfrac{7 - 2^2}{4^2 - 15}$ **3**

13) $\dfrac{5^2 + 3}{2 \times 7}$ **2**

14) $\dfrac{5 \times 6 - 4}{13}$ **2**

15) $\dfrac{8 \times 2 - 4}{3 + 1^2}$ **3**

16) $\dfrac{12 - 3 \times 2}{14 \div 7}$ **3**

17) $\dfrac{20 - 3^2}{10 - (5 + 4)}$ **11**

18) $\dfrac{3 + 9 \times 8}{1 + 6 \times 4}$ **3**

Function Machines

1) Complete the table for the function machine.

$$\longrightarrow \boxed{\times\,5} \longrightarrow \boxed{+\,3} \longrightarrow$$

In	Out
4	
7	
	48
	73

2) Complete the table for the function machine.

$$\longrightarrow \boxed{\times\,4} \longrightarrow \boxed{-\,7} \longrightarrow$$

In	Out
-2	
1	
	17
x	

3) Complete the table for the function machine.

$$\longrightarrow \boxed{+\,2} \longrightarrow \boxed{\times\,6} \longrightarrow$$

In	Out
-3	
0	
	66
x	

1) Complete the table for the function machine.

$$\longrightarrow \boxed{\times 5} \longrightarrow \boxed{+3} \longrightarrow$$

In	Out
4	23
7	38
9	48
14	73

2) Complete the table for the function machine.

$$\longrightarrow \boxed{\times 4} \longrightarrow \boxed{- 7} \longrightarrow$$

In	Out
-2	-15
1	-3
6	17
x	$4x - 7$

3) Complete the table for the function machine.

$$\longrightarrow \boxed{+ 2} \longrightarrow \boxed{\times 6} \longrightarrow$$

In	Out
-3	-6
0	12
9	66
x	$6(x + 2)$

1) Simplify the following

   a) $x + x$

   b) $2x + 3x$

   c) $5t - 3t$

   d) $7y - 6y$

   e) $x + 2x + 3x$

   f) $3g - g + 6g$

   g) $2x - 7x + 8x$

   h) $y - 2y - 3y + 6y$

2) Simplify the following

   a) $xy + 3xy$

   b) $5xy - 2xy$

   c) $4x^2y + x^2y$

   d) $3xy^2 - 2xy^2$

   e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$

   f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$

3) Simplify the following

   a) $x + y + x + y$

   b) $2x + 3y + x + 4y$

   c) $2a + 4b - a + 2b$

   d) $3x + 4y - x - 2y$

   e) $6x - 2y + 2x + 5y$

   f) $4x - 3y - 2x - 5y$

   g) $3t + 4u + 2t - 7u$

   h) $2xy + 3t - xy - 4t$

1) Simplify the following
   a) $x + x$ 2x

   b) $2x + 3x$ 5x

   c) $5t - 3t$ 2t

   d) $7y - 6y$ y

   e) $x + 2x + 3x$ 6x

   f) $3g - g + 6g$ 8g

   g) $2x - 7x + 8x$ 3x

   h) $y - 2y - 3y + 6y$ 2y

2) Simplify the following
   a) $xy + 3xy$ 4xy

   b) $5xy - 2xy$ 3xy

   c) $4x^2y + x^2y$ $5x^2y$

   d) $3xy^2 - 2xy^2$ xy^2

   e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$ $3x^2y^3$

   f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$ $9a^2bc^4$

3) Simplify the following
   a) $x + y + x + y$ 2x + 2y

   b) $2x + 3y + x + 4y$ 3x + 7y

   c) $2a + 4b - a + 2b$ a + 6b

   d) $3x + 4y - x - 2y$ 2x + 2y

   e) $6x - 2y + 2x + 5y$ 8x + 3y

   f) $4x - 3y - 2x - 5y$ 2x − 8y

   g) $3t + 4u + 2t - 7u$ 5t − 3u

   h) $2xy + 3t - xy - 4t$ xy − t

1)   Write the first 5 terms of each of these sequences.

   a) Start at 2 and add 6.

   b) Start at 14 and subtract 3.

   c) Start at 4 and subtract 7.

   d) Start at 2 and multiply by 3.

   e) Start at 64 and divide by 2.

   f) Start at 600 and divide by 10.

2)   Find the term to term rule for each of these sequences.

   a) 4, 7, 10, 13, 16

   b) 15, 13, 11, 9, 7

   c) 2, -3, -8, -13, -18

   d) 7, 14, 28, 56, 112

   e) 100, 10, 1, 0.1, 0.01

1)   Write the first 5 terms of each of these sequences.

a) Start at 2 and add 6.   2, 8, 14, 20, 26

b) Start at 14 and subtract 3.   14, 11, 8, 5, 2

c) Start at 4 and subtract 7.   4, -3, -10, -17, -24

d) Start at 2 and multiply by 3.   2, 6, 18, 54,162

e) Start at 64 and divide by 2.   64, 32, 16, 8, 4

f) Start at 600 and divide by 10.   600, 60, 6, 0.6, 0.06

2)   Find the term to term rule for each of these sequences.

a) 4, 7, 10, 13, 16   Add 3

b) 15, 13, 11, 9, 7   Subtract 2

c) 2, -3, -8, -13, -18   Subtract 5

d) 7, 14, 28, 56, 112   Multiply by 2

e) 100, 10, 1, 0.1, 0.01   Divide by 10

1) Sketch nets of these solids.

a)
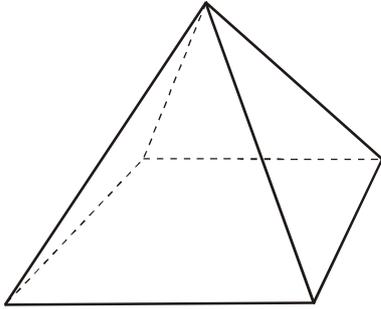
b)
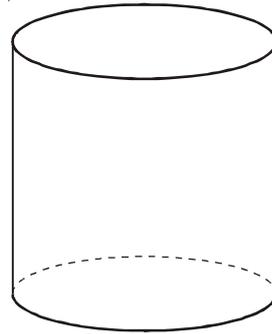
2) On squared paper draw accurate nets of these solids.

a) **Cube**

4 cm

4 cm

4 cm

b) **Cuboid**

5 cm

6 cm

8 cm

c) **Right-angled triangular prism**

5 cm

4 cm

7 cm

3 cm

d) **Triangular prism**

5 cm

3 cm

7 cm

8 cm

3) The two nets, below, are folded to make cubes.
Two other vertices will meet at the the dot, A. Mark them with As.
One other vertex will meet the dot B. Mark it with B.

a) A

b)

B

1) Sketch nets of these solids.

   a)

   b)

2)
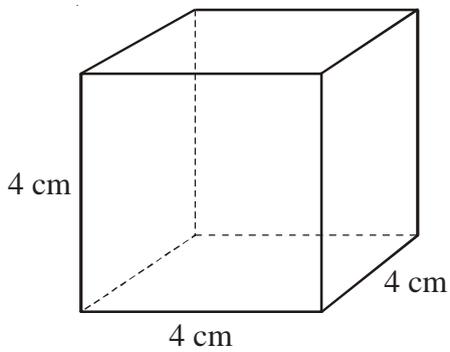
Cube

Cuboid
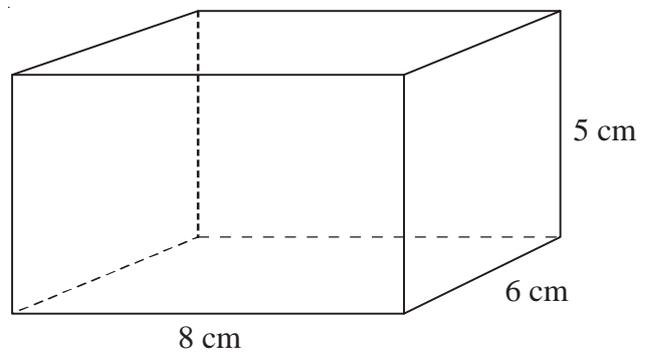
Right-angled
triangular prism
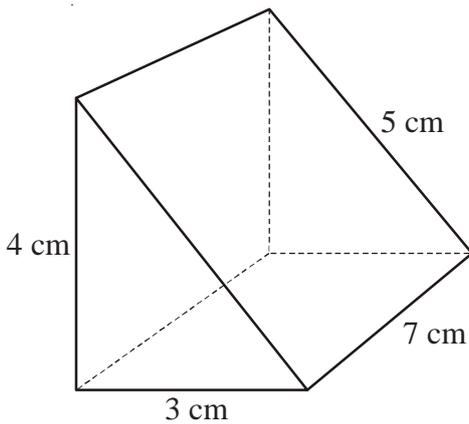
Triangular prism

3) The two nets, below, are folded to make cubes.
   Two other vertices will meet at the the dot, A. Mark them with As.
   One other vertex will meet the dot B. Mark it with B.

   a)   A

   A   A

   b)

   B

   B

Measuring and Drawing Angles

1) Measure the following angles:

a

b

c

d

e

f

2) Draw the following angles:

a) Angle $ABC = 60°$ b) Angle $PQR = 127°$ c) Angle $XYZ = 275°$

X

Q

P

B   *A*

Y

Measuring and Drawing Angles

1) Measure the following angles:

113°

45°

a

b

54°

c

d

117°

e

225°

331°

f

2) Draw the following angles:

a) Angle *ABC* = 60°

b) Angle *PQR* = 127°

c) Angle *XYZ* = 275°

C

60°

B   *A*

127°

P

Q

R

X

Z

Y

275°

1) The diagram shows a sketch of triangle *ABC*.

B

Diagram **NOT**
accurately drawn

7.4 cm

38°

A   C
8.5 cm

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) The diagram shows a sketch of triangle *PQR*.

Q

Diagram **NOT**
accurately drawn

7.3 cm

71°

P   R
9 cm
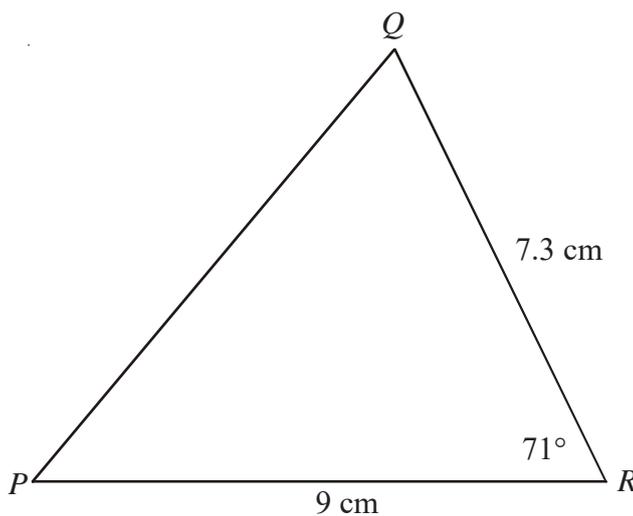
Make an accurate drawing of triangle *PQR*.

1) The diagram shows a sketch of triangle *ABC*.
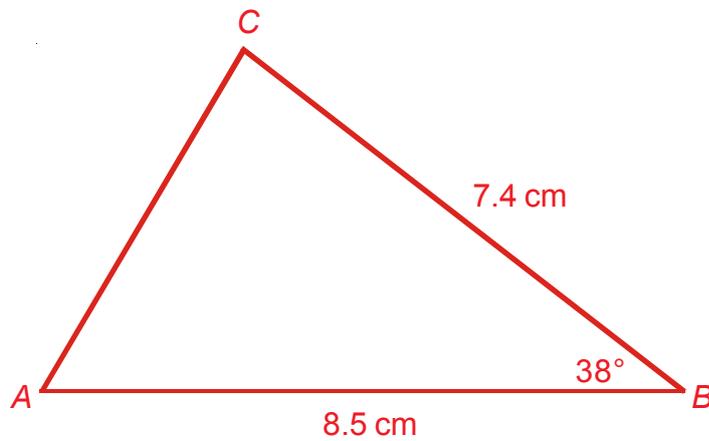
BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.   Angle *A* = 59°

2) The diagram shows a sketch of triangle *PQR*.
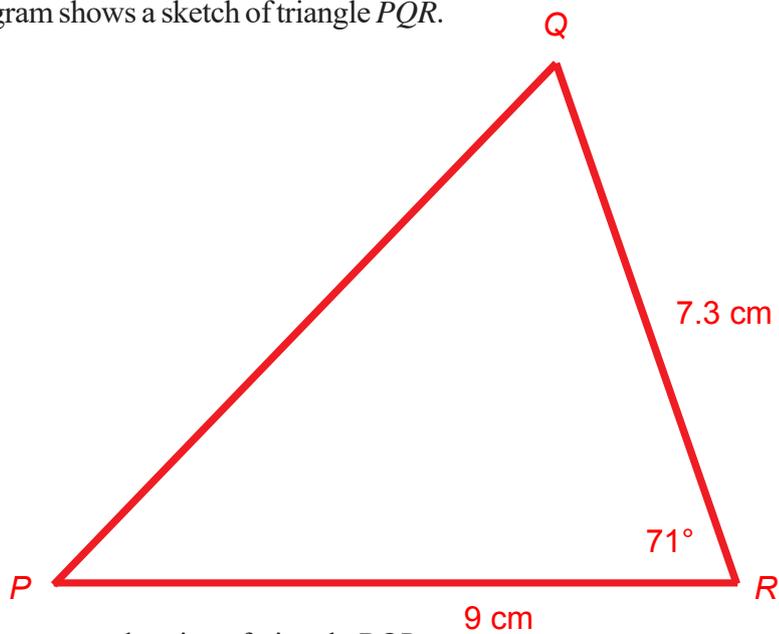
Make an accurate drawing of triangle *PQR*.

1) Find the perimeters of the following two shapes.
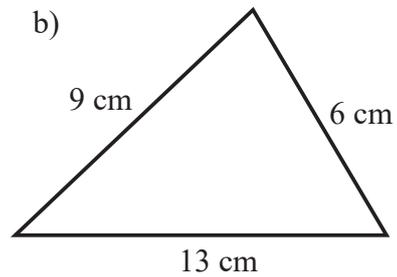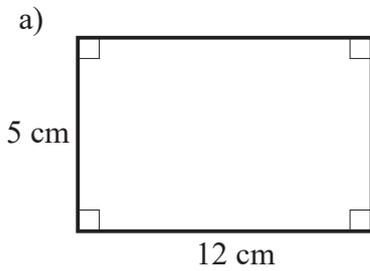
a)

5 cm

12 cm

b)

9 cm

6 cm

13 cm

2) The length of a rectangle is 9 cm.
The total perimeter is 30 cm.

Calculate the length of the width of the rectangle.

3) Work out the perimeter of this L shape.
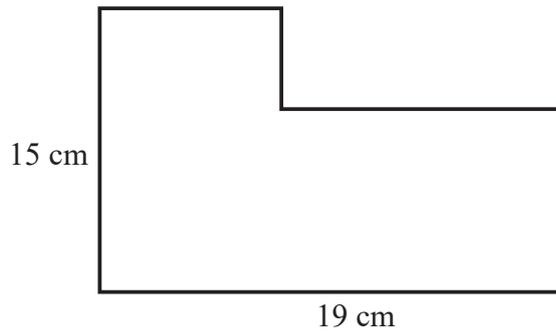
15 cm

19 cm

4) This shape is made by cutting out an equilateral triangle from a square.

Two of these shapes are then put together to make
this shape.

8 cm
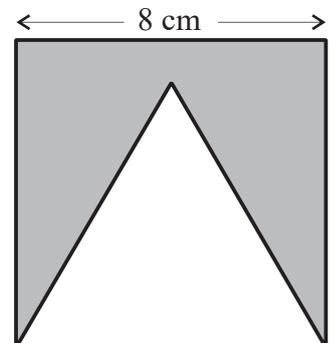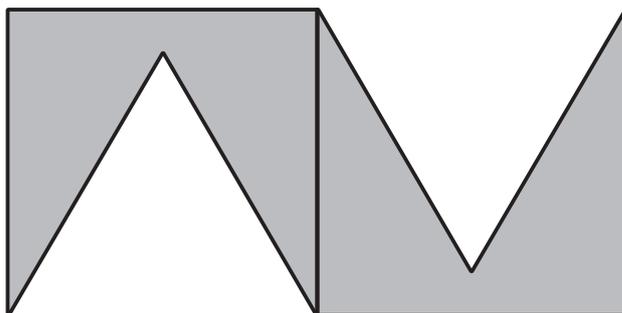
Work out the perimeter of this new shape.

1) Find the perimeters of the following two shapes.

a)

5 cm

12 cm

34 cm

b)

9 cm

6 cm
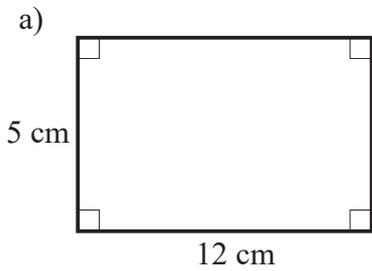
13 cm
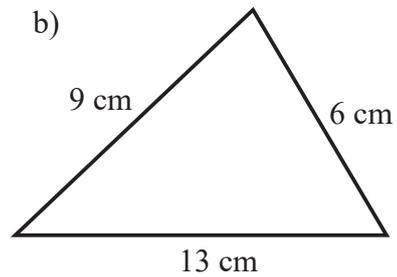
28 cm

2) The length of a rectangle is 9 cm.
The total perimeter is 30 cm.

Calculate the length of the width of the rectangle. **6 cm**

3) Work out the perimeter of this L shape. **68 cm**
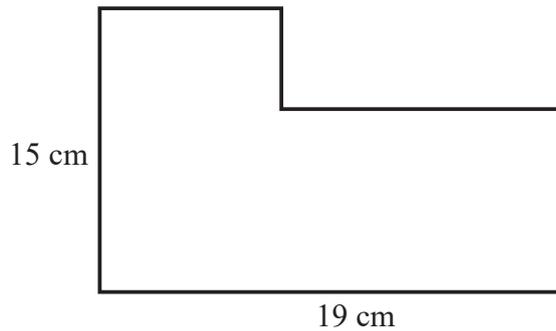
15 cm

19 cm

4) This shape is made by cutting out an equilateral triangle from a square.

Two of these shapes are then put together to make this shape.

8 cm

Work out the perimeter of this new shape. **64 cm**
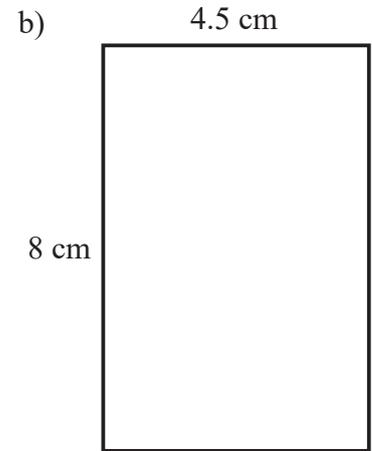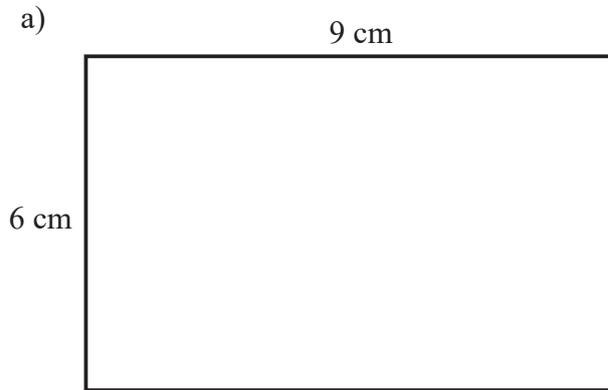
Area of a Rectangle

1) Find the areas of these two rectangles.

a)

9 cm

6 cm

b)

4.5 cm

8 cm

2) Find the size of the missing sides in these two rectangles.

a)

Area = 96 cm^2 ?

12 cm

b)

Area = 52 cm^2 ?

6.5 cm

3) Find the area of the shaded section.

16 cm

3 cm

9 cm

7 cm

4) Find the area of the L shape.

9 cm

8 cm

3 cm

20 cm

Area of a Rectangle

1) Find the areas of these two rectangles.

a)

9 cm

6 cm

54 cm²

b)

4.5 cm

8 cm

36 cm²

2) Find the size of the missing sides in these two rectangles.

a)

Area = 96 cm^2 ? **8 cm**

12 cm

b)

Area = 52 cm^2 ? **8 cm**

6.5 cm
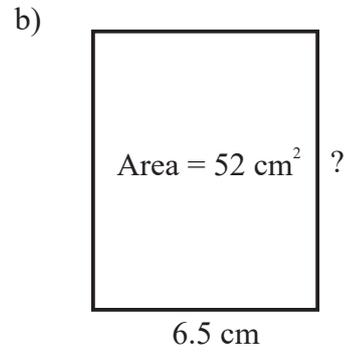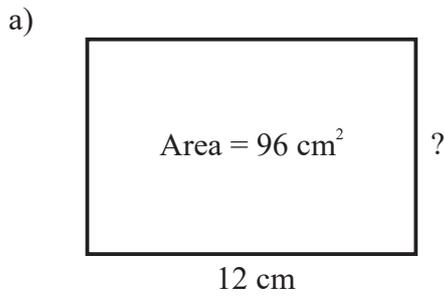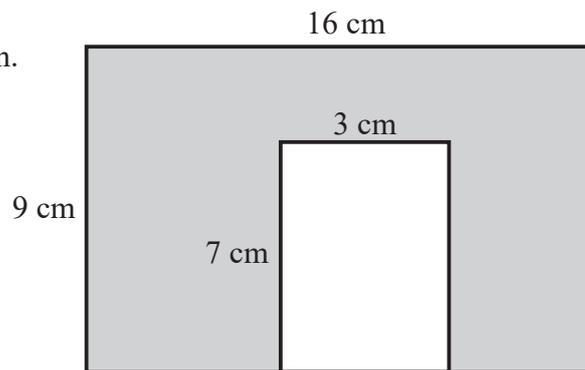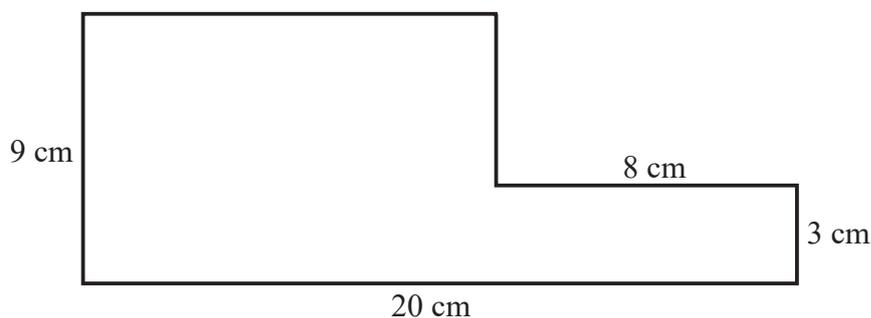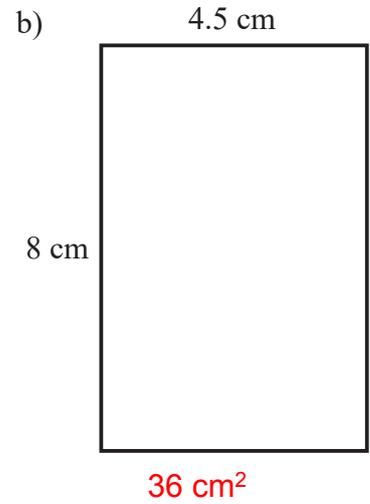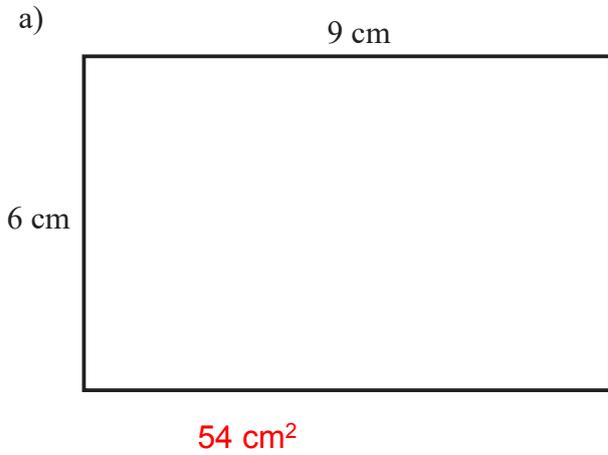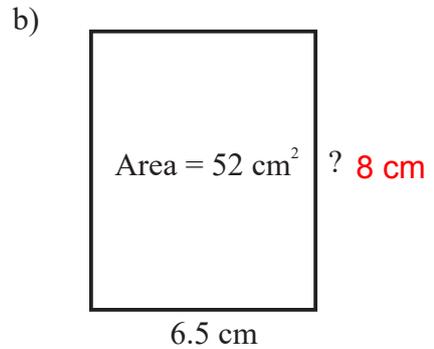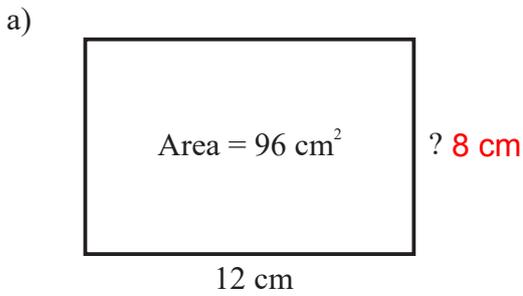
3) Find the area of the shaded section.

123 cm²

16 cm

3 cm

9 cm

7 cm

4) Find the area of the L shape.

132 cm²

9 cm

8 cm

3 cm

20 cm

Circle Definitions
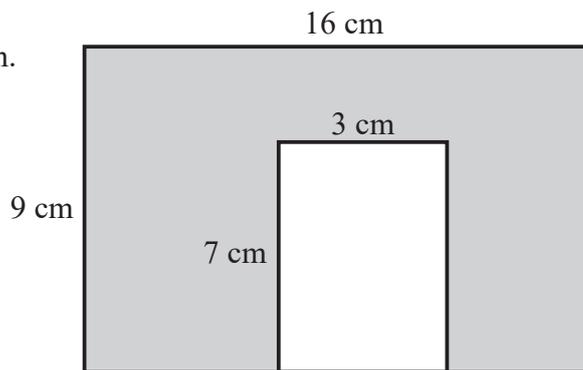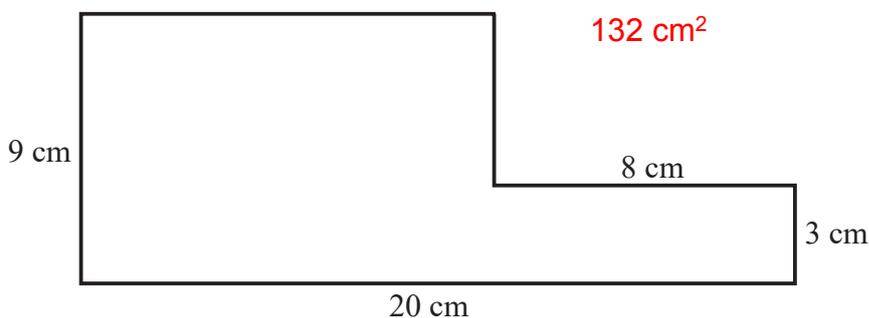
1)   In the circle, write the correct names for line *A*, *B* and *C*.

2)   What is the special name given to the perimeter of a circle?

Circle Definitions

1) In the circle, write the correct names for line *A*, *B* and *C*.

A — Chord

B — Diameter

C — Radius
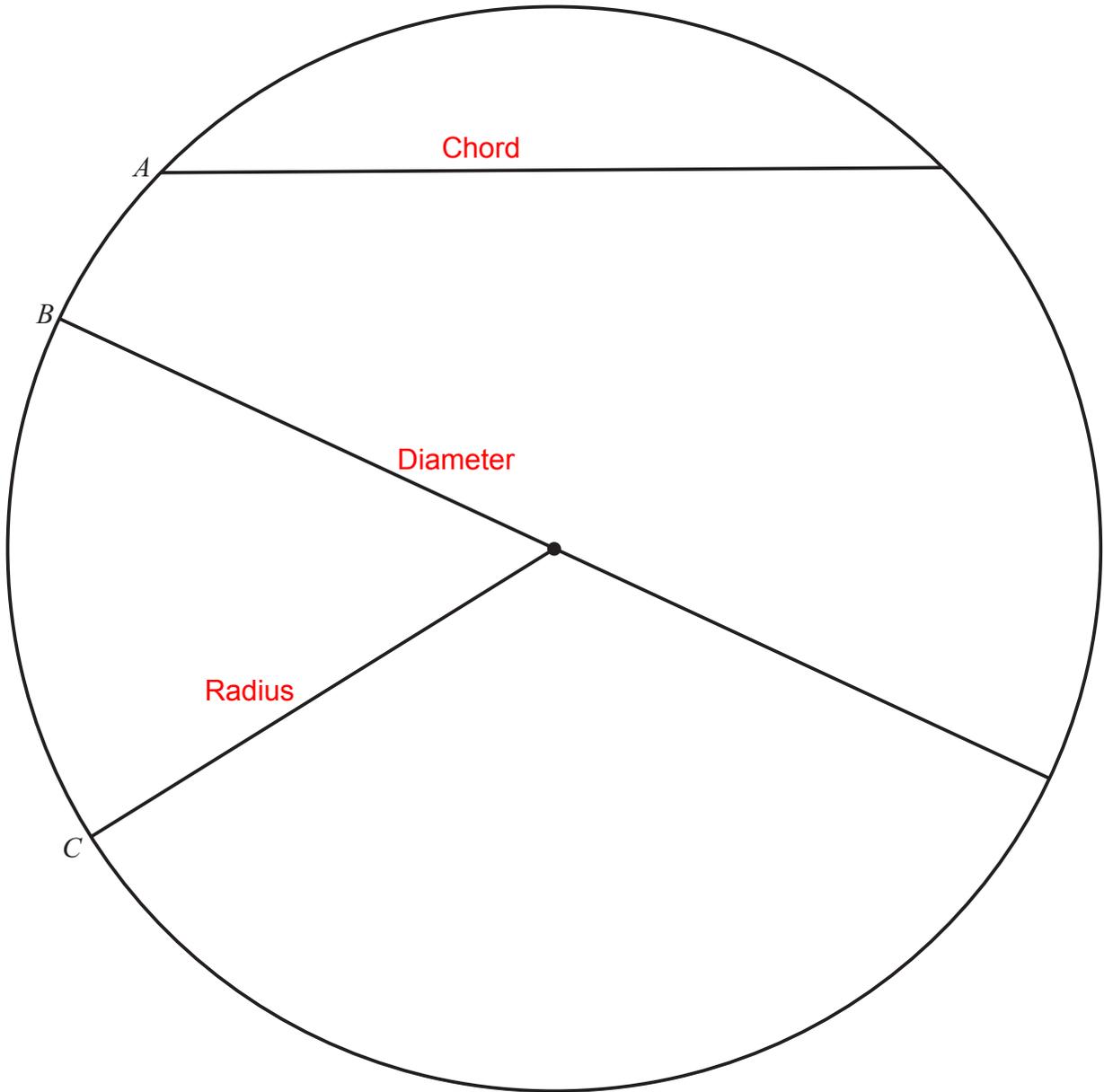
2) What is the special name given to the perimeter of a circle? Circumference

1) A box contains 3 grey counters and 2 white counters.

A counter is taken from the box at random.

What is the probability of choosing a white counter?
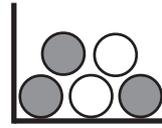
2) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

A counter is taken from the bag at random.

a) What is the probability that a green counter will be chosen?

b) What is the probability that a blue or red counter will be chosen?

3) In a class there are 10 boys and 15 girls.

A teacher chooses a student at random from the class.

Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

Jenny says that Eric is wrong.

Decide who is correct - Eric or Jenny - giving reasons for your answer.

4) Spinner A has numbers 1 to 4 on it.

Spinner B has numbers 1 to 3 on it.

Both spinners are spun and the numbers on each are added together to give a score.

What is the probability that the score will be

a) 7?

b) 3 or 4?

1) A box contains 3 grey counters and 2 white counters.

    A counter is taken from the box at random.

    What is the probability of choosing a white counter?
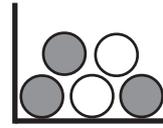
$$\frac{2}{5}$$

2) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

    A counter is taken from the bag at random.

    a)   What is the probability that a green counter will be chosen? $\frac{7}{15}$

    b)   What is the probability that a blue or red counter will be chosen? $\frac{8}{15}$

3) In a class there are 10 boys and 15 girls.

    A teacher chooses a student at random from the class.

    Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

    Jenny says that Eric is wrong.

    Decide who is correct - Eric or Jenny - giving reasons for your answer.

    Jenny is correct because there are more girls than boys, so the probability of choosing a girl will be greater than that of choosing a boy.

4) Spinner A has numbers 1 to 4 on it.

    Spinner B has numbers 1 to 3 on it.

    Both spinners are spun and the numbers on each are added together to give a score.

    What is the probability that the score will be

    a) 7? $\frac{1}{12}$

    b) 3 or 4? $\frac{5}{12}$

Possibility Spaces

1)   Two dice are rolled and their scores are multiplied together.

   a) Complete the possibility space to show all the possible results.

First dice

	1	2	3	4	5	6
1						
2						
3				12		
4						
5						
6			18			

Second dice

   b) What is the probability of getting a result that is an even number?

2)   Suppose there are three cards:

   A **black card** that is black on both sides,

   A **white card** that is white on both sides,

   A **mixed card** that is black on one side and white on the other side.

   All the cards are placed into a hat and one is taken out at random.

   It is placed on a table and the side facing up is black.

   What is the probability that the other side of the card is also black?

Possibility Spaces

1) Two dice are rolled and their scores are multiplied together.

a) Complete the possibility space to show all the possible results.

First dice

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Second dice

b) What is the probability of getting a result that is an even number? $\frac{27}{36}$

2) Suppose there are three cards:

    A **black card** that is black on both sides,

    A **white card** that is white on both sides,

    A **mixed card** that is black on one side and white on the other side.

All the cards are placed into a hat and one is taken out at random.

It is placed on a table and the side facing up is black.

What is the probability that the other side of the card is also black? $\frac{1}{2}$

Listing Outcomes

1)   List all the outcomes if two coins are flipped.

2)   a) How many possible outcomes are there if three coins are flipped?

     b) List them all - the first one has been done for you: H H H

3)   a) How many possible outcomes are there if two six-sided dice are rolled?

     b) List them all.

4)   a) How many possible outcomes are there if a coin is flipped and a dice is rolled?

     b) List them all.

5)   a) How many possible outcomes are there if two coins are flipped and a dice is rolled?

     b) List them all.

6)   How many possible outcomes are there if 6 coins are flipped?

7)   If Carly has each fingernail painted at a salon and can choose between red, blue and green for each nail, how many different combinations are there for her to choose from?

1) List all the outcomes if two coins are flipped.

H H, H T, T H, T T

2) a) How many possible outcomes are there if three coins are flipped? 8

b) List them all - the first one has been done for you: H H H

H H T, H T H, T H H, T T H, T H T, H T T, T T T

3) a) How many possible outcomes are there if two six-sided dice are rolled? 36

b) List them all.

1 1, 1 2, 1 3, 1 4, 1 5, 1 6   4 1, 4 2, 4 3, 4 4, 4 5, 4 6
2 1, 2 2, 2 3, 2 4, 2 5, 2 6   5 1, 5 2, 5 3, 5 4, 5 5, 5 6
3 1, 3 2, 3 3, 3 4, 3 5, 3 6   6 1, 6 2, 6 3, 6 4, 6 5, 6 6

4) a) How many possible outcomes are there if a coin is flipped and a dice is rolled? 12

b) List them all.

H 1, H 2, H 3, H 4, H 5, H 6
T 1, T 2, T 3, T 4, T 5, T 6

5) a) How many possible outcomes are there if two coins are flipped and a dice is rolled? 24

b) List them all.

H H 1, H H 2, H H 3, H H 4, H H 5, H H 6
H T 1, H T 2, H T 3, H T 4, H T 5, H T 6
T H 1, T H 2, T H 3, T H 4, T H 5, T H 6
T T 1, T T 2, T T 3, T T 4, T T 5, T T 6

6) How many possible outcomes are there if 6 coins are flipped? 64

7) If Carly has each fingernail painted at a salon and can choose between red, blue and green for each nail, how many different combinations are there for her to choose from? 59049

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26			53
Female		20	10	
Total			16	100

a) Complete the two-way table.

b) How many males were in the survey?

c) How many females drink only still water?

d) How many people drink only sparkling water?

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female				
Male		7		
Total	20	18		90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French?

c) How many people study Spanish?

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

Work out the number of students who like milk chocolates the best.

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26	21	6	53
Female	17	20	10	47
Total	43	41	16	100

a) Complete the two-way table.

b) How many males were in the survey? 53

c) How many females drink only still water? 17

d) How many people drink only sparkling water? 41

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female	6	11	23	40
Male	14	7	29	50
Total	20	18	52	90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French? 6

c) How many people study Spanish? 52

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

Work out the number of students who like milk chocolates the best. 51

1) Round the following numbers
to 1 significant figure:

    a)   428

    b)   783

    c)   5608

    d)   3 521

    e)   21 999

    f)   793 041

2) Round the following numbers
to 2 significant figures:

    a)   846

    b)   2 647

    c)   3 552

    d)   46 817

    e)   89 711

    f)   195 084

3) Round the following numbers
to 3 significant figures:

    a)   91 249

    b)   64 182

    c)   223 058

    d)   389 512

    e)   7 761 223

    f)   4 997 124

4) Work out the following and give your
answer to 3 significant figures:

    a) 216×348

    b) 7721×609

    c) 8714×2198

5) Round the following numbers
to 1 significant figure:

    a)   0.00618

    b)   0.00482

    c)   0.00006492

    d)   0.004981

6) Round the following numbers
to 2 significant figures:

    a)   0.035812

    b)   0.00082477

    c)   0.0038611

    d)   0.000037211

7) Round the following numbers
to 3 significant figures:

    a)   0.00143229

    b)   0.000721981

    c)   0.0000044251

    d)   0.000668821

8) Round the following numbers
to 3 significant figures:

    a)   47.84122

    b)   9.778112

    c)   12.35913

9) Work out the following and give your
answer to 3 significant figures:

    a) $15 \div 0.38$

    b) $0.31 \div 0.16$

    c) 208×366

Rounding to Significant Figures

1) Round the following numbers to 1 significant figure:

   a) 428   **400**

   b) 783   **800**

   c) 5608   **6000**

   d) 3 521   **4000**

   e) 21 999   **20000**

   f) 793 041   **800000**

2) Round the following numbers to 2 significant figures:

   a) 846   **850**

   b) 2 647   **2600**

   c) 3 552   **3600**

   d) 46 817   **47000**

   e) 89 711   **90000**

   f) 195 084   **200000**

3) Round the following numbers to 3 significant figures:

   a) 91 249   **91200**

   b) 64 182   **64200**

   c) 223 058   **223000**

   d) 389 512   **390000**

   e) 7 761 223   **7760000**

   f) 4 997 124   **5000000**

4) Work out the following and give your answer to 3 significant figures:

   a) 216×348 **75200**

   b) 7721×609 **4700000**

   c) 8714×2198 **19200000**

5) Round the following numbers to 1 significant figure:

   a) 0.00618   **0.006**

   b) 0.00482   **0.005**

   c) 0.00006492   **0.00006**

   d) 0.004981   **0.005**

6) Round the following numbers to 2 significant figures:

   a) 0.035812   **0.036**

   b) 0.00082477   **0.00082**

   c) 0.0038611   **0.0039**

   d) 0.000037211   **0.000037**

7) Round the following numbers to 3 significant figures:

   a) 0.00143229   **0.00143**

   b) 0.000721981   **0.000722**

   c) 0.0000044251   **0.00000443**

   d) 0.000668821   **0.000669**

8) Round the following numbers to 3 significant figures:

   a) 47.84122   **47.8**

   b) 9.778112   **9.78**

   c) 12.35913   **12.4**

9) Work out the following and give your answer to 3 significant figures:

   a) $15 \div 0.38$ **39.5**

   b) $0.31 \div 0.16$ **1.94**

   c) 208×366 **76100**

Reasonable Degree of Accuracy

1) Round the following measurements to a reasonable degree of accuracy.

   a) A metal rod is 30.0246 cm long.

   b) The height of a building is 68.87 m

   c) A bag of cement weighs 19.899 kg

   d) The price of silver per gram is £1.19469

2) A factory produces pens.
   The cost of production of each pen is 3.168 p

   Which of the options below gives the cost per pen to a reasonable degree of accuracy?
   Circle your answer.

31p	3p	£0.30	32p
A	B	C	D

3) Here is a square.

   8.15
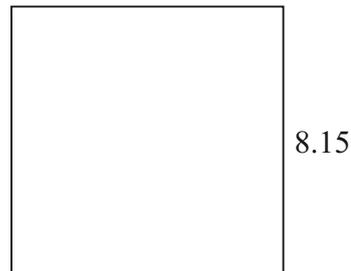
   Not drawn to scale

   Work out the area of the square.
   Round your answer to a reasonable degree of accuracy.

4) Here is a rectangle.
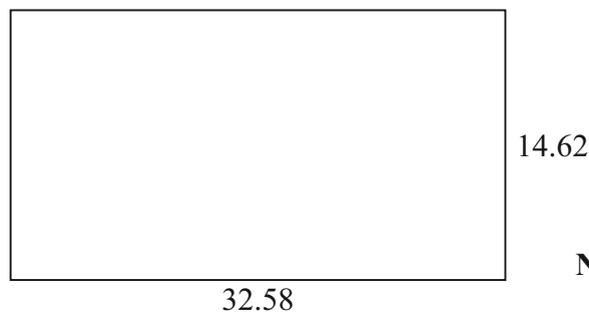
   14.62

   Not drawn to scale

   32.58

   Work out the area of the rectangle.
   Round your answer to a reasonable degree of accuracy.

Reasonable Degree of Accuracy

1) Round the following measurements to a reasonable degree of accuracy.

   a) A metal rod is 30.0246 cm long.   30 cm

   b) The height of a building is 68.87 m   69 m or 70 m

   c) A bag of cement weighs 19.899 kg   20 kg

   d) The price of silver per gram is £1.19469   £1.19 or £1.20

2) A factory produces pens.
   The cost of production of each pen is 3.168 p

   Which of the options below gives the cost per pen to a reasonable degree of accuracy?
   Circle your answer.

   31p   3p   £0.30   32p

   A   B   C   D

3) Here is a square.

   8.15
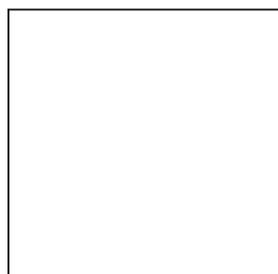
   Not drawn to scale

   Work out the area of the square.
   Round your answer to a reasonable degree of accuracy.   66.42 or 66.4 or 66

4) Here is a rectangle.

   14.62

   Not drawn to scale

   32.58

   Work out the area of the rectangle.
   Round your answer to a reasonable degree of accuracy.   476.32 or 476.3 or 476

Estimating Answers

1) Work out an estimate for $\dfrac{304 \times 9.96}{0.51}$

2) Work out an estimate for $\dfrac{6.7 \times 192}{0.051}$

3) Work out an estimate for $\dfrac{32 \times 4.92}{0.21}$

4) Work out an estimate for $\dfrac{3880}{236 \times 4.85}$

5) Work out an estimate for $\dfrac{7.18 \times 19.7}{0.47}$

Estimating Answers

1) Work out an estimate for $\dfrac{304 \times 9.96}{0.51}$ 6000

2) Work out an estimate for $\dfrac{6.7 \times 192}{0.051}$ 28000

3) Work out an estimate for $\dfrac{32 \times 4.92}{0.21}$ 750

4) Work out an estimate for $\dfrac{3880}{236 \times 4.85}$ 4

5) Work out an estimate for $\dfrac{7.18 \times 19.7}{0.47}$ 280

Using Place Value

1) Using the information that

$$4.7 \times 34 = 159.8$$

write down the value of

a) 47×34

b) 4.7×3.4

c) $159.8 \div 47$

2) Using the information that

$$324 \times 48 = 15552$$

write down the value of

a) 3.24×4.8

b) 0.324×0.48

c) $15552 \div 4.8$

3) Using the information that

$$73 \times 234 = 17082$$

write down the value of

a) 730×234

b) 73×2.34

4) Using the information that

$$27 \times 5.6 = 151.2$$

write down the value of

a) 27×56

b) 2.7×0.56

c) $151.2 \div 56$

5) Using the information that

$$719 \times 35 = 25165$$

write down the value of

a) 71.9×3.5

b) 0.719×0.35

c) $25165 \div 7.19$

Using Place Value

1) Using the information that

$$4.7 \times 34 = 159.8$$

write down the value of

a) 47×34 1598

b) 4.7×3.4 15.98

c) $159.8 \div 47$ 3.4

2) Using the information that

$$324 \times 48 = 15552$$

write down the value of

a) 3.24×4.8 15.552

b) 0.324×0.48 0.15552

c) $15552 \div 4.8$ 3240

3) Using the information that

$$73 \times 234 = 17082$$

write down the value of

a) 730×234 170820

b) 73×2.34 170.82

4) Using the information that

$$27 \times 5.6 = 151.2$$

write down the value of

a) 27×56 1512

b) 2.7×0.56 1.512

c) $151.2 \div 56$ 2.7

5) Using the information that

$$719 \times 35 = 25165$$

write down the value of

a) 71.9×3.5 251.65

b) 0.719×0.35 0.25165

c) $25165 \div 7.19$ 3500

1) What is the value of 5^2?

2) What is the value of 8^2?

3) These are the first five square numbers: 1, 4, 9, 16, 25
   a) What is the sixth square number?
   b) What is the 10th square number?

4) Which square number lies between 60 and 70?

5) What is the value of 2^3?

6) What is the value of 4^3?

7) Work out $1^3 + 2^3 + 3^3$

8) Work out $\sqrt{25}$

9) Work out $\sqrt{49}$

10) Work out the value of $\sqrt{121} \times \sqrt{121}$

11) Match together cards with the same answer

9^2	$\sqrt{9}$	81	5^3
2^5	125	32	3

Squares, Cubes and Roots

1) What is the value of 5^2? **25**

2) What is the value of 8^2? **64**

3) These are the first five square numbers: 1, 4, 9, 16, 25
   a) What is the sixth square number? **36**
   b) What is the 10th square number? **100**

4) Which square number lies between 60 and 70? **$8^2 = 64$**

5) What is the value of 2^3? **8**

6) What is the value of 4^3? **64**

7) Work out $1^3 + 2^3 + 3^3$ **36**

8) Work out $\sqrt{25}$ **5**

9) Work out $\sqrt{49}$ **7**

10) Work out the value of $\sqrt{121} \times \sqrt{121}$ **121**

11) Match together cards with the same answer

9^2 $\sqrt{9}$ 81 5^3

2^5 125   32   3

Working with Indices
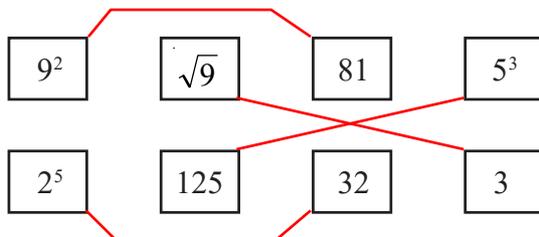
1) Evaluate the following:

    a) 2^3

    b) 3^2

    c) 10^4

2) Evaluate the following:

    a) 2^8

    b) 6^4

    c) 5^6

3) Find the value of

    a) $2^4 + 3^2$

    b) $5^2 - 2^3$

    c) $1^2 + 2^2 + 3^2$

4) Find the value of

    a) $5^4 + 6^3$

    b) $3^4 \times 2^5$

    c) $9^3 - 6^3$

5) Find the value of

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$

1) Evaluate the following:

    a) 2^3 8

    b) 3^2 9

    c) 10^4 10000

2) Evaluate the following:

    a) 2^8 256

    b) 6^4 1296

    c) 5^6 15625

3) Find the value of

    a) $2^4 + 3^2$ 25

    b) $5^2 - 2^3$ 17

    c) $1^2 + 2^2 + 3^2$ 14

4) Find the value of

    a) $5^4 + 6^3$ 841

    b) $3^4 \times 2^5$ 2592

    c) $9^3 - 6^3$ 513

5) Find the value of

     $2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$ 666

1) List the first seven prime numbers.

2) Express the following numbers as the product of their prime factors:

   a) 12

   b) 20

   c) 30

   d) 24

3) Express the following numbers as the product of their prime factors:

   a) 64

   b) 100

   c) 150

4) Express the following numbers as the product of their prime factors:

   a) 175

   b) 192

   c) 315

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.
   Find the value of m and the value of n.

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.
   Find the value of x and the value of y.

1) List the first seven prime numbers. 2, 3, 5, 7, 11, 13, 17

2) Express the following numbers as the product of their prime factors:

    a) 12 2 × 2 × 3

    b) 20 2 × 2 × 5

    c) 30 2 × 3 × 5

    d) 24 2 × 2 × 2 × 3

3) Express the following numbers as the product of their prime factors:

    a) 64 2 × 2 × 2 × 2 × 2 × 2

    b) 100 2 × 2 × 5 × 5

    c) 150 2 × 3 × 5 × 5

4) Express the following numbers as the product of their prime factors:

    a) 175 5 × 5 × 7

    b) 192 2 × 2 × 2 × 2 × 2 × 2 × 3

    c) 315 3 × 3 × 5 × 7

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.
Find the value of m and the value of n. $m = 5$ and $n = 3$

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.
Find the value of x and the value of y. $x = 2$ and $y = 3$

Decimals and Fractions

Write the following fractions as decimals

1) $\dfrac{3}{10}$

2) $\dfrac{7}{10}$

3) $\dfrac{9}{100}$

4) $\dfrac{1}{2}$

5) $\dfrac{3}{4}$

6) $\dfrac{2}{5}$

7) $\dfrac{7}{20}$

8) $\dfrac{1}{3}$

9) $\dfrac{1}{8}$

10) $\dfrac{5}{8}$

Write the following fractions as decimals

1) $\dfrac{3}{10}$ 0.3

2) $\dfrac{7}{10}$ 0.7

3) $\dfrac{9}{100}$ 0.09

4) $\dfrac{1}{2}$ 0.5

5) $\dfrac{3}{4}$ 0.75

6) $\dfrac{2}{5}$ 0.4

7) $\dfrac{7}{20}$ 0.35

8) $\dfrac{1}{3}$ 0.3

9) $\dfrac{1}{8}$ 0.125

10) $\dfrac{5}{8}$ 0.625

1) Write the following fractions as decimals and percentages:

$$eg. \quad \frac{1}{10} \xrightarrow{1 \div 10} 0\cdot1 \xrightarrow{0.1 \times 100} 10\%$$

a) $\dfrac{3}{10}$ =

b) $\dfrac{1}{5}$ =

c) $\dfrac{2}{5}$ =

d) $\dfrac{1}{4}$ =

e) $\dfrac{3}{4}$ =

f) $\dfrac{1}{2}$ =

g) $\dfrac{1}{3}$ =

2) Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\dfrac{6}{10}$		
	0.2	
	0.9	
		40%
		25%
$\dfrac{4}{5}$		
$\dfrac{12}{100}$		
	$0.\dot{3}$	
		70%

Fractions, Percentages, Decimals

1) Write the following fractions as decimals and percentages:

$$eg. \quad \frac{1}{10} \xrightarrow{1 \div 10} 0 \cdot 1 \xrightarrow{0.1 \times 100} 10\%$$

a) $\frac{3}{10}$ = 0.3 = 30%

b) $\frac{1}{5}$ = 0.2 = 20%

c) $\frac{2}{5}$ = 0.4 = 40%

d) $\frac{1}{4}$ = 0.25 = 25%

e) $\frac{3}{4}$ = 0.75 = 75%

f) $\frac{1}{2}$ = 0.5 = 50%

g) $\frac{1}{3}$ = 0.3 = 33.3%

2) Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\frac{6}{10}$	0.6	60%
$\frac{1}{5}$	0.2	20%
$\frac{9}{10}$	0.9	90%
$\frac{2}{5}$	0.4	40%
$\frac{1}{4}$	0.25	25%
$\frac{4}{5}$	0.8	80%
$\frac{12}{100}$	0.12	12%
$\frac{1}{3}$	$0.\dot{3}$	33.3%
$\frac{7}{10}$	0.7	70%

Percentage of an Amount (Calc.)

1) Work out:

   a) 21% of £340

   b) 64% of £1080

   c) 36% of £800

   d) 98% of £13

2) Work out:

   a) 17.5% of £58

   b) 20% of £5.40

   c) 61.7% of £2000

   d) 17.5% of £68.40

3) A computer costs £406 plus VAT at 20%.
   Work out the total cost of the computer.

4) A car is usually priced at £9800 but now has a discount of 8%.
   What is the new price of the car?

5) 9500 people attend a festival and 22% of them are children.
   How many children are at the festival?

6) 65% of a car, by weight, is steel and iron.
   If a car weighs 1100 kg, what is the weight of steel and iron in the car?

7) Tony earns £17800 per year and receives a 3.8% pay rise.
   How much does he now earn?

Percentage of an Amount (Calc.)

1) Work out:

    a)   21% of £340   £71.40

    b)   64% of £1080 £691.20

    c)   36% of £800 £288

    d)   98% of £13 £12.74

2) Work out:

    a)   17.5% of £58 £10.15

    b)   20% of £5.40 £1.08

    c)   61.7% of £2000 £1234

    d)   17.5% of £68.40 £11.97

3) A computer costs £406 plus VAT at 20%.

Work out the total cost of the computer. £487.20

4) A car is usually priced at £9800 but now has a discount of 8%.

What is the new price of the car? £9016

5) 9500 people attend a festival and 22% of them are children.

How many children are at the festival? 2090

6) 65% of a car, by weight, is steel and iron.

If a car weighs 1100 kg, what is the weight of steel and iron in the car? 715 kg

7) Tony earns £17800 per year and receives a 3.8% pay rise.

How much does he now earn? £18476.40

1) Work out:

   a)   10% of £170

   b)   10% of £6800

   c)   10% of £923

   d)   10% of £16

2) Work out:

   a)   20% of £60

   b)   30% of £90

   c)   15% of £800

   d)   15% of £68

3) Work out:

   a)   35% of £80

   b)   90% of £160

   c)   17.5% of £600

   d)   17.5% of £850

4) Work out:

   a)   15% of £4.60

   b)   40% of £2.80

   c)   17.5% of £3.20

   d)   97.5% of £24

5) The normal price of a jacket is £54.
In a sale, the price is reduced by 30%
What is the sale price?

6) A football costs £14 plus 20% VAT.
How much is the football?

1) Work out:

   a)   10% of £170   £17

   b)   10% of £6800   £680

   c)   10% of £923   £92.30

   d)   10% of £16   £1.60

2) Work out:

   a)   20% of £60   £12

   b)   30% of £90   £27

   c)   15% of £800   £120

   d)   15% of £68   £10.20

3) Work out:

   a)   35% of £80   £28

   b)   90% of £160   £144

   c)   17.5% of £600   £105

   d)   17.5% of £850   £148.75

4) Work out:

   a)   15% of £4.60   £0.69

   b)   40% of £2.80   £1.12

   c)   17.5% of £3.20   £0.56

   d)   97.5% of £24   £23.40

5) The normal price of a jacket is £54.
In a sale, the price is reduced by 30%
What is the sale price?   £37.80

6) A football costs £14 plus 20% VAT.
How much is the football?   £16.80

1) Write the following as percentages, giving all your answers to 1 decimal place.

   a) 12 out of 34

   b) 62 out of 85

   c) 113 out of 153

   d) 2150 out of 3452

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

   What was her mark as a percentage?
   Give your answer to 1 decimal place.

3) In a class of 32 students, 18 of them are boys.

   What percentage of the class are boys?
   Give your answer to 1 decimal place.

4) In a French class there are 13 girls and 6 boys.

   What percentage of the class are girls?
   Give your answer to 1 decimal place.

5) A new car usually costs £8500.

   Henry gets a discount of £1000.

   What is the discount as a percentage of the usual cost?
   Give your answer to 1 decimal place.

6) Write out £148 as a percentage of £600.
   Give your answer to 1 decimal place.

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

   What percentage of the trees are oak trees?

8) In England in 2010 there were 68820 deaths caused by cancer.

   Of these deaths, 37500 were caused by smoking.

   What percentage of deaths due to cancer were caused by smoking?
   Give your answer to 1 decimal place.

Change to a Percentage (Calc.)

1) Write the following as percentages, giving all your answers to 1 decimal place.

   a)   12 out of 34   35.3%

   b)   62 out of 85   72.9%

   c)   113 out of 153   73.9%

   d)   2150 out of 3452   62.3%

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

   What was her mark as a percentage?
   Give your answer to 1 decimal place.   57.1%

3) In a class of 32 students, 18 of them are boys.

   What percentage of the class are boys?
   Give your answer to 1 decimal place.   56.3%

4) In a French class there are 13 girls and 6 boys.

   What percentage of the class are girls?
   Give your answer to 1 decimal place.   68.4%

5) A new car usually costs £8500.

   Henry gets a discount of £1000.

   What is the discount as a percentage of the usual cost?
   Give your answer to 1 decimal place.   11.8%

6) Write out £148 as a percentage of £600.
   Give your answer to 1 decimal place.   24.7%

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

   What percentage of the trees are oak trees?   16%

8) In England in 2010 there were 68820 deaths caused by cancer.

   Of these deaths, 37500 were caused by smoking.

   What percentage of deaths due to cancer were caused by smoking?
   Give your answer to 1 decimal place.   54.5%

1)   Write the following as percentages.

   a)   12 out of 50

   b)   15 out of 25

   c)   8 out of 10

   d)   11 out of 20

   e)   4 out of 5

   f)   32 out of 40

   g)   12 out of 80

   h)   640 out of 800

   i)   36 out of 60

2)   Tim got 17 out of 20 in a French test.
     Write 17 out of 20 as a percentage.

3)   Write £19 as a percentage of £25

4)   Work out £14 as a percentage of £40

5)   A baker burnt 12 loaves out of the 200 loaves he baked.
     What percentage of the 200 loaves did he burn?

6)   What is £380 as a percentage of £400?

7)   What is £22 as a percentage of £40?

8)   If there are 9 girls and 11 boys in a class, what percentage of the class are girls?

1) Write the following as percentages.

a) 12 out of 50   24%

b) 15 out of 25   60%

c) 8 out of 10   80%

d) 11 out of 20   55%

e) 4 out of 5   80%

f) 32 out of 40   80%

g) 12 out of 80   15%

h) 640 out of 800   80%

i) 36 out of 60   60%

2) Tim got 17 out of 20 in a French test.
Write 17 out of 20 as a percentage.   85%

3) Write £19 as a percentage of £25   76%

4) Work out £14 as a percentage of £40   35%

5) A baker burnt 12 loaves out of the 200 loaves he baked.
What percentage of the 200 loaves did he burn?   6%

6) What is £380 as a percentage of £400?   95%

7) What is £22 as a percentage of £40?   55%

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls?   45%

1) Find the following to the nearest penny:

a) 23% of £670

b) 12% of £580

c) 48% of £64

d) 13% of £7.50

e) 87% of £44

f) 15.7% of £7000

g) 23.8% of £980

h) 34% of £16.34

i) 48.6% of £971.26

j) 78.24% of £12.82

k) 42.15% of £7876.42

l) 0.57% of £60000

2) Find the following:

a) 10% of £700

b) 10% of £400

c) 10% of £350

d) 10% of £530

e) 10% of £68

f) 10% of £46

g) 10% of £6.50

h) 10% of £12.20

i) 20% of £600

j) 30% of £900

k) 60% of £800

l) 20% of £650

m) 40% of £320

n) 15% of £300

o) 15% of £360

p) 65% of £12000

q) 45% of £64

r) 85% of £96

s) 17.5% of £800

t) 17.5% of £40

u) 17.5% of £8.80

3) Change the following to percentages, giving all answers to 1 decimal place:

a) 6 out of 28

b) 18 out of 37

c) 42 out of 83

d) 24 out of 96

e) 73 out of 403

f) 234 out of 659

g) 871 out of 903

h) 4.7 out of 23

i) 6.9 out of 79

j) 14.8 out of 23.6

k) 65.8 out of 203.7

4) Change the following to percentages:

a) 46 out of 100

b) 18 out of 50

c) 7 out of 25

d) 23 out of 25

e) 9 out of 20

f) 16 out of 20

g) 7 out of 10

h) 9.5 out of 10

i) 10 out of 40

j) 16 out of 40

k) 30 out of 40

l) 12 out of 40

m) 28 out of 80

n) 32 out of 80

o) 60 out of 80

p) 3 out of 5

q) 4 out of 5

r) 15 out of 75

s) 24 out of 75

t) 30 out of 75

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence.

6) A television costs £596 plus VAT at 17.5%.

Work out the cost of the television including VAT.

7) Peter has 128 trees in his garden.

16 of the trees are pear trees.

What percentage of the trees in his garden are pear trees?

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.

What were her percentages in both subjects to 1 decimal place?

9) In class 9A there are 7 girls and 18 boys. What percentage of the class are girls?

10) A shop decides to reduce all the prices by 15%.

The original price of a pair of trainers was £70. How much are they after the reduction?

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.

How much does it cost with the VAT?

1) Find the following to the nearest penny:

   a) 23% of £670 £154.10

   b) 12% of £580 £69.60

   c) 48% of £64 £30.72

   d) 13% of £7.50 £0.98

   e) 87% of £44 £38.28

   f) 15.7% of £7000 £1099

   g) 23.8% of £980 £233.24

   h) 34% of £16.34 £5.56

   i) 48.6% of £971.26 £472.03

   j) 78.24% of £12.82 £10.03

   k) 42.15% of £7876.42 £3319.91

   l) 0.57% of £60000 £342

2) Find the following:

   a) 10% of £700 £70

   b) 10% of £400 £40

   c) 10% of £350 £35

   d) 10% of £530 £53

   e) 10% of £68 £6.80

   f) 10% of £46 £4.60

   g) 10% of £6.50 £0.65

   h) 10% of £12.20 £1.22

   i) 20% of £600 £120

   j) 30% of £900 £270

   k) 60% of £800 £480

   l) 20% of £650 £130

   m) 40% of £320 £128

   n) 15% of £300 £45

   o) 15% of £360 £54

   p) 65% of £12000 £7800

   q) 45% of £64 £28.80

   r) 85% of £96 £81.60

   s) 17.5% of £800 £140

   t) 17.5% of £40 £7

   u) 17.5% of £8.80 £1.54

3) Change the following to percentages, giving all answers to 1 decimal place:

   a) 6 out of 28 21.4%

   b) 18 out of 37 48.6%

   c) 42 out of 83 50.6%

   d) 24 out of 96 25%

   e) 73 out of 403 18.1%

   f) 234 out of 659 35.5%

   g) 871 out of 903 96.5%

   h) 4.7 out of 23 20.4%

   i) 6.9 out of 79 8.7%

   j) 14.8 out of 23.6 62.7%

   k) 65.8 out of 203.7 32.3%

4) Change the following to percentages:

   a) 46 out of 100 46%

   b) 18 out of 50 36%

   c) 7 out of 25 28%

   d) 23 out of 25 92%

   e) 9 out of 20 45%

   f) 16 out of 20 80%

   g) 7 out of 10 70%

   h) 9.5 out of 10 95%

   i) 10 out of 40 25%

   j) 16 out of 40 40%

   k) 30 out of 40 75%

   l) 12 out of 40 30%

   m) 28 out of 80 35%

   n) 32 out of 80 40%

   o) 60 out of 80 75%

   p) 3 out of 5 60%

   q) 4 out of 5 80%

   r) 15 out of 75 20%

   s) 24 out of 75 32%

   t) 30 out of 75 40%

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence. 56p

6) A television costs £596 plus VAT at 17.5%.
   Work out the cost of the television including VAT. £700.30

7) Peter has 128 trees in his garden.
   16 of the trees are pear trees.
   What percentage of the trees in his garden are pear trees? 12.5%

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.
   What were her percentages in both subjects to 1 decimal place? Maths: 64.3% Science: 63.9%

9) In class 9A there are 7 girls and 18 boys.
   What percentage of the class are girls? 28%

10) A shop decides to reduce all the prices by 15%.
    The original price of a pair of trainers was £70. How much are they after the reduction? £59.50

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.
    How much does it cost with the VAT? £21150

Four Rules of Negatives

1) Work out the following:

   a)   2 – 7

   b)   4 – 6

   c)   1 – 8

   d)   0 – 4

2) Work out the following:

   a)   -3 + 2

   b)   -7 + 5

   c)   -3 + 8

   d)   -9 + 11

3) Work out the following:

   a)   -1 – 3

   b)   -4 – 5

   c)   -7 – 8

   d)   -2 – 12

4) Work out the following:

   a)   6 – -3

   b)   -3 – -5

   c)   -9 – -2

   d)   1 – -13

5) Work out the following:

   a)   -3 × 4

   b)   5 × -2

   c)   -4 × -5

   d)   -6 × -3

6) Work out the following:

   a)   12 ÷ -4

   b)   -20 ÷ -2

   c)   -15 ÷ 3

   d)   -100 ÷ -5

Four Rules of Negatives

1) Work out the following:

    a)   2 – 7   -5

    b)   4 – 6   -2

    c)   1 – 8   -7

    d)   0 – 4   -4

2) Work out the following:

    a)   -3 + 2   1

    b)   -7 + 5   -2

    c)   -3 + 8   5

    d)   -9 + 11   2

3) Work out the following:

    a)   -1 – 3   -4

    b)   -4 – 5   -9

    c)   -7 – 8   -15

    d)   -2 – 12   -14

4) Work out the following:

    a)   6 – -3   9

    b)   -3 – -5   2

    c)   -9 – -2   -7

    d)   1 – -13   14

5) Work out the following:

    a)   -3 × 4   -12

    b)   5 × -2   -10

    c)   -4 × -5   20

    d)   -6 × -3   18

6) Work out the following:

    a)   12 ÷ -4   -3

    b)   -20 ÷ -2   10

    c)   -15 ÷ 3   -5

    d)   -100 ÷ -5   20

Four Rules of Fractions - Adding and Subtracting Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

   a) $\dfrac{1}{7} + \dfrac{3}{7}$

   b) $\dfrac{4}{9} + \dfrac{1}{9}$

2) Work out the following:

   a) $\dfrac{1}{5} + \dfrac{3}{4}$

   b) $\dfrac{3}{8} + \dfrac{1}{4}$

   c) $\dfrac{2}{3} + \dfrac{3}{10}$

   d) $\dfrac{1}{2} + \dfrac{2}{5}$

3) Work out the following:

   a) $\dfrac{2}{3} + \dfrac{1}{2}$

   b) $\dfrac{3}{5} + \dfrac{2}{3}$

   c) $\dfrac{5}{8} + \dfrac{3}{4}$

   d) $\dfrac{5}{7} + \dfrac{2}{5}$

4) Work out the following:

   a) $2\dfrac{1}{2} + 1\dfrac{3}{4}$

   b) $1\dfrac{2}{5} + \dfrac{2}{3}$

   c) $2\dfrac{1}{6} + 1\dfrac{1}{2}$

   d) $1\dfrac{3}{7} + \dfrac{2}{5}$

5) Work out the following:

   a) $\dfrac{3}{4} - \dfrac{1}{2}$

   b) $\dfrac{5}{7} - \dfrac{2}{3}$

   c) $\dfrac{5}{8} - \dfrac{1}{3}$

   d) $\dfrac{8}{9} - \dfrac{2}{3}$

6) Work out the following:

   a) $2\dfrac{1}{2} - 1\dfrac{3}{4}$

   b) $1\dfrac{2}{3} - \dfrac{3}{4}$

   c) $3\dfrac{2}{5} - 1\dfrac{1}{2}$

   d) $2\dfrac{3}{8} - \dfrac{3}{5}$

7) Ted received his pocket money on Friday.

   He spent $\dfrac{3}{5}$ of his pocket money on games.

   He spent $\dfrac{1}{10}$ of his pocket money on magazines.

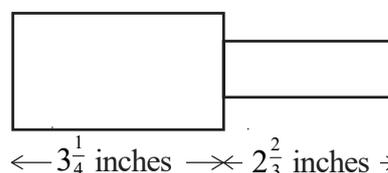   What fraction of his pocket money did he have left?

8) Maisie buys a bag of flour.

   She uses $\dfrac{1}{4}$ to bake a cake and $\dfrac{2}{5}$ to make a loaf.

   a) What fraction of the bag of flour was used?
   b) What fraction of the bag of flour is left?

9) Work out the total length of this shape.
   Give your answer as a mixed number.

$\longleftarrow 3\frac{1}{4}$ inches $\longrightarrow\!\!\times\ 2\frac{2}{3}$ inches $\rightarrow$

Four Rules of Fractions - Adding and Subtracting Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

   a) $\dfrac{1}{7} + \dfrac{3}{7}$ $\dfrac{4}{7}$

   b) $\dfrac{4}{9} + \dfrac{1}{9}$ $\dfrac{5}{9}$

2) Work out the following:

   a) $\dfrac{1}{5} + \dfrac{3}{4}$ $\dfrac{19}{20}$

   b) $\dfrac{3}{8} + \dfrac{1}{4}$ $\dfrac{5}{8}$

   c) $\dfrac{2}{3} + \dfrac{3}{10}$ $\dfrac{29}{30}$

   d) $\dfrac{1}{2} + \dfrac{2}{5}$ $\dfrac{9}{10}$

3) Work out the following:

   a) $\dfrac{2}{3} + \dfrac{1}{2}$ $1\dfrac{1}{6}$

   b) $\dfrac{3}{5} + \dfrac{2}{3}$ $1\dfrac{4}{15}$

   c) $\dfrac{5}{8} + \dfrac{3}{4}$ $1\dfrac{3}{8}$

   d) $\dfrac{5}{7} + \dfrac{2}{5}$ $1\dfrac{4}{35}$

4) Work out the following:

   a) $2\dfrac{1}{2} + 1\dfrac{3}{4}$ $4\dfrac{1}{4}$

   b) $1\dfrac{2}{5} + \dfrac{2}{3}$ $2\dfrac{1}{15}$

   c) $2\dfrac{1}{6} + 1\dfrac{1}{2}$ $3\dfrac{2}{3}$

   d) $1\dfrac{3}{7} + \dfrac{2}{5}$ $1\dfrac{29}{35}$

5) Work out the following:

   a) $\dfrac{3}{4} - \dfrac{1}{2}$ $\dfrac{1}{4}$

   b) $\dfrac{5}{7} - \dfrac{2}{3}$ $\dfrac{1}{21}$

   c) $\dfrac{5}{8} - \dfrac{1}{3}$ $\dfrac{7}{24}$

   d) $\dfrac{8}{9} - \dfrac{2}{3}$ $\dfrac{2}{9}$

6) Work out the following:

   a) $2\dfrac{1}{2} - 1\dfrac{3}{4}$ $\dfrac{3}{4}$

   b) $1\dfrac{2}{3} - \dfrac{3}{4}$ $\dfrac{11}{12}$

   c) $3\dfrac{2}{5} - 1\dfrac{1}{2}$ $1\dfrac{9}{10}$

   d) $2\dfrac{3}{8} - \dfrac{3}{5}$ $1\dfrac{31}{40}$

7) Ted received his pocket money on Friday.

   He spent $\dfrac{3}{5}$ of his pocket money on games.

   He spent $\dfrac{1}{10}$ of his pocket money on magazines.

   What fraction of his pocket money did he have left? $\dfrac{3}{10}$
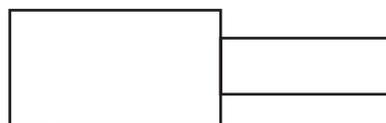
8) Maisie buys a bag of flour.

   She uses $\dfrac{1}{4}$ to bake a cake and $\dfrac{2}{5}$ to make a loaf.

   a) What fraction of the bag of flour was used? $\dfrac{13}{20}$
   b) What fraction of the bag of flour is left? $\dfrac{7}{20}$

9) Work out the total length of this shape.
   Give your answer as a mixed number. $5\dfrac{11}{12}$

   $\longleftarrow 3\frac{1}{4}$ inches $\longrightarrow\!\!\longleftarrow 2\frac{2}{3}$ inches $\rightarrow$

Four Rules of Fractions - Finding a Fraction of an Amount

1) Work out these amounts.

   a) $\frac{3}{4}$ of £20

   b) $\frac{2}{3}$ of 60 kg

   c) $\frac{3}{8} \times 24$

   d) $150 \times \frac{2}{3}$

   e) $\frac{2}{9}$ of 180 cm

   f) $49 \times \frac{4}{7}$

   g) $60 \times \frac{1}{4}$

   h) $\frac{5}{8}$ of £48

   i) $4000 \times \frac{7}{8}$

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

   How many apples have maggots in them?

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

   At midday they had already travelled $\frac{5}{7}$ of the total distance.

   What distance, in km, had they travelled by midday?

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

   What was the selling price?

5) Yesterday Thomas travelled a total of 175 miles.

   He travelled $\frac{2}{5}$ of this distance in the morning.

   How many miles did he travel during the rest of the day?

6) Debra received her £15 pocket money on Saturday.

   She spent $\frac{1}{3}$ of her pocket money on magazines.

   She spent $\frac{2}{5}$ of her pocket money on a necklace.

   How much of the £15 did she have left?

Four Rules of Fractions - Finding a Fraction of an Amount

1) Work out these amounts.

a) $\frac{3}{4}$ of £20   £15   b) $\frac{2}{3}$ of 60 kg   40 kg   c) $\frac{3}{8} \times 24$ 9

d) $150 \times \frac{2}{3}$ 100   e) $\frac{2}{9}$ of 180 cm   40 cm   f) $49 \times \frac{4}{7}$ 28

g) $60 \times \frac{1}{4}$ 15   h) $\frac{5}{8}$ of £48   £30   i) $4000 \times \frac{7}{8}$ 3 500

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them?   360 apples

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday?   550 km

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price?   £21

5) Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day?   105 miles

6) Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left?   £4

Four Rules of Fractions - Multiplying Fractions

*In all the questions on this page, please
give your answers in their simplest form.*

1) Work out the following:

   a) $\dfrac{1}{2} \times \dfrac{1}{2}$

   b) $\dfrac{2}{3} \times \dfrac{1}{3}$

   c) $\dfrac{3}{5} \times \dfrac{2}{7}$

   d) $\dfrac{4}{7} \times \dfrac{5}{9}$

2) Work out the following:

   a) $\dfrac{1}{2} \times \dfrac{2}{3}$

   b) $\dfrac{3}{4} \times \dfrac{8}{11}$

   c) $\dfrac{2}{9} \times \dfrac{3}{4}$

   d) $\dfrac{4}{5} \times \dfrac{1}{12}$

3) Work out the following:

   a) $1\dfrac{1}{2} \times \dfrac{1}{3}$

   b) $\dfrac{2}{3} \times 2\dfrac{2}{5}$

   c) $3\dfrac{1}{2} \times 1\dfrac{1}{2}$

   d) $1\dfrac{2}{7} \times 3\dfrac{1}{3}$

Four Rules of Fractions - Multiplying Fractions

_In all the questions on this page, please
give your answers in their simplest form._

1) Work out the following:

a) $\dfrac{1}{2} \times \dfrac{1}{2}$ $\dfrac{1}{4}$

b) $\dfrac{2}{3} \times \dfrac{1}{3}$ $\dfrac{2}{9}$

c) $\dfrac{3}{5} \times \dfrac{2}{7}$ $\dfrac{6}{35}$

d) $\dfrac{4}{7} \times \dfrac{5}{9}$ $\dfrac{20}{63}$

2) Work out the following:

a) $\dfrac{1}{2} \times \dfrac{2}{3}$ $\dfrac{1}{3}$

b) $\dfrac{3}{4} \times \dfrac{8}{11}$ $\dfrac{6}{11}$

c) $\dfrac{2}{9} \times \dfrac{3}{4}$ $\dfrac{1}{6}$

d) $\dfrac{4}{5} \times \dfrac{1}{12}$ $\dfrac{1}{15}$

3) Work out the following:

a) $1\dfrac{1}{2} \times \dfrac{1}{3}$ $\dfrac{1}{2}$

b) $\dfrac{2}{3} \times 2\dfrac{2}{5}$ $1\dfrac{3}{5}$

c) $3\dfrac{1}{2} \times 1\dfrac{1}{2}$ $5\dfrac{1}{4}$

d) $1\dfrac{2}{7} \times 3\dfrac{1}{3}$ $4\dfrac{2}{7}$

Four Rules of Fractions - Dividing Fractions

In all the questions on this page, please
give your answers in their simplest form.

1) Work out the following:

a) $\dfrac{2}{5} \div \dfrac{3}{4}$

b) $\dfrac{1}{7} \div \dfrac{3}{5}$

c) $\dfrac{4}{9} \div \dfrac{1}{2}$

d) $\dfrac{3}{10} \div \dfrac{5}{9}$

2) Work out the following:

a) $\dfrac{1}{2} \div \dfrac{1}{3}$

b) $\dfrac{3}{7} \div \dfrac{4}{7}$

c) $\dfrac{1}{9} \div \dfrac{2}{3}$

d) $\dfrac{2}{5} \div \dfrac{3}{10}$

3) Work out the following:

a) $1\dfrac{1}{3} \div \dfrac{1}{4}$

b) $\dfrac{3}{5} \div 2\dfrac{2}{3}$

c) $3\dfrac{2}{3} \div 1\dfrac{1}{5}$

d) $4\dfrac{1}{2} \div 1\dfrac{1}{2}$

Four Rules of Fractions - Dividing Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\dfrac{2}{5} \div \dfrac{3}{4}$ $\dfrac{8}{15}$

b) $\dfrac{1}{7} \div \dfrac{3}{5}$ $\dfrac{5}{21}$

c) $\dfrac{4}{9} \div \dfrac{1}{2}$ $\dfrac{8}{9}$

d) $\dfrac{3}{10} \div \dfrac{5}{9}$ $\dfrac{27}{50}$

2) Work out the following:

a) $\dfrac{1}{2} \div \dfrac{1}{3}$ $1\dfrac{1}{2}$

b) $\dfrac{3}{7} \div \dfrac{4}{7}$ $\dfrac{3}{4}$

c) $\dfrac{1}{9} \div \dfrac{2}{3}$ $\dfrac{1}{6}$

d) $\dfrac{2}{5} \div \dfrac{3}{10}$ $1\dfrac{1}{3}$

3) Work out the following:

a) $1\dfrac{1}{3} \div \dfrac{1}{4}$ $5\dfrac{1}{3}$

b) $\dfrac{3}{5} \div 2\dfrac{2}{3}$ $\dfrac{9}{40}$

c) $3\dfrac{2}{3} \div 1\dfrac{1}{5}$ $3\dfrac{1}{18}$

d) $4\dfrac{1}{2} \div 1\dfrac{1}{2}$ 3

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2}$$

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35}$$

Write down all the figures on your calculator display.

3) Work out $\dfrac{5.8 + 4.65}{3.1^2 + 1.62}$

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71}$$

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}}$$

Write down all the figures on your calculator display.

Calculator Questions

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2}$$ 12.52008929

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35}$$ 1.380899523

Write down all the figures on your calculator display.

3) Work out $$\frac{5.8 + 4.65}{3.1^2 + 1.62}$$ 0.9305431879

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71}$$ 40.6395664

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45}$$ 0.5405405405

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$$ 33.83823544

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}}$$ 9.299940263

Write down all the figures on your calculator display.

1) Write the following ratios in their simplest form:

   a)   6 : 9

   b)   10 : 5

   c)   7 : 21

   d)   4 : 24

   e)   12 : 40

   f)   4 : 2 : 8

   g)   18 : 63 : 9

2) Write the missing value in these equivalent ratios:

   a) $3 : 5 = 12 :$ ☐

   b) $4 : 9 =$ ☐ $: 27$

   c)   ☐ $: 7 = 16 : 14$

3) The ratio of girls to boys in a class is 4 : 5.

   What fraction of the class are girls?

4) A model of a plane is made using a scale of 1 : 5.

   a)   If the real length of the plane is 20 m, what is
        the length of the model?

   b)   If the wings of the model are 1.2 m long, what is
        the actual length of the wings on the plane?

1) Write the following ratios in their simplest form:

    a)   6 : 9   **2 : 3**

    b)   10 : 5   **2 : 1**

    c)   7 : 21   **1 : 3**

    d)   4 : 24   **1 : 6**

    e)   12 : 40   **3 : 10**

    f)   4 : 2 : 8   **2 : 1 : 4**

    g)   18 : 63 : 9   **2 : 7 : 1**

2) Write the missing value in these equivalent ratios:

    a)   3 : 5 = 12 : **20**

    b)   4 : 9 = **12** : 27

    c)   **8** : 7 = 16 : 14

3) The ratio of girls to boys in a class is 4 : 5.

    What fraction of the class are girls? $\dfrac{4}{9}$

4) A model of a plane is made using a scale of 1 : 5.

    a)   If the real length of the plane is 20 m, what is
            the length of the model?   **4 m**

    b)   If the wings of the model are 1.2 m long, what is
            the actual length of the wings on the plane?   **6 m**

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes

250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs.

Kate makes 12 pancakes.

b) Work out how much flour she needs.

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people
180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs.

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs.

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people
800 g of pineapple

4 egg whites

½ lemon

100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

a) Work out how much caster sugar he uses.

Sid makes a pineapple sorbet.
He uses 2 lemons.

b) Work out how many people he makes pineapple sorbet for.

Ratio - Recipe Questions

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes

250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs. 750 ml

Kate makes 12 pancakes.

b) Work out how much flour she needs. 210 g

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people
180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs. 90 g

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs. 450 ml

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people
800 g of pineapple
4 egg whites
½ lemon
100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

a) Work out how much caster sugar he uses. 300 g

Sid makes a pineapple sorbet.
He uses 2 lemons.

b) Work out how many people he makes pineapple sorbet for. 24 people

Page 60 B

Direct Proportion - Introduction

1) 3 bananas cost £2

   Work out the cost of 6 bananas.

2) 100 g of sweets cost 36p

   Work out the cost of 1000 g of sweets.

3) It takes 4 litres of water to make 5 jugs of orange squash.

   How much water will be needed to make 20 jugs of orange squash?

4) 8 identical boxes weigh 36 kg.

   Find the weight of 2 of these boxes.

5) Emily bought 4 identical pairs of socks for £3.60

   Work out the price of 9 pairs of these socks.

6) The price of 36 chocolates is £7.20

   Work out the cost of 8 chocolates.

7) Theresa bought 5 theatre tickets for £60

   Work out the cost of 9 theatre tickets.

8) A machine labels 120 bottles in 5 minutes.

   How many bottles will it label in half an hour?

9) Jenny buys 4 folders.
   The total cost of these 4 folders is £6.40

   Work out the total cost for 7 of these folders.

10) The cost of 15 litres of petrol is £18

    Work out the cost of 20 litres of petrol.

11) 3 maths books cost £7.47

    Work out the cost of 5 of these.

12) The amount of fertiliser needed to treat an area of $14\,m^2$ is 525 g

    How much fertiliser is needed to treat an area of $8\,m^2$?

1) 3 bananas cost £2

Work out the cost of 6 bananas. £4

2) 100 g of sweets cost 36p

Work out the cost of 1000 g of sweets. £3.60 or 360p

3) It takes 4 litres of water to make 5 jugs of orange squash.

How much water will be needed to make 20 jugs of orange squash? 16 litres

4) 8 identical boxes weigh 36 kg.

Find the weight of 2 of these boxes. 9 kg

5) Emily bought 4 identical pairs of socks for £3.60

Work out the price of 9 pairs of these socks. £8.10

6) The price of 36 chocolates is £7.20

Work out the cost of 8 chocolates. £1.60

7) Theresa bought 5 theatre tickets for £60

Work out the cost of 9 theatre tickets. £108

8) A machine labels 120 bottles in 5 minutes.

How many bottles will it label in half an hour? 720 bottles

9) Jenny buys 4 folders.
The total cost of these 4 folders is £6.40

Work out the total cost for 7 of these folders. £11.20

10) The cost of 15 litres of petrol is £18

Work out the cost of 20 litres of petrol. £24

11) 3 maths books cost £7.47

Work out the cost of 5 of these. £12.45

12) The amount of fertiliser needed to treat an area of $14\,m^2$ is 525 g

How much fertiliser is needed to treat an area of $8\,m^2$? 300 g

1)   Tony buys

        4 kg of potatoes at £1.60 per kilogram

                    and

        2 kg of onions at £1.80 per kilogram.

    She pays with a £20 note.

    How much change should she receive?

2)

Bags of sweets
£1.50 per bag
Buy 3, get 1 free

    How many bags of sweets can you buy for £9?

3)   **Cinema Prices**

Adult	£2.99
Child	£2.30
Family ticket (2 adults and 2 children	£9.00

    a) 1 adult and 7 children went to the cinema.

        How much did they pay altogether?

    b) 2 adults and 2 children went to the cinema and bought a family ticket.

        How much did they save altogether?

1) Tony buys

   4 kg of potatoes at £1.60 per kilogram

   and

   2 kg of onions at £1.80 per kilogram.

   She pays with a £20 note.

   How much change should she receive? **£10**

2)

Bags of sweets
£1.50 per bag
Buy 3, get 1 free

   How many bags of sweets can you buy for £9? **8**

3)
   Cinema Prices

Adult	£2.99
Child	£2.30
Family ticket (2 adults and 2 children	£9.00

   a) 1 adult and 7 children went to the cinema.

   How much did they pay altogether? **£19.09**

   b) 2 adults and 2 children went to the cinema and bought a family ticket.

   How much did they save altogether? **£1.58**

1) Which of the following offer better value for money?
   Working must be shown
   a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

   b) 600g of bananas for 70p or 200g of bananas for 22p

   c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

   d) 60 teabags for £1.62 or 40 teabags for £0.96

2) Which of these is the best buy?

   | 20 exercise books for £4.00 | 35 exercise books for £7.80 |

3) Hamza needs to buy 2 litres of paint.
   At the shop he gets two choices:
   500ml for £2.55 or 1 litre for £4.79.

   a) Work out which of these would be the best buy for Hamza.

   b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

   You must show all your working.

4) Honey pots are sold in two sizes.
   A small pot costs 45p and weighs 450g.
   A large pot costs 80p and weighs 850g.

   Which pot of honey is better value for money?
   You must show all your working.

1) Which of the following offer better value for money?
Working must be shown

a) 200ml of toothpaste for 50p or <u>400ml of toothpaste for 90p</u>

50 ÷ 200 = 0.25   90 ÷ 400 = 0.225

b) 600g of bananas for 70p or <u>200g of bananas for 22p</u>

70 ÷ 600 = 0.1167   22 ÷ 200 = 0.11

c) 2 litres of paint for £1.60 or <u>5 litres of paint for £3.50</u>

1.60 ÷ 2 = 0.8   3.50 ÷ 5 = 0.7

d) 60 teabags for £1.62 or <u>40 teabags for £0.96</u>

1.62 ÷ 60 = 0.027   0.96 ÷ 40 = 0.049

2) Which of these is the best buy?

20 exercise books for £4.00		35 exercise books for £7.80

400 ÷ 20 = 20   780 ÷ 35 = 22.3

20p per book   22p per book

3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

2.55 ÷ 500 = 0.0051   4.79 ÷ 1000 = 0.00479

a) Work out which of these would be the best buy for Hamza.

1 litre of paint for £4.79

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

£0.62 or 62p

You must show all your working.

4 × 2.55 = 10.20   10.20 − 9.58 = 0.62

2 × 4.79 = 9.58

4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g.   45 ÷ 450 = 0.1p per g

A large pot costs 80p and weighs 850g.   80 ÷ 850 = 0.09p per g

Which pot of honey is better value for money?

You must show all your working.   Large pot at 80p for 850g

1) Simplify the following

    a) $x \times x$

    b) $x \times x \times x \times x \times x$

    c) $y \times y \times y$

2) Simplify the following

    a) $x^2 \times x^4$

    b) $x^3 \times x^5$

    c) $y \times y^3$

    d) $x^2 \times x \times x^4$

    e) $y^2 \times y^3 \times y^4$

3) Simplify the following

    a) $2x \times x$

    b) $4x \times 3x$

    c) $3t^2 \times 2t$

    d) $4y^2 \times 3y^3$

    e) $x \times 2x^2 \times 3x^3$

4) Simplify the following

    a) $x \times y$

    b) $2x \times 3y$

    c) $5r \times 2s \times 3t$

    d) $6x \times 2y \times z$

5) Simplify the following

    a) $3x \times y$

    b) $4x^2y \times 2x$

    c) $3xy^2 \times 2xy^3$

    d) $6xy \times x^2y^3 \times 2y$

    e) $2x^2y^3 \times 5x^4y^2$

    f) $tu^2 \times t^2u \times 4tu$

1) Simplify the following

 a) $x \times x$ x^2

 b) $x \times x \times x \times x \times x$ x^5

 c) $y \times y \times y$ y^3

2) Simplify the following

 a) $x^2 \times x^4$ x^6

 b) $x^3 \times x^5$ x^8

 c) $y \times y^3$ y^4

 d) $x^2 \times x \times x^4$ x^7

 e) $y^2 \times y^3 \times y^4$ y^9

3) Simplify the following

 a) $2x \times x$ $2x^2$

 b) $4x \times 3x$ $12x^2$

 c) $3t^2 \times 2t$ $6t^3$

 d) $4y^2 \times 3y^3$ $12y^5$

 e) $x \times 2x^2 \times 3x^3$ $6x^6$

4) Simplify the following

 a) $x \times y$ xy

 b) $2x \times 3y$ $6xy$

 c) $5r \times 2s \times 3t$ $30rst$

 d) $6x \times 2y \times z$ $12xyz$

5) Simplify the following

 a) $3x \times y$ $3xy$

 b) $4x^2y \times 2x$ $8x^3y$

 c) $3xy^2 \times 2xy^3$ $6x^2y^5$

 d) $6xy \times x^2y^3 \times 2y$ $12x^3y^5$

 e) $2x^2y^3 \times 5x^4y^2$ $10x^6y^5$

 f) $tu^2 \times t^2u \times 4tu$ $4t^4u^4$

1) Simplify the following

   a) $x^5 \div x$

   b) $y^4 \div y^3$

   c) $g^8 \div g^5$

   d) $y^4 \div y^2$

   e) $x^3 \div x^3$

2) Simplify the following

   a) $6x^4 \div x$

   b) $12y^5 \div 3y^2$

   c) $10g^7 \div 2g^5$

3) Simplify the following

   a) $\dfrac{x^6}{x^2}$

   b) $\dfrac{x^9}{x^4}$

   c) $\dfrac{6x^8}{2x^6}$

4) Simplify the following

   a) $\dfrac{x^6 \times x^3}{x^4}$

   b) $\dfrac{x^3 \times x^4}{x^2 \times x}$

   c) $\dfrac{(x + 5)^5}{(x + 5)^2}$

5) Simplify the following

   a) $20x^6 \div 5x^2$

   b) $\dfrac{14x^7}{2x^2}$

   c) $\dfrac{8x \times 2x^3}{4x^2}$

1) Simplify the following

   a) $\quad x^5 \div x \quad$ **x^4**

   b) $\quad y^4 \div y^3 \quad$ **y**

   c) $\quad g^8 \div g^5 \quad$ **g^3**

   d) $\quad y^4 \div y^2 \quad$ **y^2**

   e) $\quad x^3 \div x^3 \quad$ **1**

2) Simplify the following

   a) $\quad 6x^4 \div x \quad$ **$6x^3$**

   b) $\quad 12y^5 \div 3y^2 \quad$ **$4y^3$**

   c) $\quad 10g^7 \div 2g^5 \quad$ **$5g^2$**

3) Simplify the following

   a) $\quad \dfrac{x^6}{x^2} \quad$ **x^4**

   b) $\quad \dfrac{x^9}{x^4} \quad$ **x^5**

   c) $\quad \dfrac{6x^8}{2x^6} \quad$ **$3x^2$**

4) Simplify the following

   a) $\quad \dfrac{x^6 \times x^3}{x^4} \quad$ **x^5**

   b) $\quad \dfrac{x^3 \times x^4}{x^2 \times x} \quad$ **x^4**

   c) $\quad \dfrac{(x+5)^5}{(x+5)^2} \quad$ **$(x+5)^3$**

5) Simplify the following

   a) $\quad 20x^6 \div 5x^2 \quad$ **$4x^4$**

   b) $\quad \dfrac{14x^7}{2x^2} \quad$ **$7x^5$**

   c) $\quad \dfrac{8x \times 2x^3}{4x^2} \quad$ **$4x^2$**

1) a) Simplify $4p \times 6q$

   b) Simplify $d \times d \times d \times d$

   c) Simplify $t^9 \div t^4$

2) a) Simplify $4a + 3c - 2a + c$

   b) Simplify $2x - 6c - x + 2c$

3) a) Simplify $5xt + 2xt - 4xt$

   b) Simplify $4x + 3y - 2x + 4y$

   c) Simplify $m \times m \times m$

   d) Simplify $3n \times 2t$

4) Simplify $3x^2 \times 4x^5y^4$

5) Simplify $4x + 3y - 2x + 6y$

6) a) Simplify $t^4 \times t^5$

   b) Simplify $a \times a \times a$

7) a) Simplify $x^6 \times x^2$

   b) Simplify $10x^2y^4 \div 2xy^2$

8) a) Simplify $3a + 5c - a + 3c$

   b) Simplify $x^3 \times x^4$

   c) Simplify $4x^2y^4 \times 5xy^2$

9) Simplify $6x + 8y + 2x - 10y$

10) a) Simplify $x \times x \times x \times x$

    b) Simplify $2x \times 3y$

11) a) Simplify $pq + 2pq$

    b) Simplify $5x + 3y - x - 4y$

12) a) Simplify $6a + 5b - 3b + a$

    b) Simplify $x^4 + x^4$

13) a) Simplify $x + y + x + y + x$

    b) Simplify $t^2 + t^2 + t^2$

14) a) Simplify $a^3 \times a^3$

    b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$

15) a) Simplify $3d + e - d + 4e$

    b) Simplify $3x^2 - x^2$

    c) Simplify $5t + 8d - 2t - 3d$

    d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$

Algebraic Simplification

1) a) Simplify $4p \times 6q$ **24pq**

   b) Simplify $d \times d \times d \times d$ **d⁴** d^4

   c) Simplify $t^9 \div t^4$ **t^5**

2) a) Simplify $4a + 3c - 2a + c$ **2a + 4c**

   b) Simplify $2x - 6c - x + 2c$ **x − 4c**

3) a) Simplify $5xt + 2xt - 4xt$ **3xt**

   b) Simplify $4x + 3y - 2x + 4y$ **2x + 7y**

   c) Simplify $m \times m \times m$ **m^3**

   d) Simplify $3n \times 2t$ **6nt**

4) Simplify $3x^2 \times 4x^5y^4$ **$12x^7y^4$**

5) Simplify $4x + 3y - 2x + 6y$ **2x + 9y**

6) a) Simplify $t^4 \times t^5$ **t^9**

   b) Simplify $a \times a \times a$ **a^3**

7) a) Simplify $x^6 \times x^2$ **x^8**

   b) Simplify $10x^2y^4 \div 2xy^2$ **$5xy^2$**

8) a) Simplify $3a + 5c - a + 3c$ **2a + 8c**

   b) Simplify $x^3 \times x^4$ **x^7**

   c) Simplify $4x^2y^4 \times 5xy^2$ **$20x^3y^6$**

9) Simplify $6x + 8y + 2x - 10y$ **8x − 2y**

10) a) Simplify $x \times x \times x \times x$ **x^4**

   b) Simplify $2x \times 3y$ **6xy**

11) a) Simplify $pq + 2pq$ **3pq**

   b) Simplify $5x + 3y - x - 4y$ **4x − y**

12) a) Simplify $6a + 5b - 3b + a$ **7a + 2b**

   b) Simplify $x^4 + x^4$ **$2x^4$**

13) a) Simplify $x + y + x + y + x$ **3x + 2y**

   b) Simplify $t^2 + t^2 + t^2$ **$3t^2$**

14) a) Simplify $a^3 \times a^3$ **a^6**

   b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$ **$6x^2y^2$**

15) a) Simplify $3d + e - d + 4e$ **2d + 5e**

   b) Simplify $3x^2 - x^2$ **$2x^2$**

   c) Simplify $5t + 8d - 2t - 3d$ **3t + 5d**

   d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$ **$(3x + 1)^2$**

1) Expand these brackets

   a) $2(x + 3)$

   b) $3(2x + 4)$

   c) $5(3p - 2q)$

   d) $4(x^2 + 2y^2)$

   e) $6(r - r^2)$

2) Expand these brackets

   a) $x(x - 2)$

   b) $x(3x + 5)$

   c) $p(3p - 7q)$

   d) $y(y + 6y^2)$

   e) $x(r + r^2)$

3) Expand these brackets

   a) $2x(x - 5)$

   b) $4x(2x + 3)$

   c) $5p(4p - 2q)$

   d) $2y(3y + 4x^2)$

   e) $x(x + r^2)$

4) Expand these brackets

   a) $x(x^2 - 2)$

   b) $3x(2x^3 + 1)$

   c) $5p^2(4p - 2)$

   d) $2y^2(3y^3 + 4y)$

   e) $2xy(x + y^2)$

Expanding Brackets

1) Expand these brackets

a) $2(x + 3)$ $2x + 6$

b) $3(2x + 4)$ $6x + 12$

c) $5(3p - 2q)$ $15p - 10q$

d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

e) $6(r - r^2)$ $6r - 6r^2$

2) Expand these brackets

a) $x(x - 2)$ $x^2 - 2x$

b) $x(3x + 5)$ $3x^2 + 5x$

c) $p(3p - 7q)$ $3p^2 - 7pq$

d) $y(y + 6y^2)$ $y^2 + 6y^3$

e) $x(r + r^2)$ $xr + xr^2$

3) Expand these brackets

a) $2x(x - 5)$ $2x^2 - 10x$

b) $4x(2x + 3)$ $8x^2 + 12x$

c) $5p(4p - 2q)$ $20p^2 - 10pq$

d) $2y(3y + 4x^2)$ $6y^2 + 8x^2y$

e) $x(x + r^2)$ $x^2 + r^2x$

4) Expand these brackets

a) $x(x^2 - 2)$ $x^3 - 2x$

b) $3x(2x^3 + 1)$ $6x^4 + 3x$

c) $5p^2(4p - 2)$ $20p^3 - 10p^2$

d) $2y^2(3y^3 + 4y)$ $6y^5 + 8y^3$

e) $2xy(x + y^2)$ $2x^2y + 2xy^3$

Factorisation - Introduction

1) Factorise

   a) $2x + 4$

   b) $2y + 10$

   c) $3x + 12$

   d) $3x - 6$

   e) $5x - 15$

2) Factorise

   a) $p^2 + 7p$

   b) $x^2 + 4x$

   c) $y^2 - 2y$

   d) $p^2 - 5p$

   e) $x^2 + x$

3) Factorise

   a) $2x^2 + 6x$

   b) $2y^2 - 8y$

   c) $5p^2 + 10p$

   d) $7c^2 - 21c$

   e) $6x^2 + 9x$

4) Factorise

   a) $2x^2 - 4xy$

   b) $2t^2 + 10tu$

   c) $6x^2 - 8xy$

   d) $3x^2y^2 + 9xy$

1) Factorise

    a) $2x + 4$ 2(x + 2)

    b) $2y + 10$ 2(y + 5)

    c) $3x + 12$ 3(x + 4)

    d) $3x - 6$ 3(x − 2)

    e) $5x - 15$ 5(x − 3)

2) Factorise

    a) $p^2 + 7p$ p(p + 7)

    b) $x^2 + 4x$ x(x + 4)

    c) $y^2 - 2y$ y(y − 2)

    d) $p^2 - 5p$ p(p − 5)

    e) $x^2 + x$ x(x + 1)

3) Factorise

    a) $2x^2 + 6x$ 2x(x + 3)

    b) $2y^2 - 8y$ 2y(y − 4)

    c) $5p^2 + 10p$ 5p(p + 2)

    d) $7c^2 - 21c$ 7c(c − 3)

    e) $6x^2 + 9x$ 3x(2x + 3)

4) Factorise

    a) $2x^2 - 4xy$ 2x(x − 2y)

    b) $2t^2 + 10tu$ 2t(t + 5u)

    c) $6x^2 - 8xy$ 2x(3x − 4y)

    d) $3x^2y^2 + 9xy$ 3xy(xy + 3)

Substitution

1) $y = 5x$
 a) Work out the value of y when $x = 3$
 b) Work out the value of y when $x = -2$

2) $y = 2x + 7$
 a) Work out the value of y when $x = 4$
 b) Work out the value of y when $x = -3$

3) $y = 2x + 4t$
 $x = 6$
 $t = 1$
 Work out the value of y.

4) $y = 2a - 3b$
 $a = 4$
 $b = -2$
 Work out the value of y.

5) $v = 3a + 5b$
 $a = 6$
 $b = -3$
 Work out the value of v.

6) $y = x^2$
 a) Work out the value of y when $x = 6$
 b) Work out the value of y when $x = -4$

7) $y = 2x^2$
 a) Work out the value of y when $x = 5$
 b) Work out the value of y when $x = -3$

8) $y = 3x^2 + 2x$
 a) Work out the value of y when $x = 2$
 b) Work out the value of y when $x = -4$

9) $v = u^2 + 5as$
 $u = 6$
 $a = 2.5$
 $s = 9$
 Work out the value of v.

10) $y = p - 2qx^2$
 $p = -10$
 $q = 2$
 $x = -5$
 Work out the value of y.

11) $v^2 = u^2 + 2as$
 $u = 6$
 $a = 2.5$
 $s = 9$
 Work out the value of v.

12) $v^2 = u^2 + 2as$
 $u = 3$
 $a = 9.8$
 $s = 12$
 Work out the value of v.
 Give your answer correct to 1 decimal place

13) $s = ut + 0.5at^2$
 $a = 9.8$
 $t = 5$
 $u = 7$
 Work out the value of s.

Substitution

1) $y = 5x$

    a)   Work out the value of y when $x = 3$ **15**

    b)   Work out the value of y when $x = -2$ **-10**

2) $y = 2x + 7$

    a)   Work out the value of y when $x = 4$ **15**

    b)   Work out the value of y when $x = -3$ **1**

3) $y = 2x + 4t$

    $x = 6$

    $t = 1$

    Work out the value of y.   **16**

4) $y = 2a - 3b$

    $a = 4$

    $b = -2$

    Work out the value of y.   **14**

5) $v = 3a + 5b$

    $a = 6$

    $b = -3$

    Work out the value of v.   **3**

6) $y = x^2$

    a)   Work out the value of y when $x = 6$ **36**

    b)   Work out the value of y when $x = -4$ **16**

7) $y = 2x^2$

    a)   Work out the value of y when $x = 5$ **50**

    b)   Work out the value of y when $x = -3$ **18**

8) $y = 3x^2 + 2x$

    a)   Work out the value of y when $x = 2$ **16**

    b)   Work out the value of y when $x = -4$ **40**

9) $v = u^2 + 5as$

    $u = 6$

    $a = 2.5$

    $s = 9$

    Work out the value of v. **148.5**

10) $y = p - 2qx^2$

    $p = -10$

    $q = 2$

    $x = -5$

    Work out the value of y.   **-110**

11) $v^2 = u^2 + 2as$

    $u = 6$

    $a = 2.5$

    $s = 9$

    Work out the value of v.   **9**

12) $v^2 = u^2 + 2as$

    $u = 3$

    $a = 9.8$

    $s = 12$

    Work out the value of v. **15.6**

    Give your answer correct

    to 1 decimal place

13) $s = ut + 0.5at^2$

    $a = 9.8$

    $t = 5$

    $u = 7$

    Work out the value of s. **157.5**

Solving Equations - Introduction

1) Solve
   a) $x + 3 = 8$
   b) $x + 1 = 13$
   c) $x - 4 = 10$
   d) $x - 8 = 9$
   e) $x + 7 = 21$
   f) $x - 6 = 33$
   g) $16 = x + 2$
   h) $11 = x - 7$
   i) $14 = 3 + x$
   j) $5 = x - 12$

2) Solve
   a) $x + 2 = 9$
   b) $x + 1 = 16$
   c) $x - 3 = 14$
   d) $x - 8 = 7$
   e) $x + 5 = 29$
   f) $x - 8 = 35$
   g) $21 = x + 3$
   h) $18 = x - 6$
   i) $15 = 7 + x$
   j) $9 = x - 13$

3) Solve
   a) $2x = 8$
   b) $5x = 30$
   c) $40 = 4x$
   d) $24 = 8x$
   e) $\dfrac{x}{4} = 7$
   f) $\dfrac{x}{2} = 9$
   g) $3 = \dfrac{x}{5}$
   h) $6 = \dfrac{x}{6}$
   i) $2x = 68$
   j) $\dfrac{x}{8} = 7$

4) Solve
   a) $2x = 6$
   b) $6x = 30$
   c) $50 = 2x$
   d) $24 = 6x$
   e) $\dfrac{x}{4} = 8$
   f) $\dfrac{x}{2} = 10$
   g) $7 = \dfrac{x}{5}$
   h) $9 = \dfrac{x}{6}$
   i) $2x = 82$
   j) $\dfrac{x}{8} = 11$

5) Solve
   a) $y + 12 = 20$
   b) $\dfrac{d}{3} = 9$
   c) $m - 10 = 13$
   d) $7k = 35$
   e) $11 + c = 24$
   f) $60 = 10p$
   g) $8 = r - 19$
   h) $7 = \dfrac{c}{11}$
   i) $72 = 9q$
   j) $37 = 26 + x$

6) Solve
   a) $y + 14 = 26$
   b) $\dfrac{d}{3} = 12$
   c) $m - 10 = 17$
   d) $9k = 63$
   e) $15 + c = 29$
   f) $40 = 10p$
   g) $9 = r - 17$
   h) $6 = \dfrac{c}{11}$
   i) $54 = 6q$
   j) $34 = 27 + x$

Solving Equations - Introduction

1) Solve
   a) $x + 3 = 8$ $x = 5$
   b) $x + 1 = 13$ $x = 12$
   c) $x - 4 = 10$ $x = 14$
   d) $x - 8 = 9$ $x = 17$
   e) $x + 7 = 21$ $x = 14$
   f) $x - 6 = 33$ $x = 39$
   g) $16 = x + 2$ $x = 14$
   h) $11 = x - 7$ $x = 18$
   i) $14 = 3 + x$ $x = 11$
   j) $5 = x - 12$ $x = 17$

2) Solve
   a) $x + 2 = 9$ $x = 7$
   b) $x + 1 = 16$ $x = 15$
   c) $x - 3 = 14$ $x = 17$
   d) $x - 8 = 7$ $x = 15$
   e) $x + 5 = 29$ $x = 24$
   f) $x - 8 = 35$ $x = 43$
   g) $21 = x + 3$ $x = 18$
   h) $18 = x - 6$ $x = 24$
   i) $15 = 7 + x$ $x = 8$
   j) $9 = x - 13$ $x = 22$

3) Solve
   a) $2x = 8$ $x = 4$
   b) $5x = 30$ $x = 6$
   c) $40 = 4x$ $x = 10$
   d) $24 = 8x$ $x = 3$
   e) $\dfrac{x}{4} = 7$ $x = 28$
   f) $\dfrac{x}{2} = 9$ $x = 18$
   g) $3 = \dfrac{x}{5}$ $x = 15$
   h) $6 = \dfrac{x}{6}$ $x = 36$
   i) $2x = 68$ $x = 34$
   j) $\dfrac{x}{8} = 7$ $x = 56$

4) Solve
   a) $2x = 6$ $x = 3$
   b) $6x = 30$ $x = 5$
   c) $50 = 2x$ $x = 25$
   d) $24 = 6x$ $x = 4$
   e) $\dfrac{x}{4} = 8$ $x = 32$
   f) $\dfrac{x}{2} = 10$ $x = 20$
   g) $7 = \dfrac{x}{5}$ $x = 35$
   h) $9 = \dfrac{x}{6}$ $x = 54$
   i) $2x = 82$ $x = 41$
   j) $\dfrac{x}{8} = 11$ $x = 88$

5) Solve
   a) $y + 12 = 20$ $y = 8$
   b) $\dfrac{d}{3} = 9$ $d = 27$
   c) $m - 10 = 13$ $m = 23$
   d) $7k = 35$ $k = 5$
   e) $11 + c = 24$ $c = 13$
   f) $60 = 10p$ $p = 6$
   g) $8 = r - 19$ $r = 27$
   h) $7 = \dfrac{c}{11}$ $c = 77$
   i) $72 = 9q$ $q = 8$
   j) $37 = 26 + x$ $x = 11$

6) Solve
   a) $y + 14 = 26$ $y = 12$
   b) $\dfrac{d}{3} = 12$ $d = 36$
   c) $m - 10 = 17$ $m = 27$
   d) $9k = 63$ $k = 7$
   e) $15 + c = 29$ $c = 14$
   f) $40 = 10p$ $p = 4$
   g) $9 = r - 17$ $r = 26$
   h) $6 = \dfrac{c}{11}$ $c = 66$
   i) $54 = 6q$ $q = 9$
   j) $34 = 27 + x$ $x = 7$

1) Solve the following equations.

   a) $2x - 7 = 11$

   b) $5x + 3 = 43$

2) Solve the following equations.

   a) $\frac{x}{5} + 1 = 7$

   b) $\frac{x}{2} - 6 = 2.5$

3) Solve the following equations.

   a) $2(4x - 1) = 46$

   b) $6(2x + 7) = 48$

4) Solve the following equations.

   a) $3\left(\frac{x}{7} + 2\right) = 6$

   b) $2\left(\frac{5x}{3} - 1\right) = 8$

Solving Equations - Flowcharts

1) Solve the following equations.

   a) $2x - 7 = 11$

   $x = 9$

   b) $5x + 3 = 43$

   $x = 8$

2) Solve the following equations.

   a) $\frac{x}{5} + 1 = 7$

   $x = 30$

   b) $\frac{x}{2} - 6 = 2.5$

   $x = 17$

3) Solve the following equations.

   a) $2(4x - 1) = 46$

   $x = 6$

   b) $6(2x + 7) = 48$

   $x = 0.5$

4) Solve the following equations.

   a) $3(\frac{x}{7} + 2) = 6$

   $x = 0$

   b) $2(\frac{5x}{3} - 1) = 8$

   $x = 3$

1) Make the variable shown in brackets the subject of the formula in each case.

 a) $x = y + 7$ (y)

 b) $y = x - 2$ (x)

 c) $p = q + 12$ (q)

 d) $q = p - 25$ (p)

 e) $u = 8 + v$ (v)

 f) $v = u - 1$ (u)

 g) $a + 4 = b$ (a)

 h) $b - 6 = a$ (b)

 i) $9 + c = d$ (c)

 j) $d + 10 = c$ (d)

3) Make the variable shown in brackets the subject of the formula in each case.

 a) $5y = x$ (y)

 b) $p = 3q$ (q)

 c) $11u = v$ (u)

 d) $a = 15b$ (b)

 e) $\dfrac{x}{2} = y$ (x)

 f) $\dfrac{p}{10} = q$ (p)

 g) $u = \dfrac{v}{6}$ (v)

 h) $b = \dfrac{a}{7}$ (a)

 i) $c = 4d$ (d)

 j) $\dfrac{c}{8} = d$ (c)

5) Make the variable shown in brackets the subject of the formula in each case.

 a) $p - 7 = q$ (p)

 b) $\dfrac{v}{9} = u$ (v)

 c) $y = 3 + x$ (x)

 d) $c = d - 14$ (d)

 e) $m = 2n$ (n)

 f) $a + 1 = b$ (a)

 g) $6q = r$ (q)

 h) $x = \dfrac{y}{3}$ (y)

 i) $8 + c = d$ (c)

 j) $\dfrac{b}{10} = a$ (b)

1) Make the variable shown in brackets the subject of the formula in each case.

   a) $x = y + 7$ (y) $y = x - 7$ or $y = -7 + x$

   b) $y = x - 2$ (x) $x = y + 2$ or $x = 2 + y$

   c) $p = q + 12$ (q) $q = p - 12$ or $q = -12 + p$

   d) $q = p - 25$ (p) $p = q + 25$ or $p = 25 + q$

   e) $u = 8 + v$ (v) $v = u - 8$ or $v = -8 + u$

   f) $v = u - 1$ (u) $u = v + 1$ or $u = 1 + v$

   g) $a + 4 = b$ (a) $a = b - 4$ or $a = -4 + b$

   h) $b - 6 = a$ (b) $b = a + 6$ or $b = 6 + a$

   i) $9 + c = d$ (c) $c = d - 9$ or $c = -9 + d$

   j) $d + 10 = c$ (d) $d = c - 10$ or $d = -10 + c$

3) Make the variable shown in brackets the subject of the formula in each case.

   a) $5y = x$ (y) $y = x \div 5$ or $y = \dfrac{x}{5}$

   b) $p = 3q$ (q) $q = p \div 3$ or $q = \dfrac{p}{3}$

   c) $11u = v$ (u) $u = v \div 11$ or $u = \dfrac{v}{11}$

   d) $a = 15b$ (b) $b = a \div 15$ or $b = \dfrac{a}{15}$

   e) $\dfrac{x}{2} = y$ (x) $x = 2y$

   f) $\dfrac{p}{10} = q$ (p) $p = 10q$

   g) $u = \dfrac{v}{6}$ (v) $v = 6u$

   h) $b = \dfrac{a}{7}$ (a) $a = 7b$

   i) $c = 4d$ (d) $d = c \div 4$ or $d = \dfrac{c}{4}$

   j) $\dfrac{c}{8} = d$ (c) $c = 8d$

5) Make the variable shown in brackets the subject of the formula in each case.

   a) $p - 7 = q$ (p) $p = q + 7$ or $p = 7 + q$

   b) $\dfrac{v}{9} = u$ (v) $v = 9u$

   c) $y = 3 + x$ (x) $x = y - 3$ or $x = -3 + y$

   d) $c = d - 14$ (d) $d = c + 14$ or $d = 14 + c$

   e) $m = 2n$ (n) $n = m \div 2$ or $n = \dfrac{m}{2}$

   f) $a + 1 = b$ (a) $a = b - 1$ or $a = -1 + b$

   g) $6q = r$ (q) $q = r \div 6$ or $q = \dfrac{r}{6}$

   h) $x = \dfrac{y}{3}$ (y) $y = 3x$

   i) $8 + c = d$ (c) $c = d - 8$ or $c = -8 + d$

   j) $\dfrac{b}{10} = a$ (b) $b = 10a$

1) Make x the subject of the formula $w = 5x + 2$

2) Make x the subject of the formula $y = 2x - 6$

3) Make x the subject of the formula $2w = 3y + \dfrac{x}{5}$

4) Make t the subject of the formula $a = 2(b + 3t) + 1$

5) Make x the subject of the formula $y = 5 + \sqrt{x}$

6) Make t the subject of the formula $w = x^2 + t$

7) Make n the subject of the formula $m = 3n^2 - p$

8) Make q the subject of the formula $2(5q^2 + 1) = c$

1) Make x the subject of the formula $w = 5x + 2$

$x = \dfrac{w - 2}{5}$

2) Make x the subject of the formula $y = 2x - 6$

$x = \dfrac{y + 6}{2}$

3) Make x the subject of the formula $2w = 3y + \dfrac{x}{5}$

$x = 5(2w - 3y)$

4) Make t the subject of the formula $a = 2(b + 3t) + 1$

$t = \dfrac{\dfrac{a - 1}{2} + b}{3}$

5) Make x the subject of the formula $y = 5 + \sqrt{x}$

$x = (y - 5)^2$

6) Make t the subject of the formula $w = x^2 + t$

$t = w - x^2$

7) Make n the subject of the formula $m = 3n^2 - p$

$n = \sqrt{\dfrac{m + p}{3}}$

8) Make q the subject of the formula $2(5q^2 + 1) = c$

$q = \sqrt{\dfrac{\dfrac{c}{2} - 1}{5}}$

1)   The *n*th term of a number sequence is $2n + 1$
      Write down the first three terms of the sequence.

2)   The *n*th term of a number sequence is $n + 5$
      Write down the first three terms of the sequence.

3)   The *n*th term of a number sequence is $4n$

      a) Write down the first five terms of the sequence.
      b) Write down the tenth term of the sequence.

4)   The *n*th term of a number sequence is $5n + 2$

      a) Write down the first five terms of the sequence.
      b) Write down the tenth term of the sequence.

5)   The *n*th term of a number sequence is $3n - 1$

      a) Write down the first five terms of the sequence.
      b) Write down the tenth term of the sequence.

6)   The *n*th term of a number sequence is $n - 2$

      a) Write down the first five terms of the sequence.
      b) Write down the 50th term of the sequence.

7)   The *n*th term of a number sequence is $2n - 7$
      a) Write down the first five terms of the sequence.
      b) Write down the 10th term of the sequence.

8)   The *n*th term of a number sequence is $10n + 3$
      Write down the 100th term of the sequence.

9)   The *n*th term of a number sequence is $8n - 5$
      Write down the 100th term of the sequence.

1)   The *n*th term of a number sequence is $2n + 1$
     Write down the first three terms of the sequence.   3, 5, 7

2)   The *n*th term of a number sequence is $n + 5$
     Write down the first three terms of the sequence.   6, 7, 8

3)   The *n*th term of a number sequence is $4n$

     a) Write down the first five terms of the sequence.   4, 8, 12, 16, 20
     b) Write down the tenth term of the sequence.   40

4)   The *n*th term of a number sequence is $5n + 2$

     a) Write down the first five terms of the sequence.   7, 12, 17, 22, 27
     b) Write down the tenth term of the sequence.   52

5)   The *n*th term of a number sequence is $3n - 1$

     a) Write down the first five terms of the sequence.   2, 5, 8, 11, 14
     b) Write down the tenth term of the sequence.   29

6)   The *n*th term of a number sequence is $n - 2$

     a) Write down the first five terms of the sequence.   –1, 0, 1, 2, 3
     b) Write down the 50th term of the sequence.   48

7)   The *n*th term of a number sequence is $2n - 7$
     a) Write down the first five terms of the sequence.   –5, –3, –1, 1, 3
     b) Write down the 10th term of the sequence.   13

8)   The *n*th term of a number sequence is $10n + 3$
     Write down the 100th term of the sequence.   1003

9)   The *n*th term of a number sequence is $8n - 5$
     Write down the 100th term of the sequence.   795

1) Here are the first five terms of an arithmetic sequence.

     1   3   5   7   9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

2) Here are the first five terms of an arithmetic sequence.

     6   10   14   18   22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

3) Here are the first five terms of an arithmetic sequence.

     1   4   7   10   13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

4) Here are the first five terms of an arithmetic sequence.

     7   12   17   22   27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

5) Here are the first five terms of an arithmetic sequence.

     8   6   4   2   0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

1)   Here are the first five terms of an arithmetic sequence.

     1   3   5   7   9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$2n - 1$

2)   Here are the first five terms of an arithmetic sequence.

     6   10   14   18   22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$4n + 2$

3)   Here are the first five terms of an arithmetic sequence.

     1   4   7   10   13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$3n - 2$

4)   Here are the first five terms of an arithmetic sequence.

     7   12   17   22   27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$5n + 2$

5)   Here are the first five terms of an arithmetic sequence.

     8   6   4   2   0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$-2n + 10$

1) Here are the first four terms of an arithmetic sequence.

   4   7   10   13

   Find an expression, in terms of *n*, for the *n*th term of the sequence.

2) The *n*th term of a number sequence is $n^2 + 3$
   Write down the first three terms of the sequence.

3) Here are the first five terms of an arithmetic sequence.

   2   7   12   17   22

   a) Find, in terms of *n*, an expression for the *n*th term of this sequence.

   b) An expression for the *n*th term of another sequence is $11 - n^2$

      (i) Find the third term of this sequence.

      (ii) Find the fifth term of this sequence.

4) The *n*th term of a sequence is $2n^2$

   (i) Find the 4th term of the sequence.

   (ii) Is the number 400 a term of the sequence?

   Give reasons for your answer.

1)   Here are the first four terms of an arithmetic sequence.

4   7   10   13

Find an expression, in terms of *n*, for the *n*th term of the sequence.   3*n* + 1

2)   The *n*th term of a number sequence is $n^2 + 3$
Write down the first three terms of the sequence.   4, 7, 12

3)   Here are the first five terms of an arithmetic sequence.

2   7   12   17   22

a)   Find, in terms of *n*, an expression for the *n*th term of this sequence.   5*n* − 3

b)   An expression for the *n*th term of another sequence is $11 - n^2$

(i) Find the third term of this sequence.   2

(ii) Find the fifth term of this sequence.   -14

4)   The *n*th term of a sequence is $2n^2$

(i)   Find the 4th term of the sequence.   32

(ii)   Is the number 400 a term of the sequence?

Give reasons for your answer.   No, 400 = 2 × 200, but 200 is not a square number.

1) The *n*th term of a number sequence is given by $4n + 1$
    a) Work out the first **two** terms of the number sequence.

    Here are the first four terms of another number sequence.
        1 4 7 10
    b) Find, in terms of *n*, an expression for the *n*th term of this
        number sequence.

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4			
. . .			
10			

    a) Complete Line Number 4 of the pattern.

    b) Complete Line Number 10 of the pattern.

    c) Use the number pattern to find the answer to $999^2 + 1001^2$

1) The *n*th term of a number sequence is given by $4n + 1$

    a) Work out the first **two** terms of the number sequence.

       5, 9

   Here are the first four terms of another number sequence.

       1   4   7   10

    b) Find, in terms of *n*, an expression for the *n*th term of this number sequence.

       $3n - 2$

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4	$4^2 + 6^2$	$2 \times 5^2 + 2$	52
. . .			
10	$10^2 + 12^2$	$2 \times 11^2 + 2$	244

    a) Complete Line Number 4 of the pattern.

    b) Complete Line Number 10 of the pattern.

    c) Use the number pattern to find the answer to $999^2 + 1001^2$ 2000002

Straight Line Graphs - Drawing

1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1		
y	-10		-2			10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.

c) Use the graph to find the value of y when $x = 2.5$

d) Use the graph to find the value of x when $y = -8$
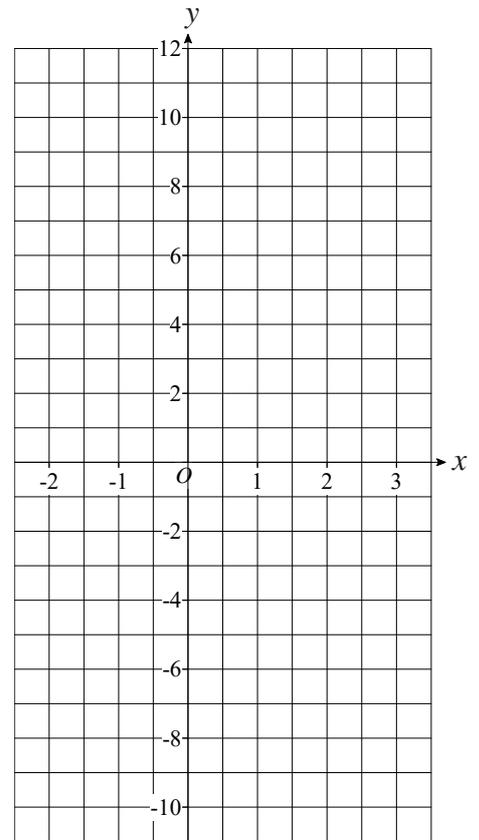
2) a) Complete the table of values for $y = 2x + 2$

x	-2	-1	0	1	2	3
y		0	2			

b) On the grid, draw the graph of $y = 2x + 2$.
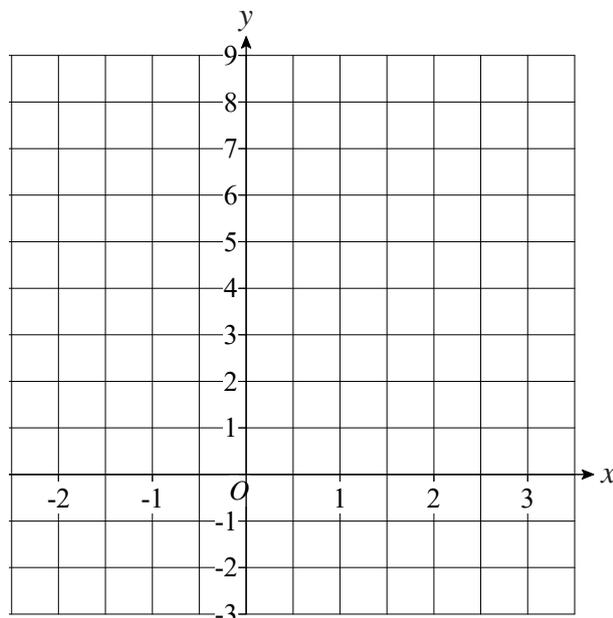
Straight Line Graphs - Drawing

1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1		
y	-10	-6	-2	2	6	10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.

c) Use the graph to find the value of y when $x = 2.5$
   y = 8
d) Use the graph to find the value of x when $y = -8$
   x = -1.5
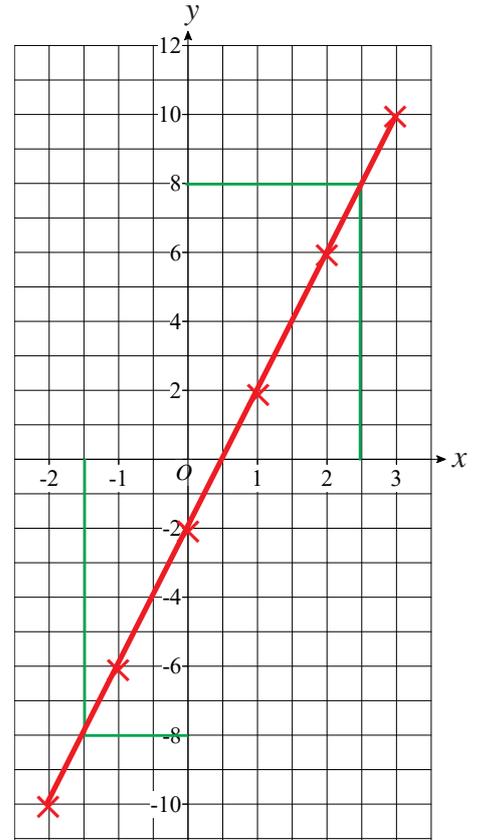
2) a) Complete the table of values for $y = 2x + 2$

x	-2	-1	0	1	2	3
y	-2	0	2	4	6	

b) On the grid, draw the graph of $y = 2x + 2$.
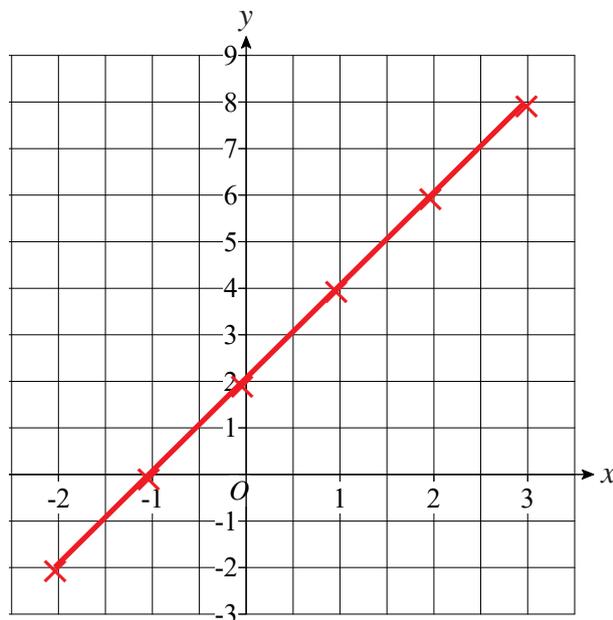
Straight Line Graphs - Drawing

1) On the grid, draw the graph of $y = 2x - 4$
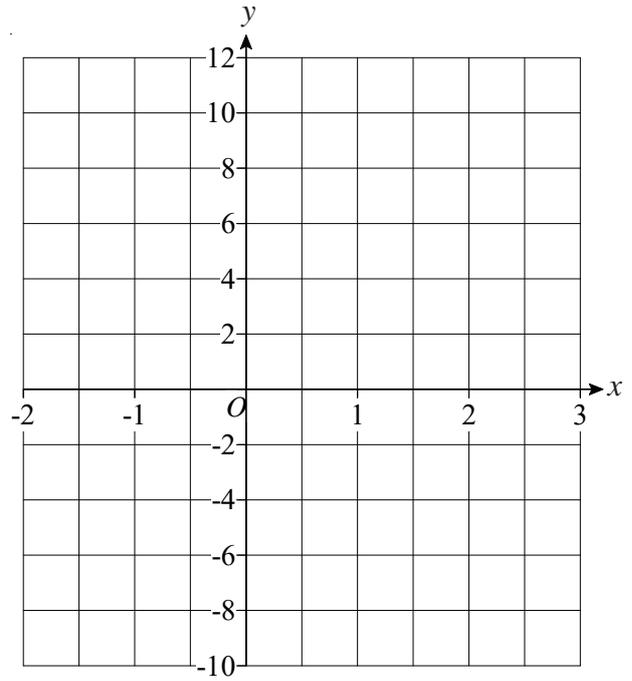
2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y		4.5	3			-1.5

b) On the grid, draw the graph of $3x + 2y = 6$
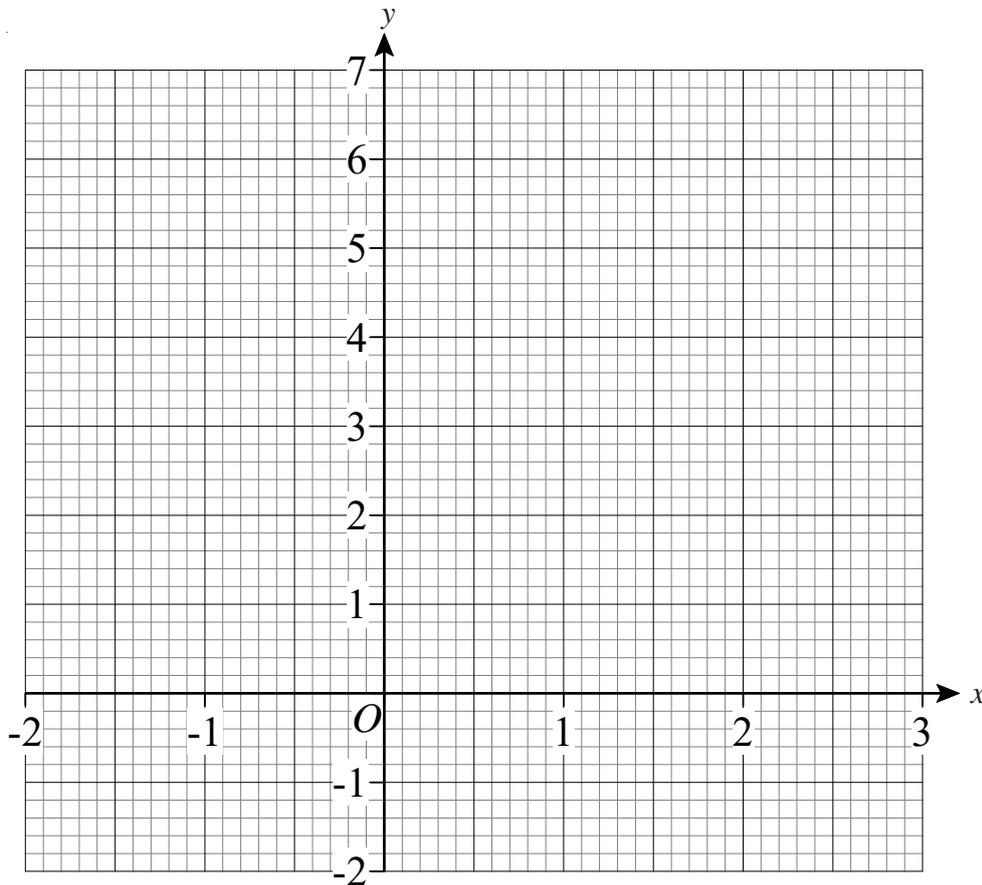
c) Find the gradient of the graph of $3x + 2y = 6$.

Straight Line Graphs - Drawing

1) On the grid, draw the graph of $y = 2x - 4$
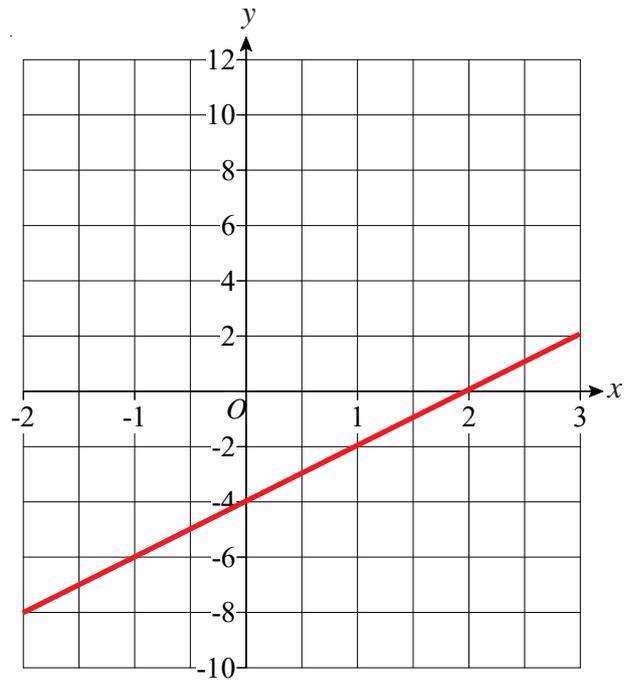
2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y	6	4.5	3	1.5	0	-1.5

b) On the grid, draw the graph of $3x + 2y = 6$
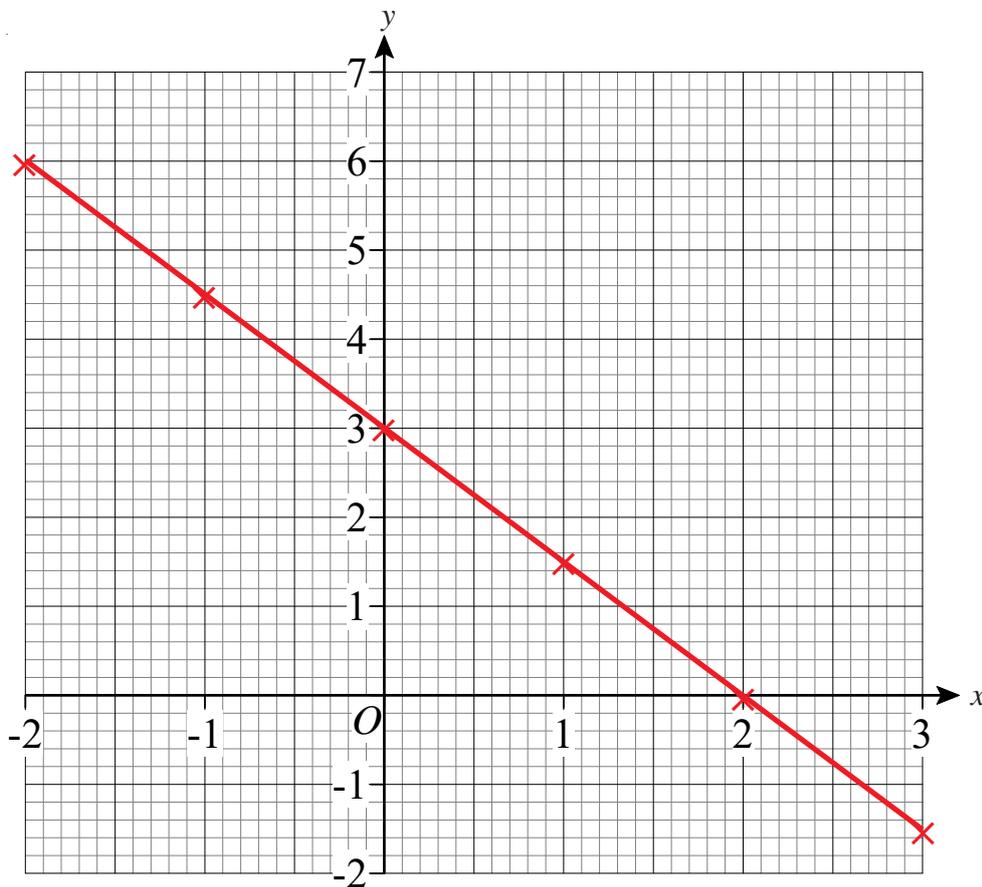
c) Find the gradient of the graph of $3x + 2y = 6$.   Gradient is -1.5

Straight Line Graphs - Drawing

1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y				1		

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$

d) Use your graph to work out the value of x when $y = 4.5$

_____
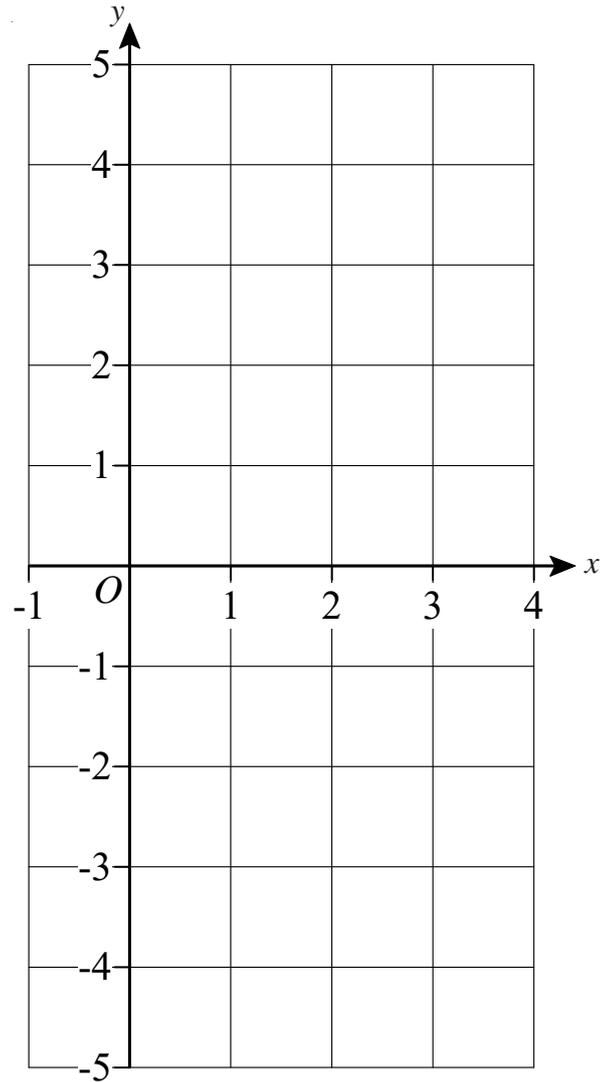
2) a) Complete the table of values for $y = 2 - x$

x	-1	0	1	2	3	4
y					-1	

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

_____

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y				0		

b) Draw the graph of $y = \frac{1}{2}x - 1$
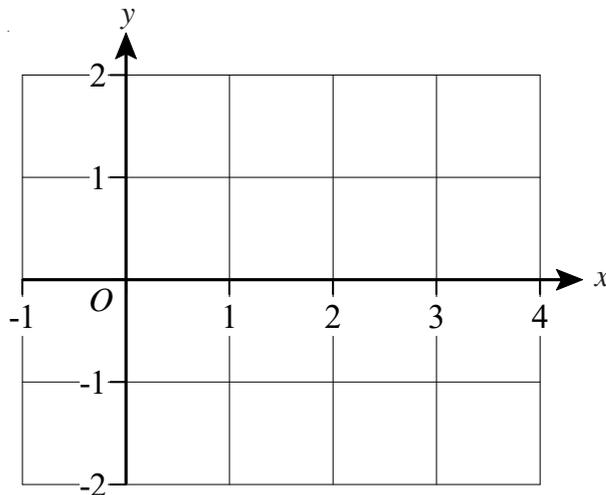
c) Use your graph to find the value of y when $x = 3.5$

Straight Line Graphs - Drawing

1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y	-5	-3	-1	1	3	5

  b) Using the axes on the right draw the graph of $y = 2x - 3$

  c) Use your graph to work out the value of y when $x = 2.5$ $y = 2$

  d) Use your graph to work out the value of x when $y = 4.5$ $x = 3.75$
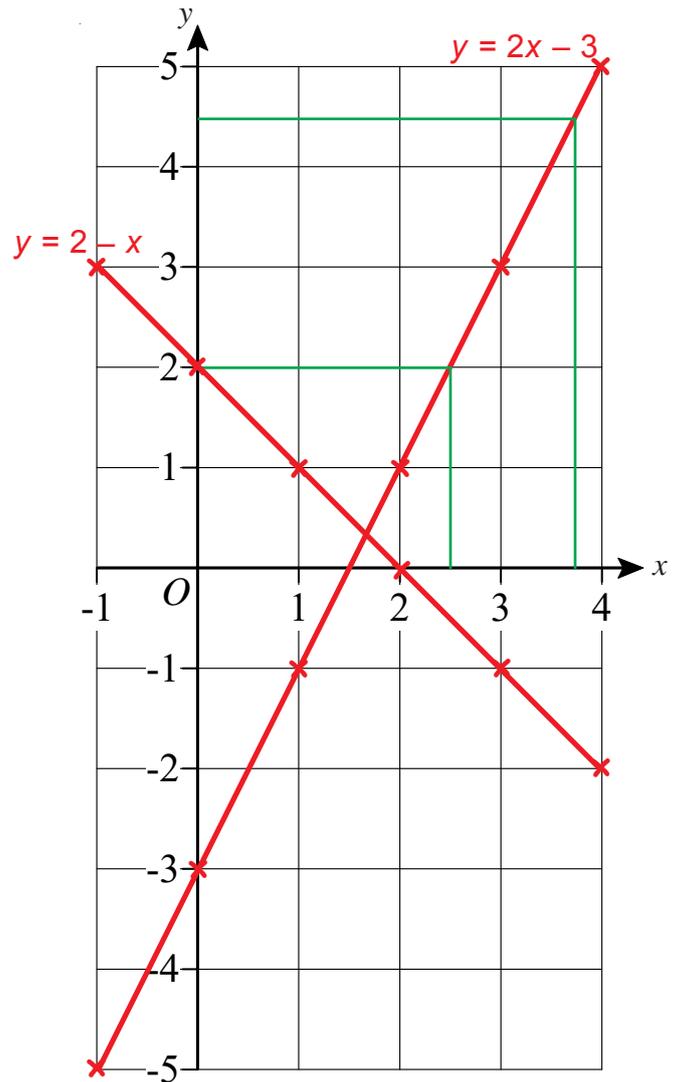
2) a) Complete the table of values for $y = 2 - x$

x	-1	0	1	2	3	4
y	3	2	1	0	-1	-2

  b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

  b) Draw the graph of $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
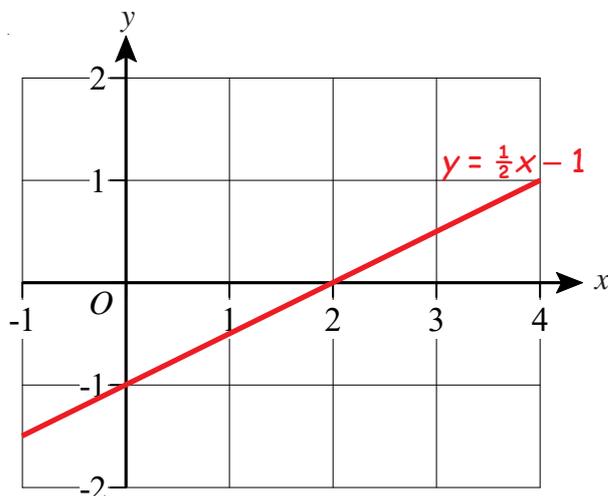
  c) Use your graph to find the value of y when $x = 3.5$ $x = 0.75$

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.
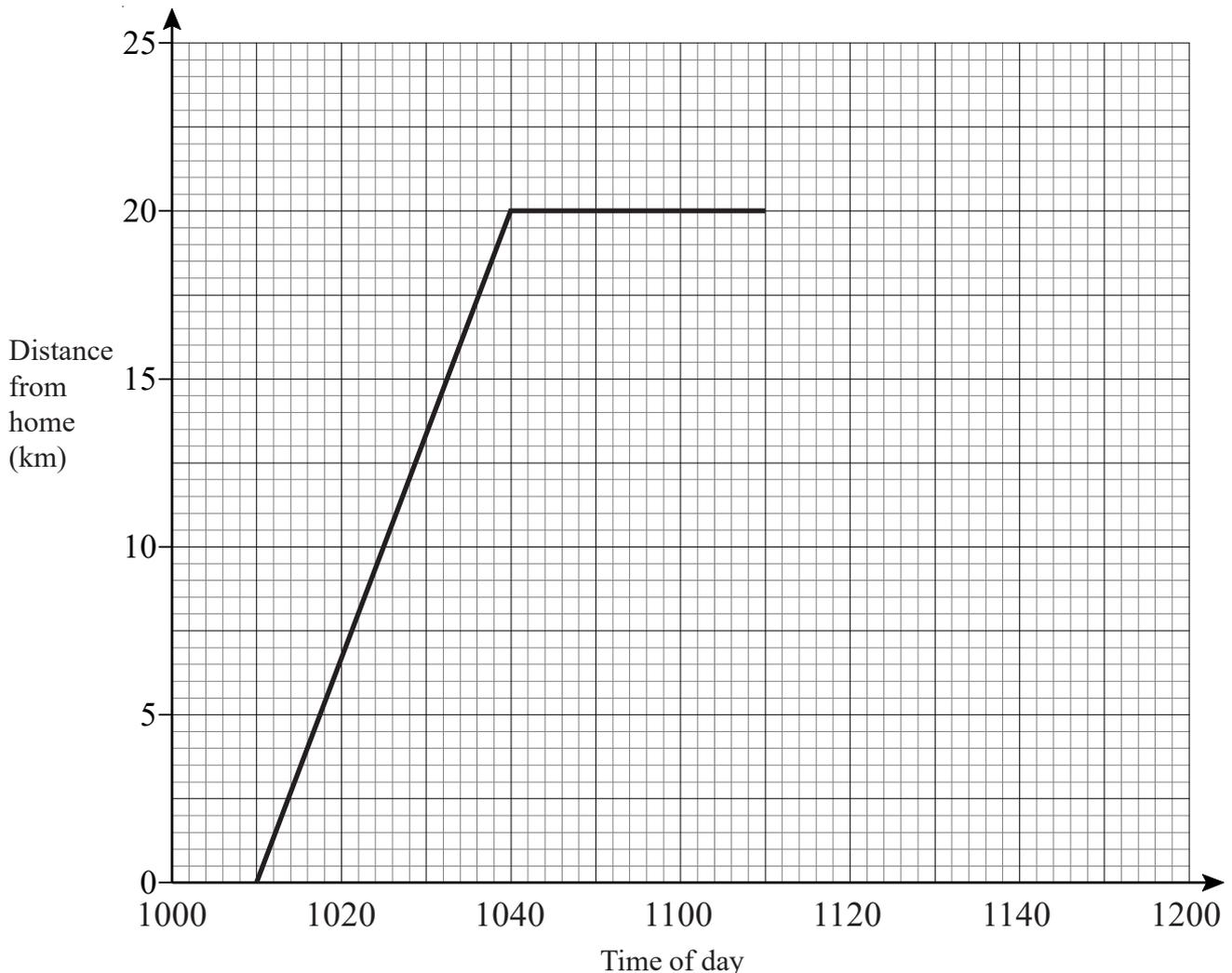
a) At what time did Sarah leave home?

b) How far was Sarah from home at 10 30?

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed.
She arrived home at 11 50

d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.

Distance from home (km)

Time of day
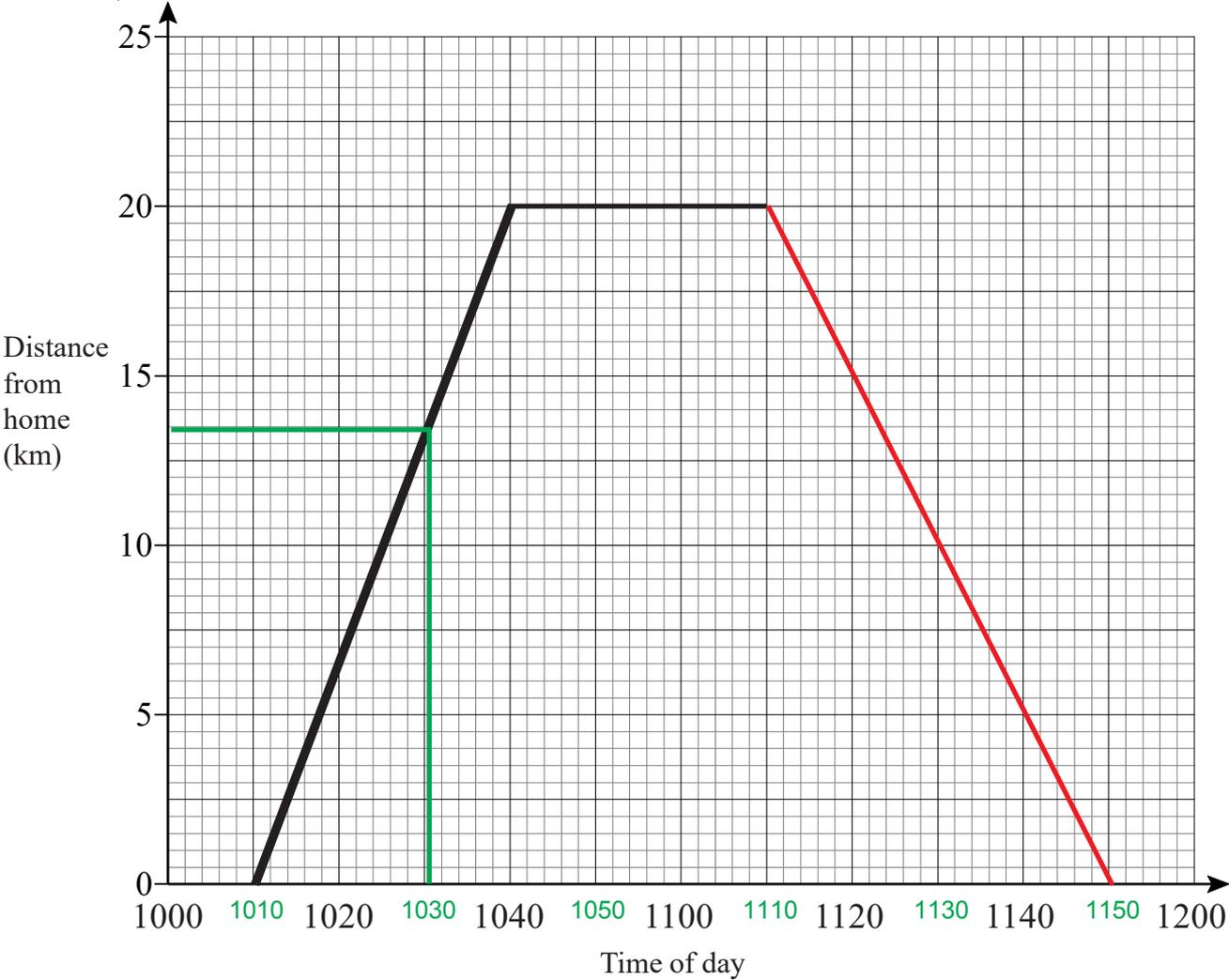
a) At what time did Sarah leave home?   10 10

b) How far was Sarah from home at 10 30?   13.5 km

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.   30 minutes

Sarah returned home at a steady speed.
She arrived home at 11 50

d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.   40 km/h

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.   30 km/h

| Tangent |
| Radius |
| Minor sector |
| Minor segment |
| Arc |
| Diameter |
| Chord |
| Circumference |

On the diagram, mark on all of the words from the box in an appropriate place.

Tangent

Radius

Minor sector

Minor segment

Arc

Diameter

Chord

Circumference

On the diagram, mark on all of the words from the box in an appropriate place.

Circumference

Minor
segment

Radius

Chord

Arc

Minor sector

Diameter

Tangent

Constructions - Angle Bisector

1)   Bisect angle *ABC*.

A

B   *C*

2)   The diagram below shows the plan of a park.
     The border of the park is shown by the quadrilateral *RSTUV*

S   *T*   *U*

V

R

There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Show exactly where the man can walk.

Constructions - Angle Bisector
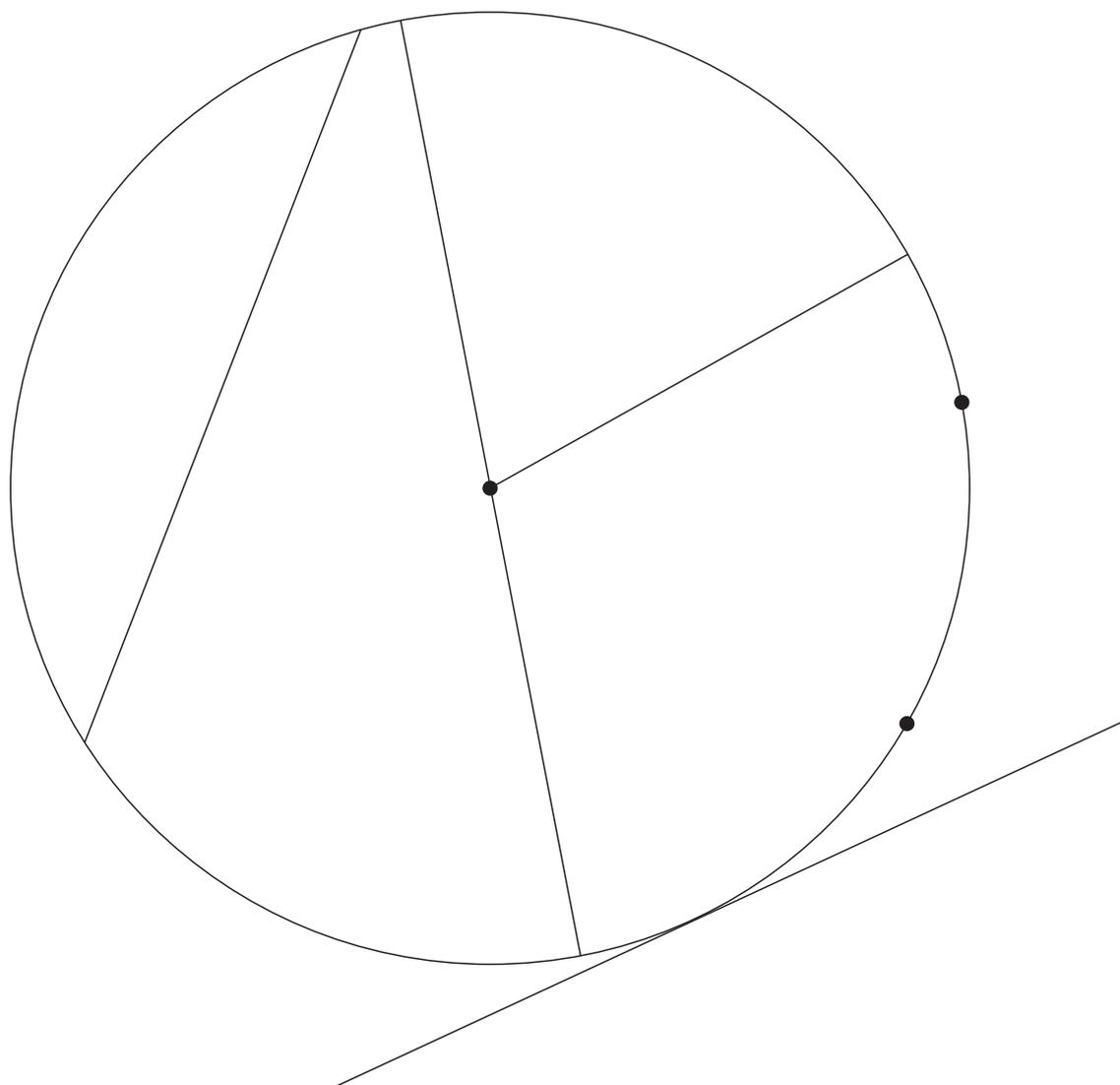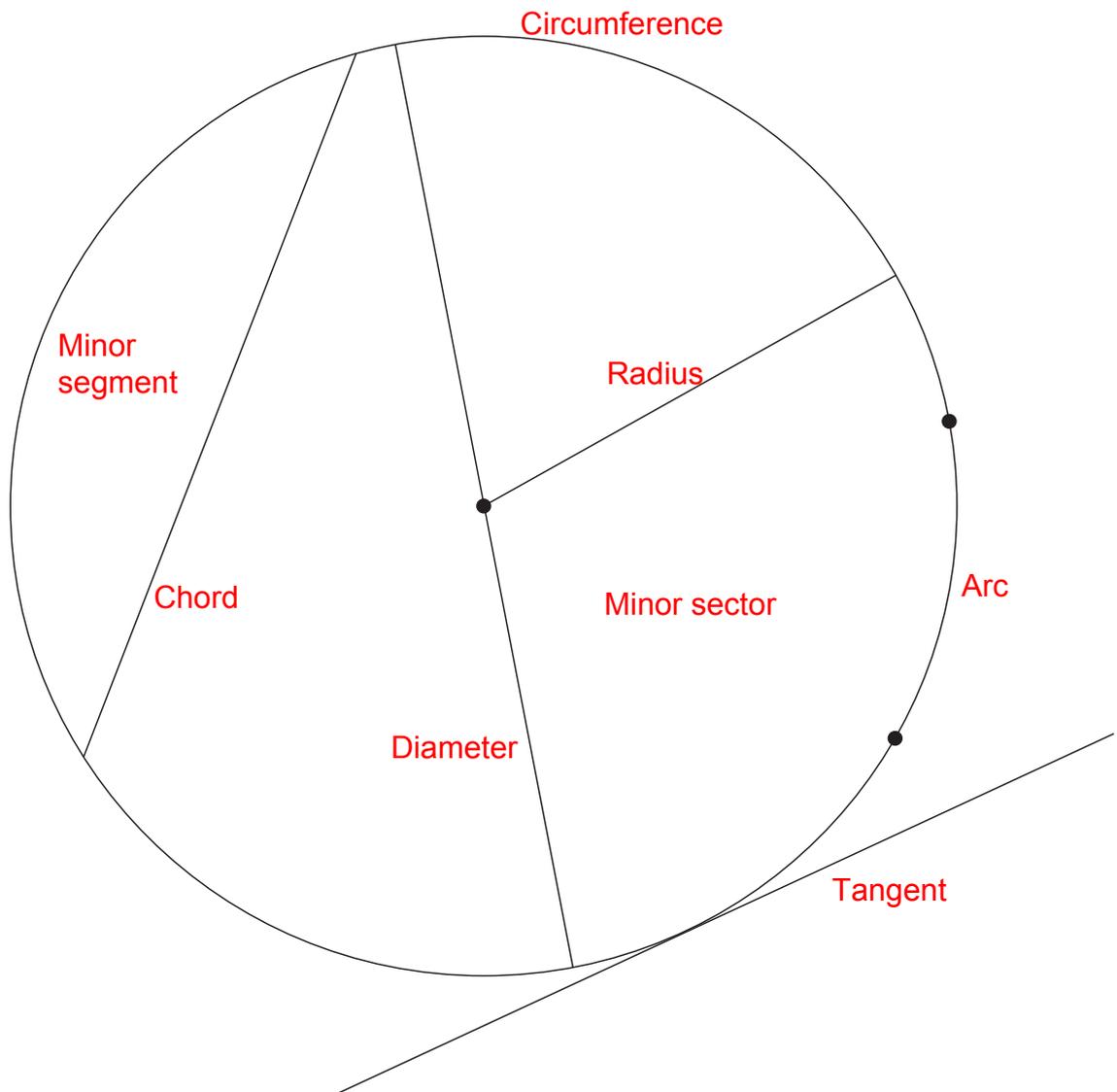
1) Bisect angle *ABC*.

2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*
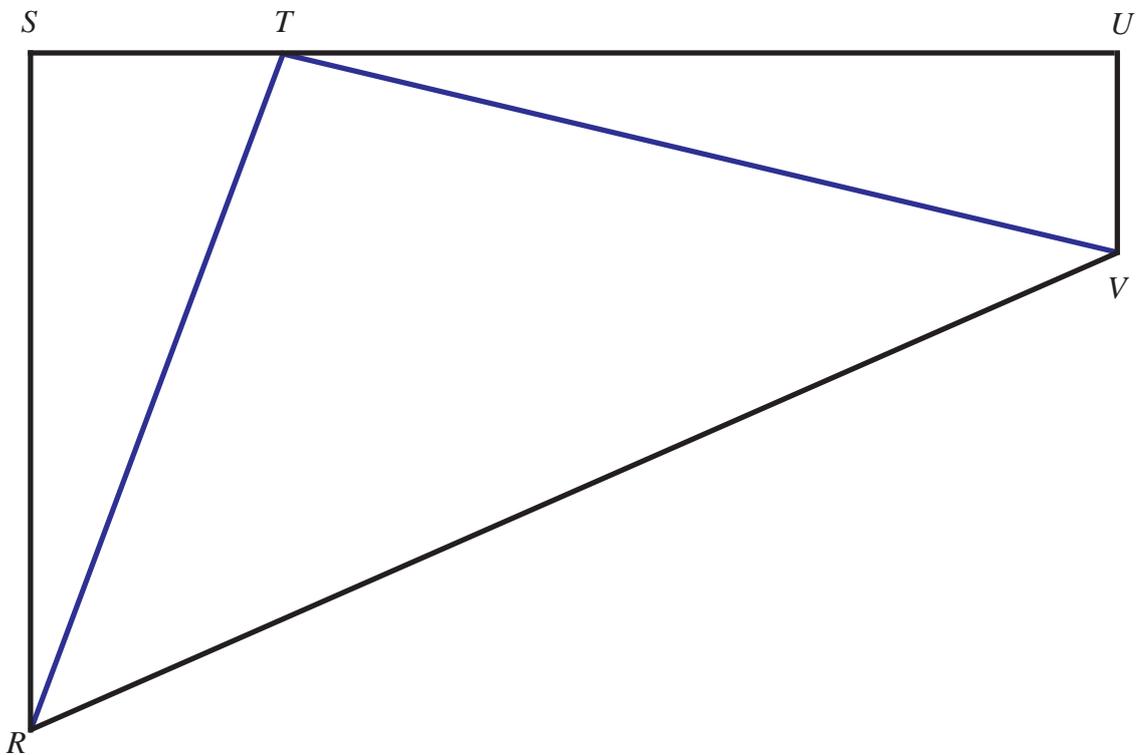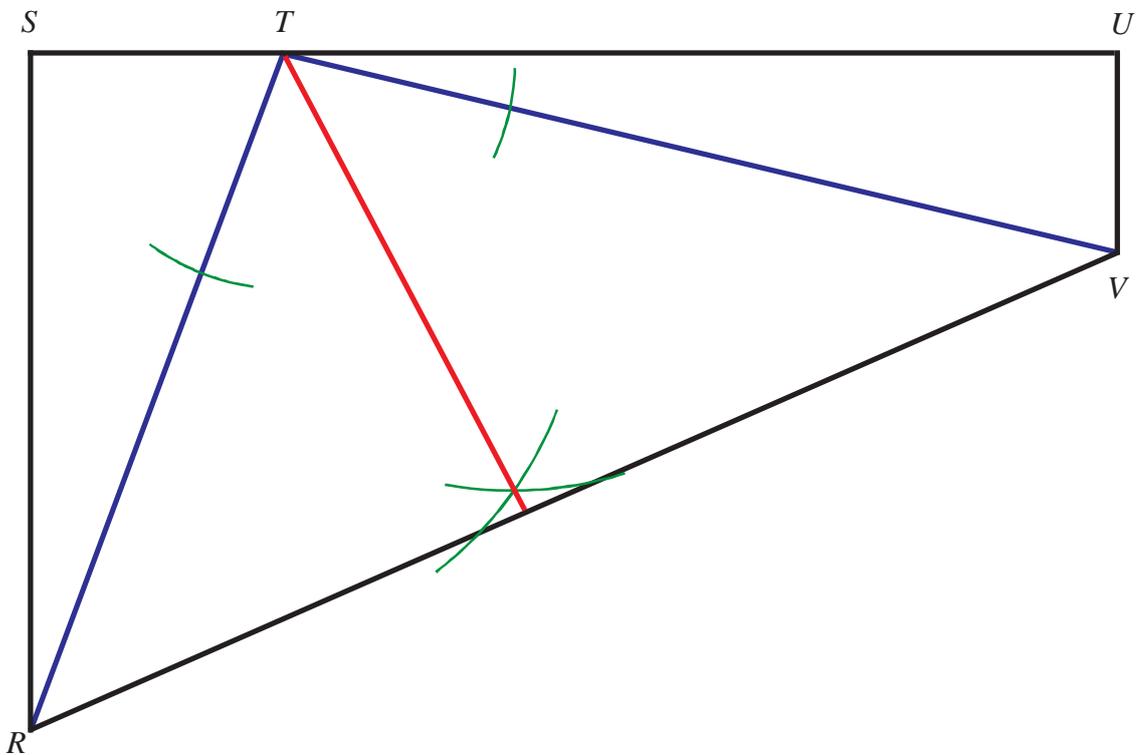
There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Show exactly where the man can walk.

1) Bisect the line segment *AB*. You must show all construction lines.

B

A

2) a) Bisect line *AB*
    b) Bisect line *BC*
    c) Bisect line *AC*
    d) Place your compass point where your three lines cross*
       Now open them out until your pencil is touching vertex *A*.
       Draw a circle using this radius.

C

B

A

* If your three lines don't cross at a point then
  you have a mistake somewhere or just haven't
  been accurate enough.

Page 73 B

1)   Bisect the line segment *AB*. You must show all construction lines.

A   *B*

2)   a) Bisect line *AB*
      b) Bisect line *BC*
      c) Bisect line *AC*
      d) Place your compass point where your three lines cross*

         Now open them out until your pencil is touching vertex *A*.
         Draw a circle using this radius.

C

B

A

* If your three lines don't cross at a point then
  you have a mistake somewhere or just haven't
  been accurate enough.

Page 73 B

1) The diagram shows a sketch of triangle *ABC*.

B

Diagram **NOT**
accurately drawn

7.4 cm

38°

A   8.5 cm   C

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) Use ruler and compasses to **construct** an equilateral triangle with
sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

Q

Diagram **NOT**
accurately drawn

10.5 cm   7.3 cm

P   9 cm   R
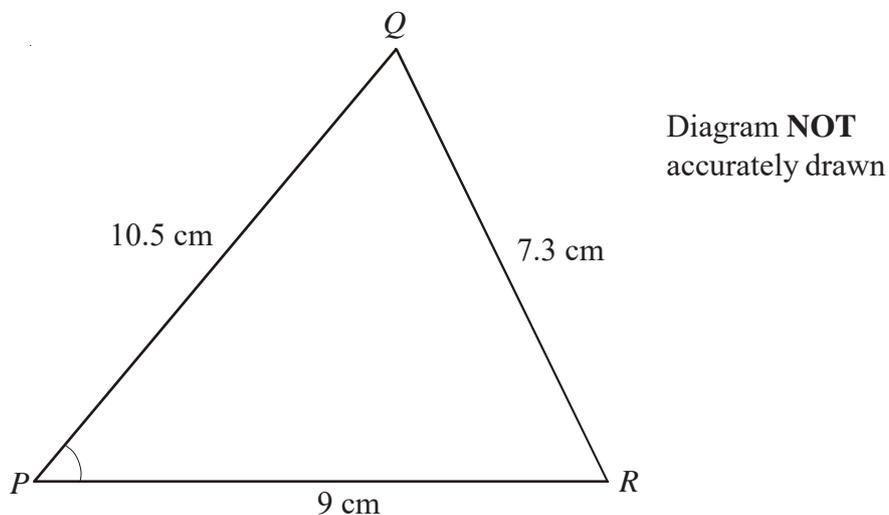
a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.

1) The diagram shows a sketch of triangle *ABC*.
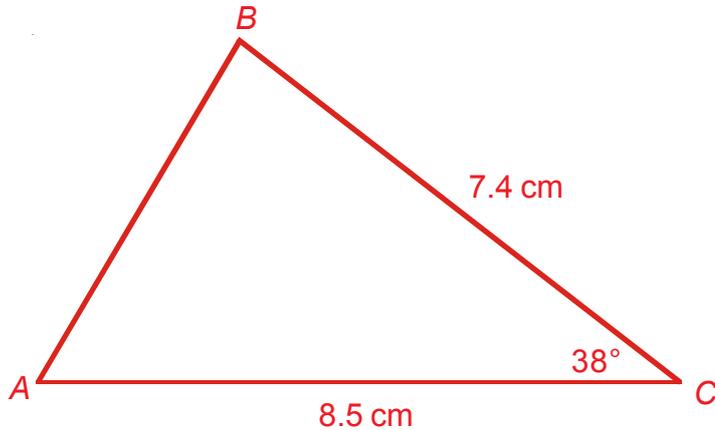
B

7.4 cm

38°

A

8.5 cm

C

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram. Angle A = 59°

2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

Q

10.5 cm

7.3 cm

43°

P

9 cm

R
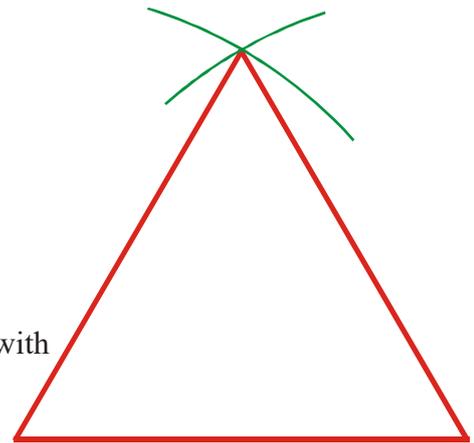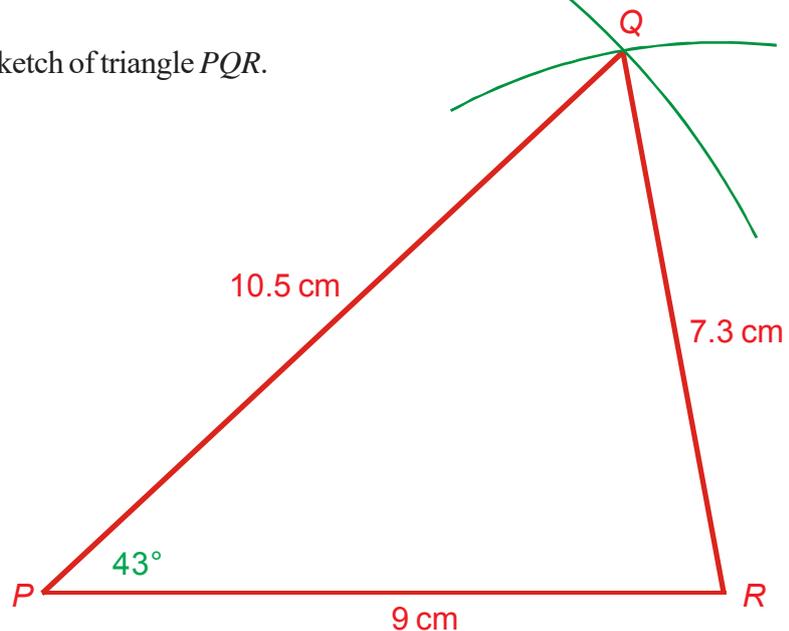
a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.   Angle P = 43°

Angles on a Line and at a Point

1)   Work out the values of the unknown angles.
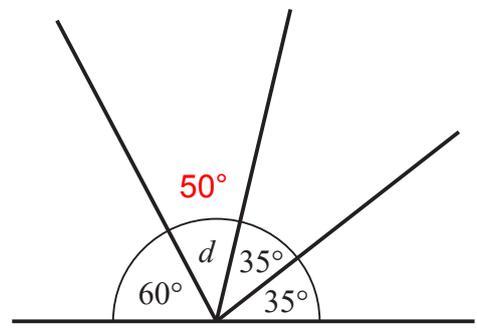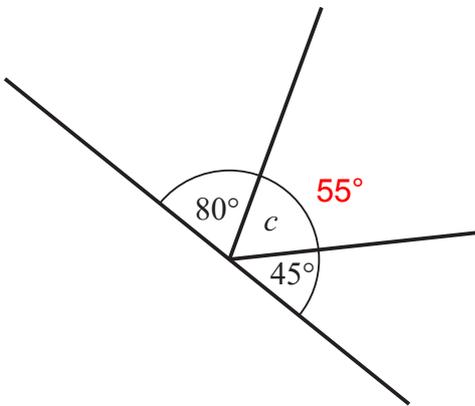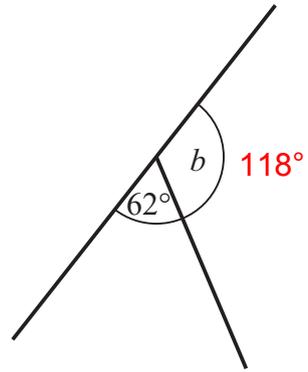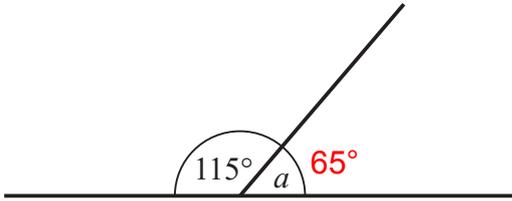
2)   Work out the values of the unknown angles.
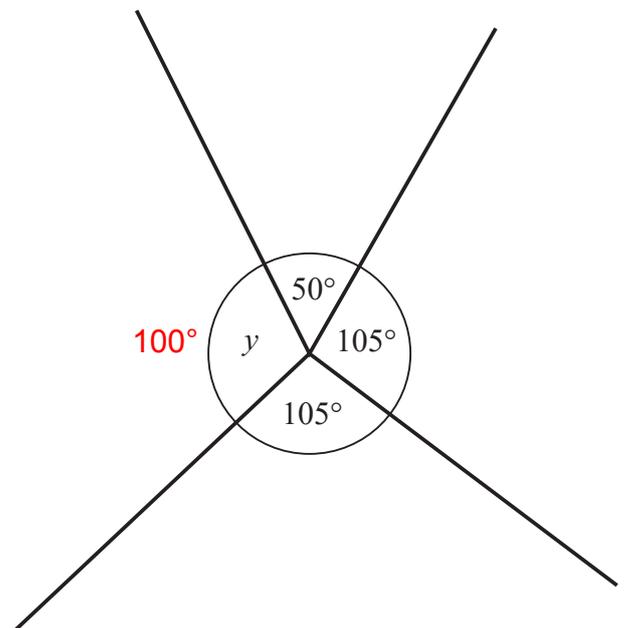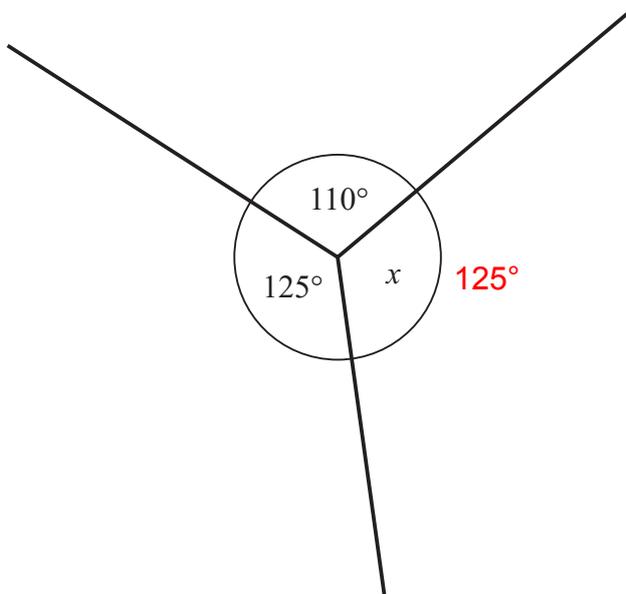
1) Work out the values of the unknown angles.

115° a 65°

b 118°
62°

80° c 55°
45°

50°
d 35°
60° 35°

2) Work out the values of the unknown angles.

110°
125° x 125°

50°
100° y 105°
105°

Angles and Parallel Lines

1) Line *PQ* is parallel to line *RS*.

    If angle *PQR* is equal to 36°
    a) What is the size of angle *QRS*?

    b) Give a reason for your answer.
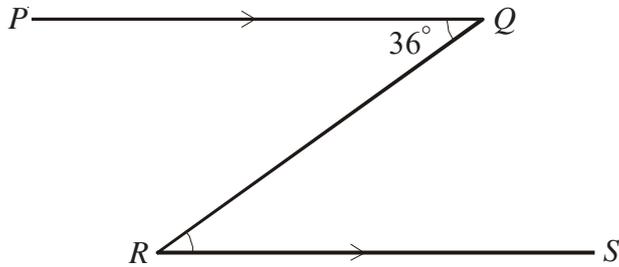
2) Line *DCE* is parallel to line *AB*

    a) Find the size of angle *ABC*
    b) Find the size of angle *DCA*
    c) Calculate the size of angle *ACB*
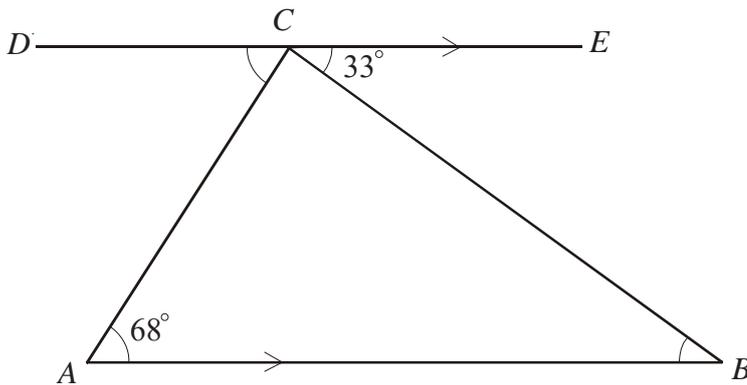
3) a) Find the size of angle *DBF*
    b) Find the size of angle *HGC*

Angles and Parallel Lines
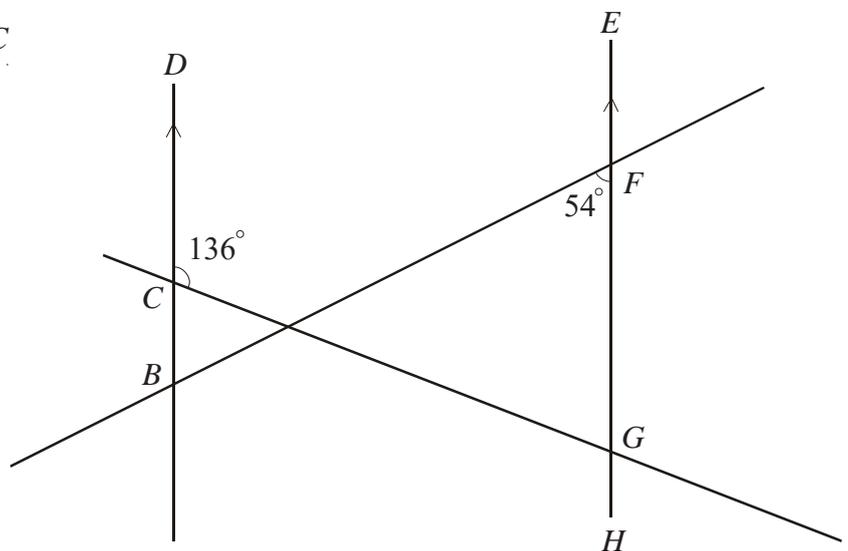
1)   Line *PQ* is parallel to line *RS*.

   If angle *PQR* is equal to 36°
   a) What is the size of angle *QRS*?   **36°**

   b) Give a reason for your answer.   **Alternate angles**
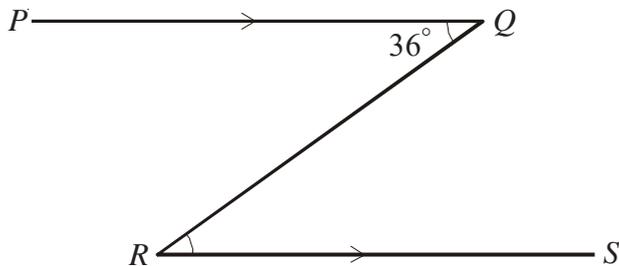
2)   Line *DCE* is parallel to line *AB*

   a) Find the size of angle *ABC*   **33°**
   b) Find the size of angle *DCA*   **68°**
   c) Calculate the size of angle *ACB*   **79°**
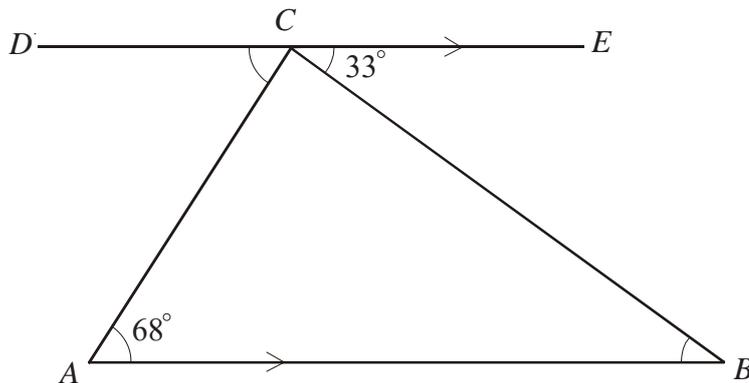
3)   a) Find the size of angle *DBF*   **54°**
   b) Find the size of angle *HGC*   **136°**

1)
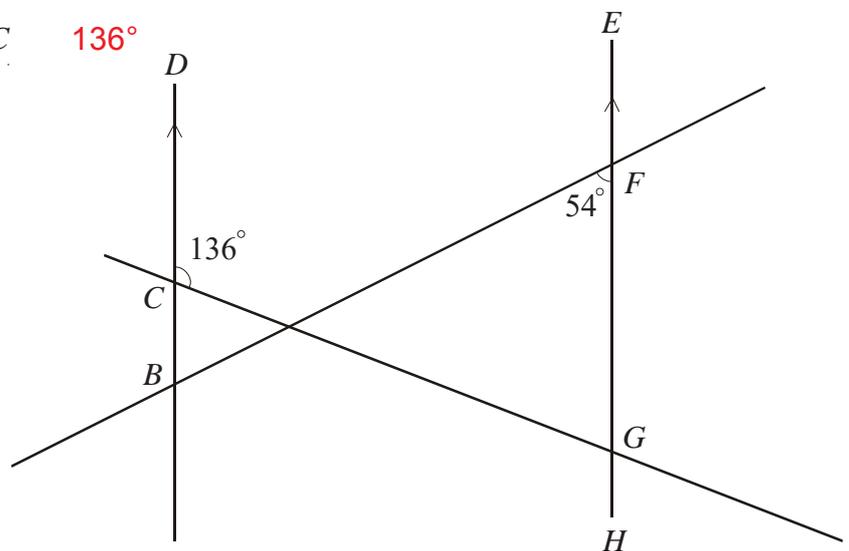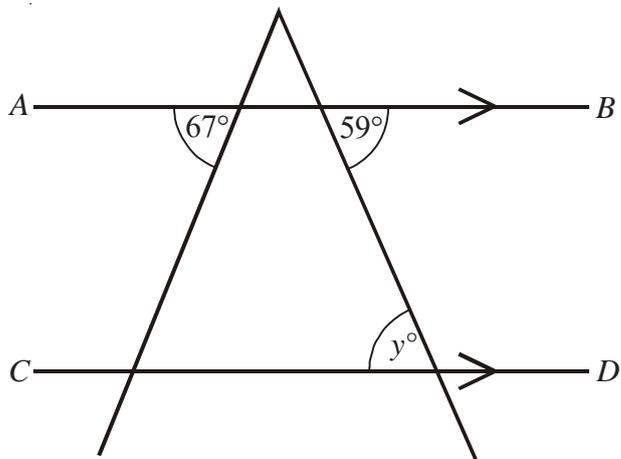
AB is parallel to *CD*.

(i) Write down the value of *y*.

(ii) Give a reason for your answer.

2)
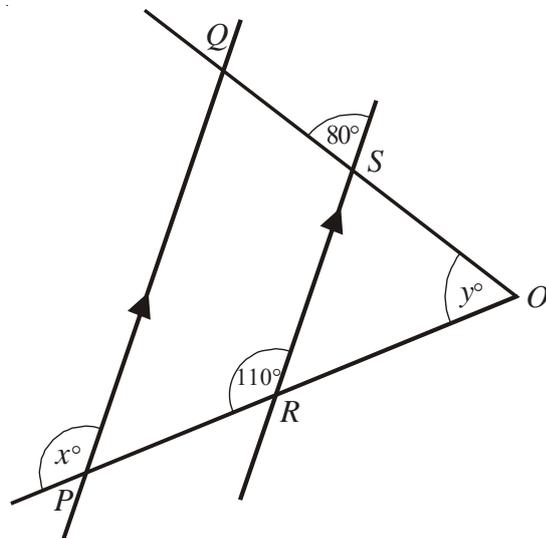
PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

a) (i) Write down the value of *x*.

    (ii) Give a reason for your answer.

b) Work out the value of *y*.

1)
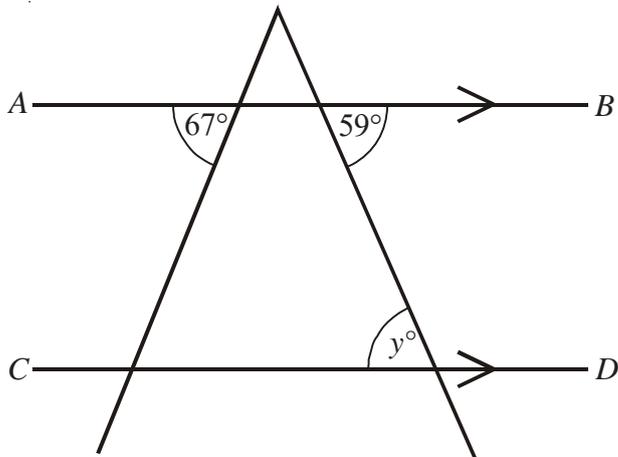
AB is parallel to *CD*.

(i) Write down the value of *y*. 59°

(ii) Give a reason for your answer. Alternate angles

2)
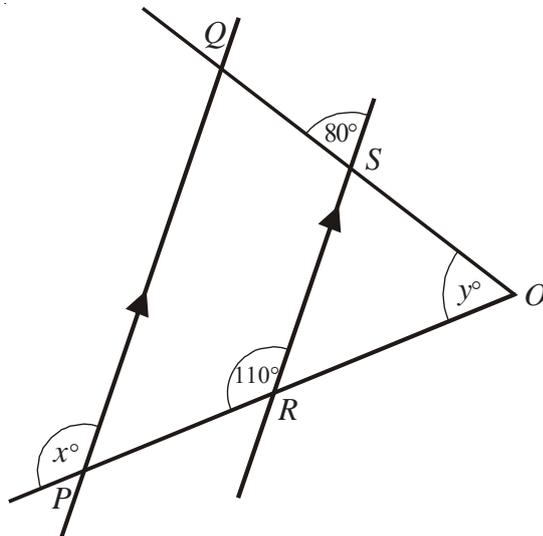
PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

a) (i) Write down the value of *x*. 110°

(ii) Give a reason for your answer. Corresponding angles

b) Work out the value of *y*. 30°

1)
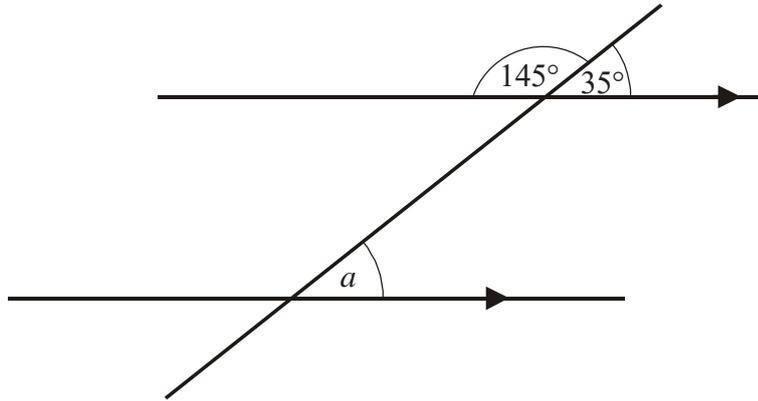
(i) Write down the size of the angle marked *a*.

(ii) Give a reason for your answer.
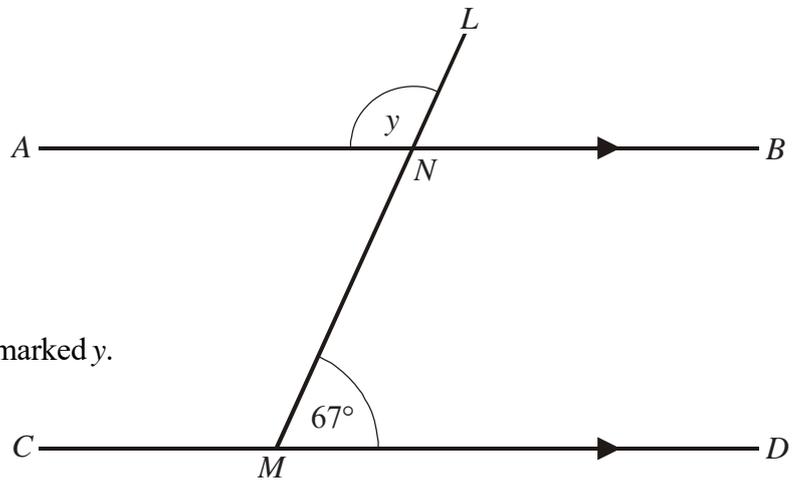
2)

ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°
(i) Work out the size of the angle marked *y*.
(ii) Give reasons for your answer.

3)
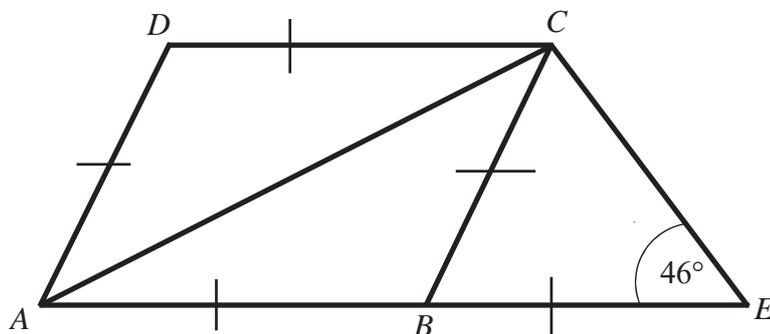
ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*.

1)

145° 35°

a
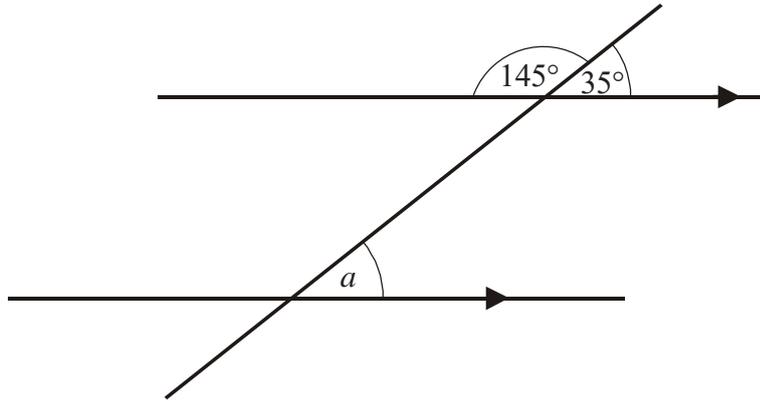
(i) Write down the size of the angle marked *a*.   **35°**

(ii) Give a reason for your answer.   **Corresponding angles**

2)
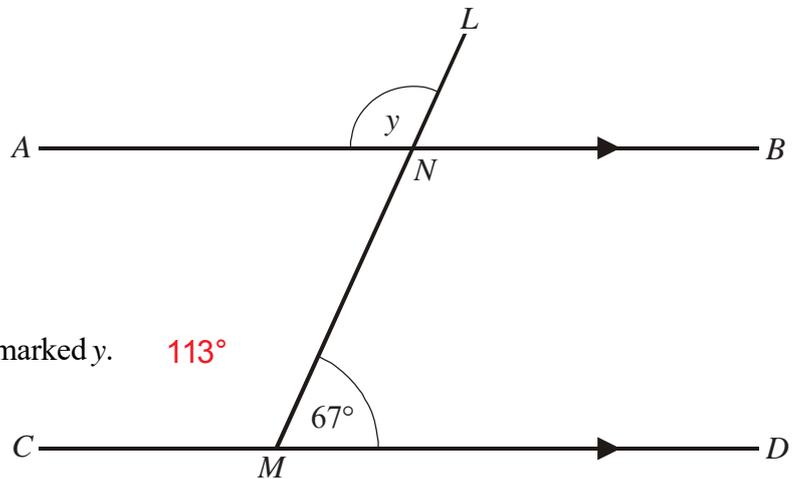
L

y

A —————————————→ *B*

N

ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*.   **113°**

(ii) Give reasons for your answer.

67°

**Angle *LNB* = 67°
(corresponding angles)
y = 113° (angles on straight
line add up to 180°)**
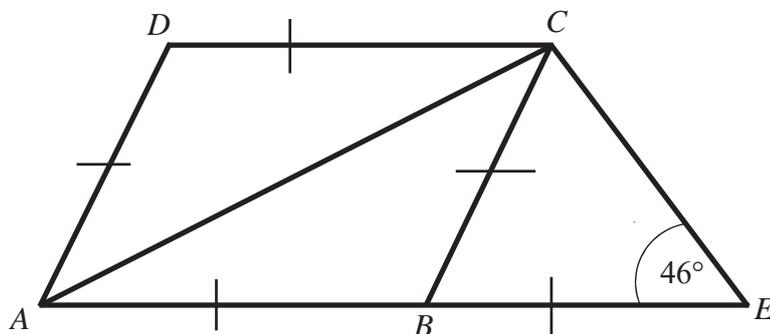
C —————————————→ *D*

M

3)

D   *C*

46°

A   *B*   *E*

ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*.   **44°**

1)   Work out the size of angle *a*.
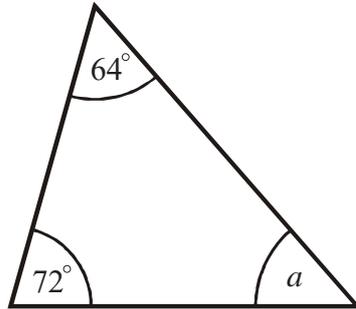
2)   Work out the size of angle *b*.
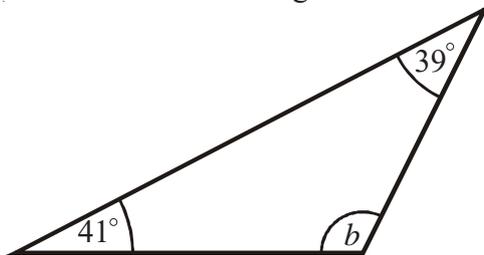
3)   Work out the size of angle *c*.
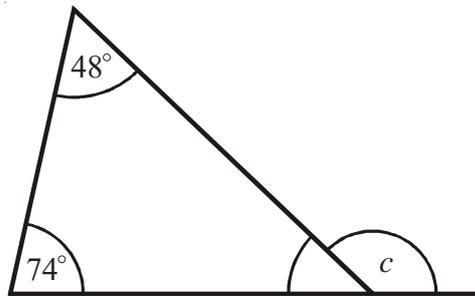
4)   Work out the size of angle *d*.
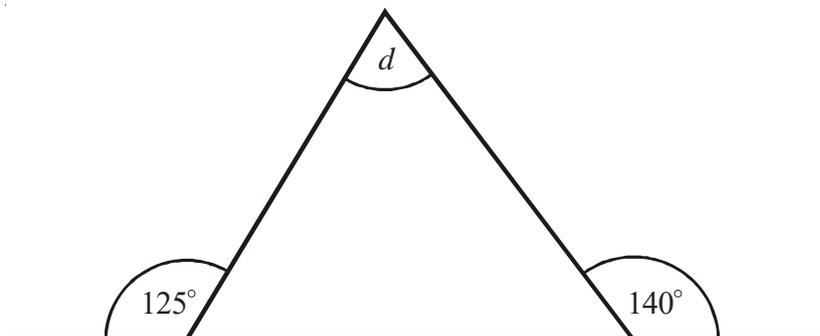
1)   Work out the size of angle *a*.   **44°**
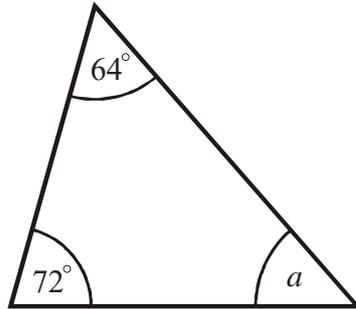
2)   Work out the size of angle *b*.   **100°**
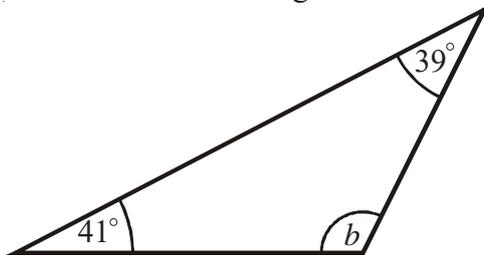
3)   Work out the size of angle *c*.   **122°**
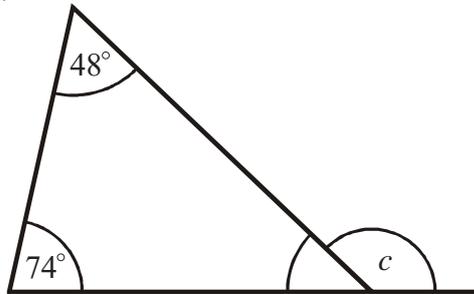
4)   Work out the size of angle *d*.   **85°**

1) *ABC* is a triangle.

   a) Find the size of angle *A*.

   b) Triangle *ABC* is equilateral.
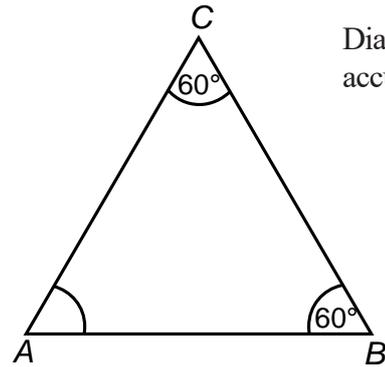
   Explain why.

Diagram **NOT**
accurately drawn

C

60°

60°

A   *B*

2) *BCD* is a triangle.
   ABC is a straight line.
   Angle *CBD* = 70°.
   BD = *CD*.

   a) (i) Work out the value of *x*.

   (ii) Give a reason for your answer.

   b) (i) Work out the value of *y*.

   (ii) Give reasons for your answer.
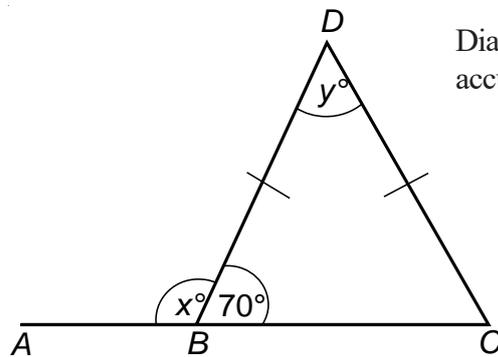
Diagram **NOT**
accurately drawn

D

y°

x° 70°

A   *B*   *C*

3) The diagram shows a 5-sided shape.
   All the sides of the shape are equal in length.

   a) (i) Find the value of *x*.

   (ii) Give a reason for your answer.

   b) (i) Work out the value of *y*.

   (ii) Explain your answer.

y°

x°
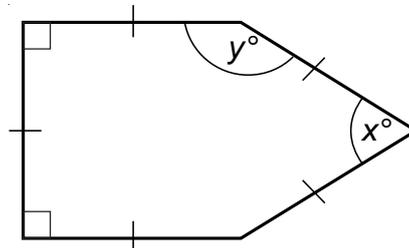
Angles in a Triangle - Special Triangles

1) *ABC* is a triangle.

   a) Find the size of angle *A*. **60°**

   b) Triangle *ABC* is equilateral.

   Explain why. **All of the angles are equal.**
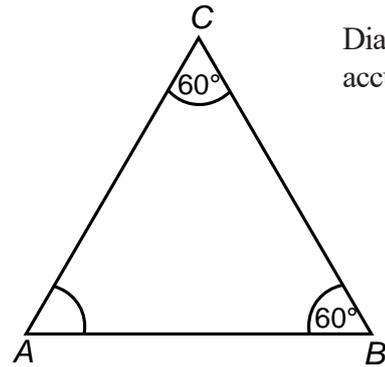
Diagram **NOT**
accurately drawn

C
60°
60°
A   B

2) *BCD* is a triangle.

   ABC is a straight line.

   Angle *CBD* = 70°.

   BD = *CD*.

   a) (i) Work out the value of *x*. **110°**

   (ii) Give a reason for your answer.

   Angles on a straight line add up to 180°.

   b) (i) Work out the value of *y*. **40°**

   (ii) Give reasons for your answer.

   Base angles of an isosceles triangle are equal.
   Angles in a traingle add up to 180°.
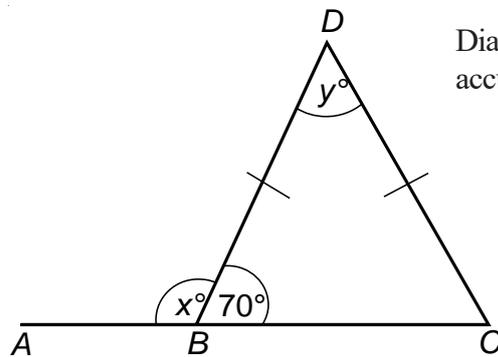
Diagram **NOT**
accurately drawn

D
y°
x° 70°
A   B   C

3) The diagram shows a 5-sided shape.

   All the sides of the shape are equal in length.

   a) (i) Find the value of *x*. **60°**

   (ii) Give a reason for your answer.

   Equilateral triangle

   b) (i) Work out the value of *y*.

   150°

   (ii) Explain your answer.

   Angle in square + angle in equilateral triangle = 90° + 60° = 150°

y°
x°

Angles in a Quadrilateral

1) Work out the size of angle *a*

120°

a

135°

45°

2) Work out the size of angle *b*

70°

b

35°

40°

3) Work out the size of angle *c*

79°

134°

c

4) Work out the size of angle *d*

103°

88°

112°

d

5) Work out the size of angle *e*

e

312°

6) Work out the size of angle *f*

154°

38°

f

72°

Angles in a Quadrilateral

1)   Work out the size of angle *a*   *a* = 60°

120°

a

135°   45°

2)   Work out the size of angle *b*   *b* = 215°

70°

b

35°   40°
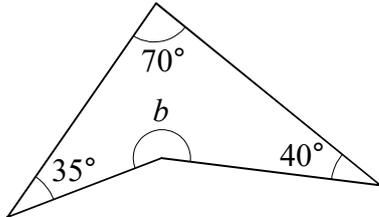
3)   Work out the size of angle *c*   *c* = 57°

79°

134°

c
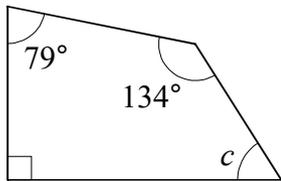
4)   Work out the size of angle *d*   *d* = 101°

103°

88°

112°   *d*
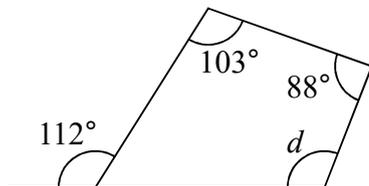
5)   Work out the size of angle *e*   *e* = 132°

e

312°
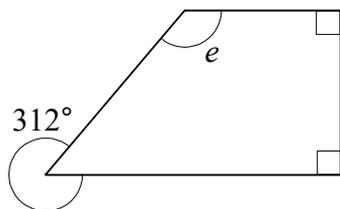
6)   Work out the size of angle *f*   *f* = 136°

154°

38°

f

72°
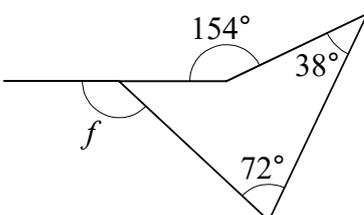
1) Change 9 m² into cm²

2) How many square metres are there in 5 square kilometres?

3) Change 4 cm² into mm²

4) Convert 6.5 m² into mm²

5) Change 2 m³ into cm³

6) How many cubic millimetres are there in 3 cubic centimetres?

7) Change 7 m³ into mm³

8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall?

Tile

2.5 m

4 m

10 cm

16 cm

9) A carpet-fitter is laying carpet tiles on a rectangular floor which
measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor?

4.5 m

7.5 m

Carpet tile

50 cm

50 cm

Unit Conversions - Metric Conversions
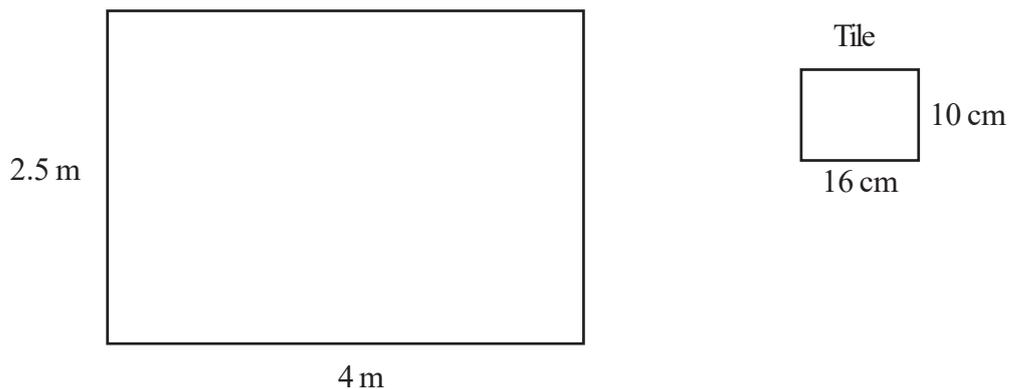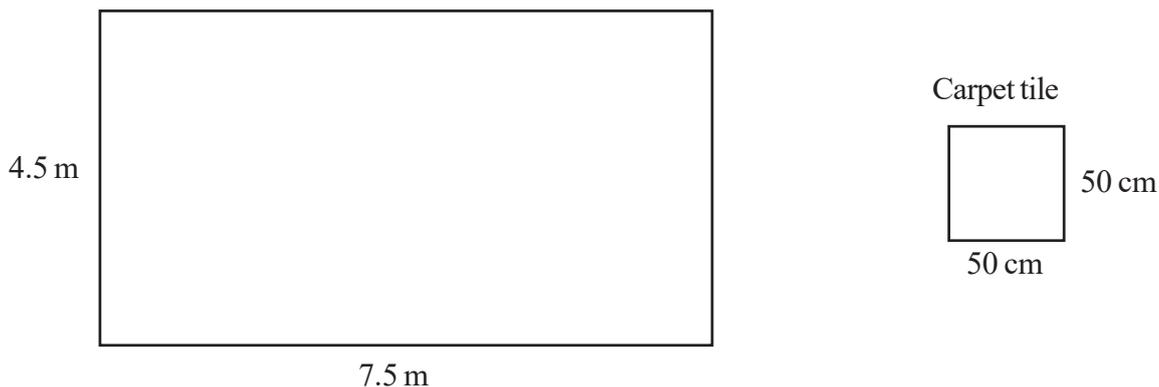
1) Change 9 m² into cm²   90000 cm²

2) How many square metres are there in 5 square kilometres?   5000000 m²

3) Change 4 cm² into mm²   400 mm²

4) Convert 6.5 m² into mm²   6500000 mm²

5) Change 2 m³ into cm³   2000000cm³

6) How many cubic millimetres are there in 3 cubic centimetres?   3000 mm³

7) Change 7 m³ into mm³   7000000000 mm³

8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall?   625
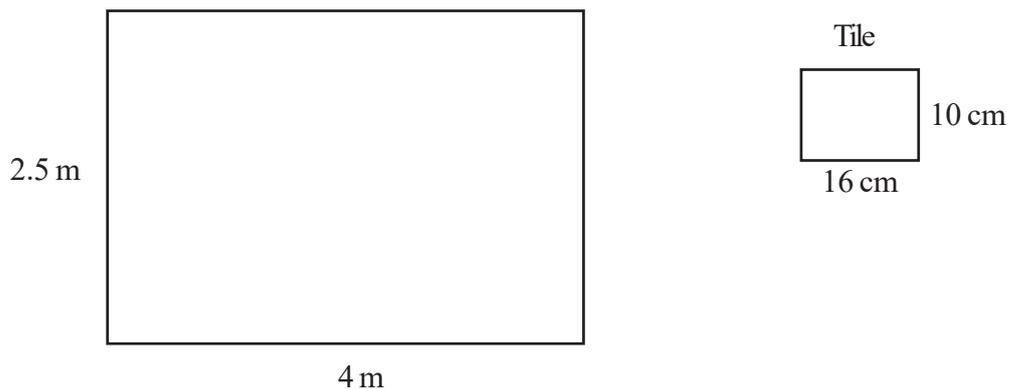
Tile

10 cm

16 cm

2.5 m

4 m

9) A carpet-fitter is laying carpet tiles on a rectangular floor which
measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor?   135

Carpet tile

50 cm

50 cm

4.5 m

7.5 m
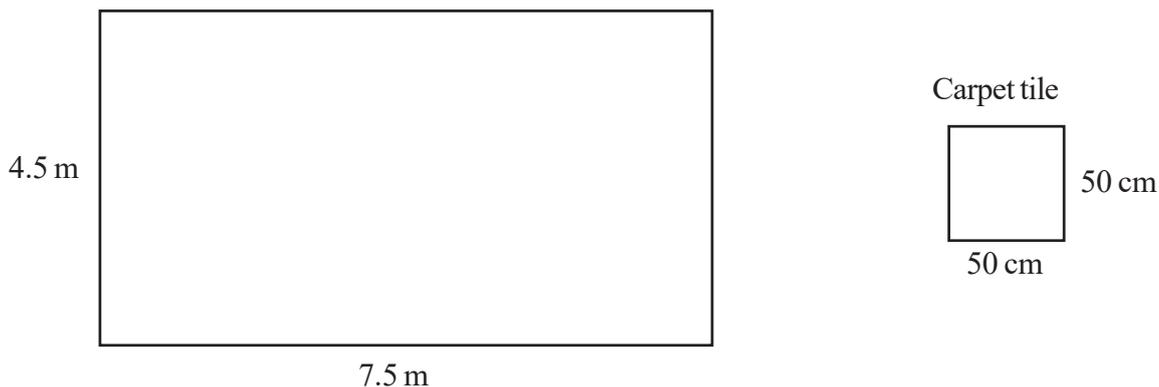
1)   Change the following to pounds:

   a) 20 kg   c) 35 kg

   b) 90 kg   d) 52 kg

> 1 stone = 14 pounds
> 1 kg ≈ 2.2 pounds

2)   Ivan weighs 10 stone and 8 pounds.
    Siobhan weighs 65 kg.

    Which of the two is heavier and by how much?

3)   a) Bill weighs 142 lb.
       Work out how much Bill weighs in stones and pounds.

    b) Elliot weighs 9 stone and 10 pounds.
       Work out how much Elliot weighs in kg.

4)   Carol is driving along a road in Spain which has a speed limit of 60 km/h.
    She is driving at a speed of 45 mph.

    By how much is her speed above or below the speed limit?

> 1 mile ≈ 1.6 km

5)   Hassan can buy 2 litres of milk for £1.25 in his local supermarket.
    In the corner shop, the cost of milk is £1.50 for 4 pints.

    Which is the best value?
    You must show your working.

> 1 litre ≈ 1.75 pints

Unit Conversions - Imperial/Metric

1) Change the following to pounds:

| 1 stone = 14 pounds |
| 1 kg ≈ 2.2 pounds |

a) 20 kg   44 lb

c) 35 kg   77 lb

b) 90 kg   198 lb

d) 52 kg   114.4 lb

2) Ivan weighs 10 stone and 8 pounds.
Siobhan weighs 65 kg.

Which of the two is heavier and by how much?

Ivan is heavier by 5 lb.

3) a) Bill weighs 142 lb.
Work out how much Bill weighs in stones and pounds.   10 stones and 2 lb.

b) Elliot weighs 9 stone and 10 pounds.
Work out how much Elliot weighs in kg.   61.8 kg

4) Carol is driving along a road in Spain which has a speed limit of 60 km/h.
She is driving at a speed of 45 mph.

| 1 mile ≈ 1.6 km |

By how much is her speed above or below the speed limit?

12 km/h above the speed limit.

5) Hassan can buy 2 litres of milk for £1.25 in his local supermarket.
In the corner shop, the cost of milk is £1.50 for 4 pints.

| 1 litre ≈ 1.75 pints |

Which is the best value?
You must show your working.

Local Supermarket:
2 × 1.75 = 3.5 pints
1.25 ÷ 3.5 = £0.36 per pint

Corner Shop:
1.50 ÷ 4 = £0.38 per pint

The supermarket is the best value.

Area of a Triangle

1) Find the areas of the following two triangles.
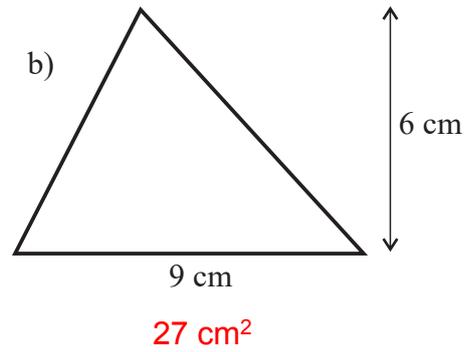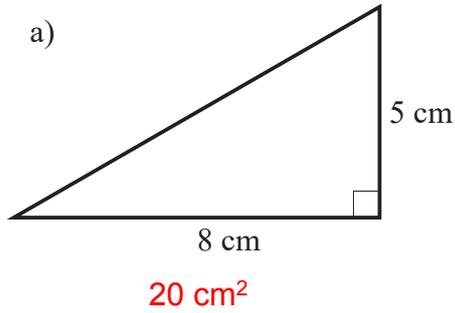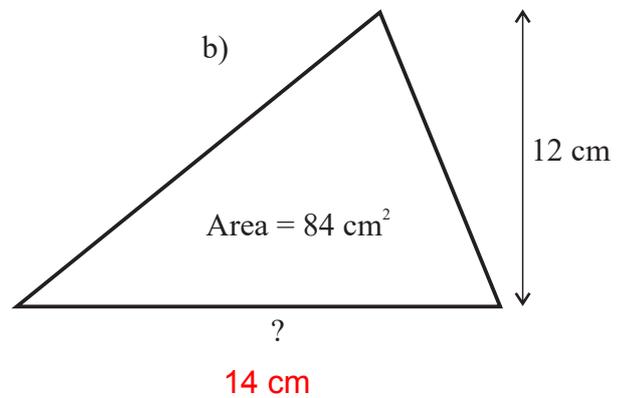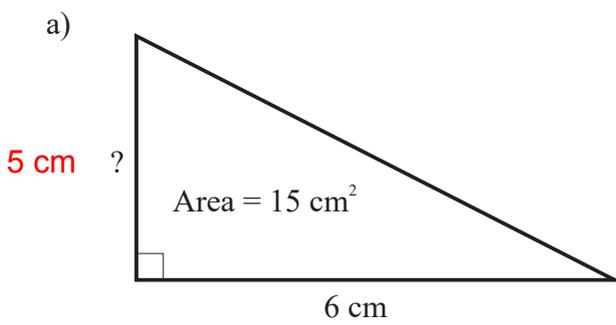
a)

5 cm

8 cm

b)

6 cm

9 cm

2) Find the missing lengths.

a)

?

Area = 15 cm^2

6 cm

b)

12 cm

Area = 84 cm^2

?

3) *ABCD* is a square.

PQRS is a square.

A   Q   B

P

C   S   D

1 cm   9 cm

Find the area of the shaded square, *PQRS*.

1) Find the areas of the following two triangles.

a)

5 cm

8 cm

20 cm²

b)

6 cm

9 cm

27 cm²

2) Find the missing lengths.

a)

5 cm ?

Area = 15 cm²

6 cm

b)

12 cm

Area = 84 cm²

?

14 cm

3) *ABCD* is a square.

PQRS is a square.

A   Q   B

P

R

C   S   D

1 cm   9 cm
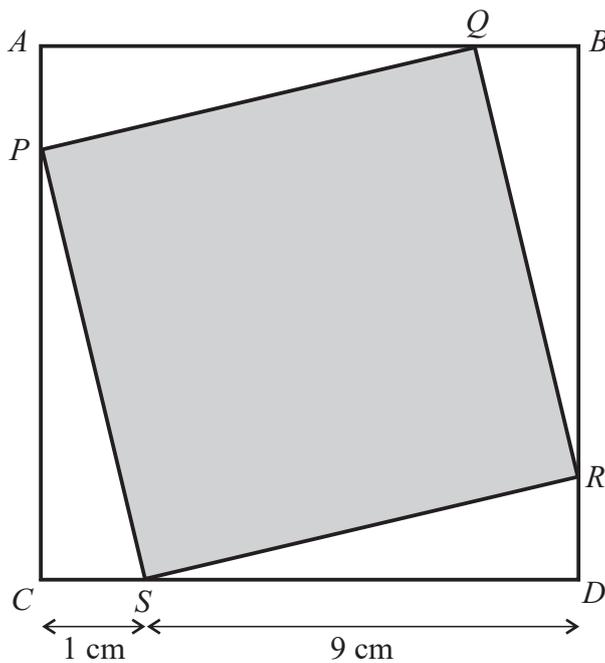
Find the area of the shaded square, *PQRS*. **82 cm²**
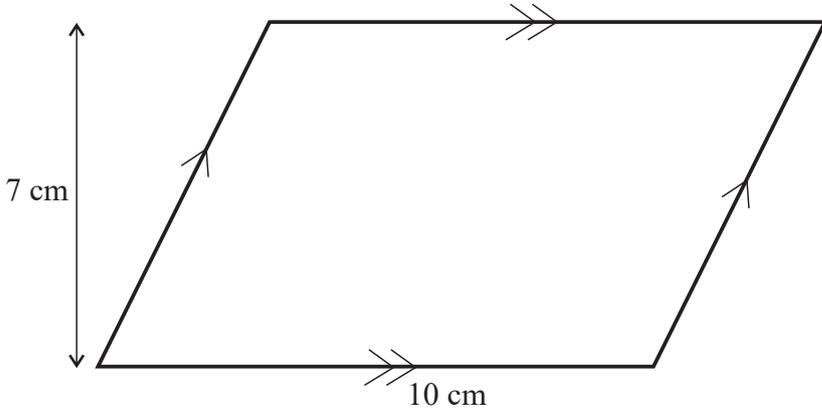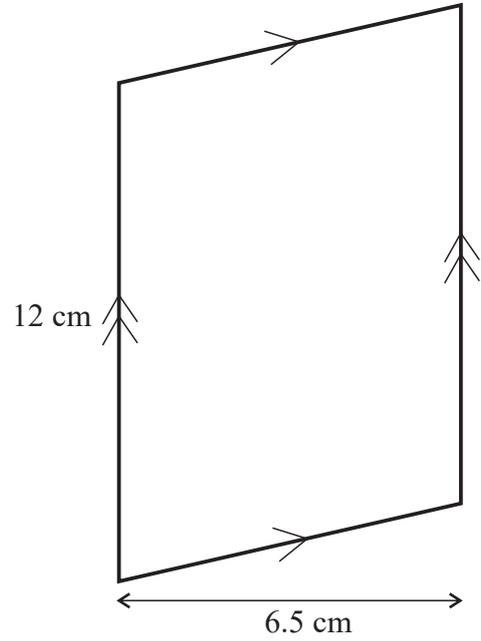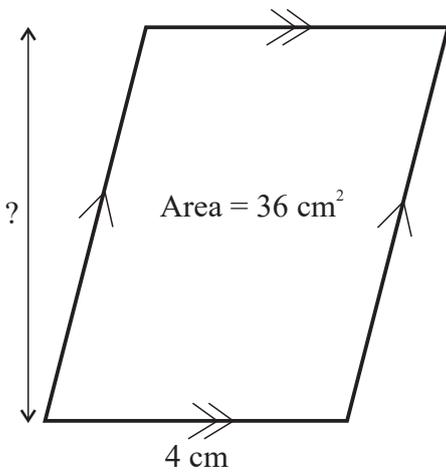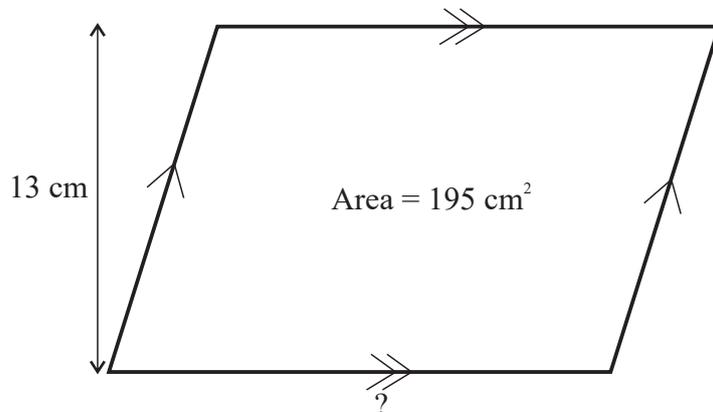
Area of a Parallelogram

1) Find the area of each of these parallelograms.
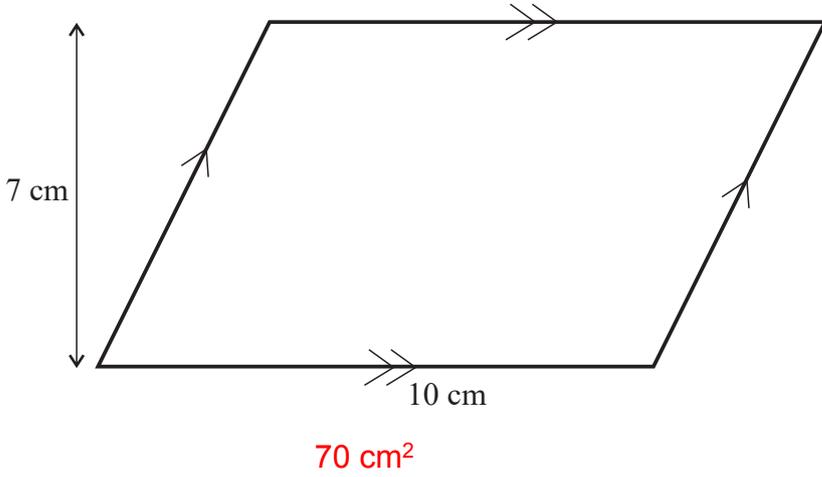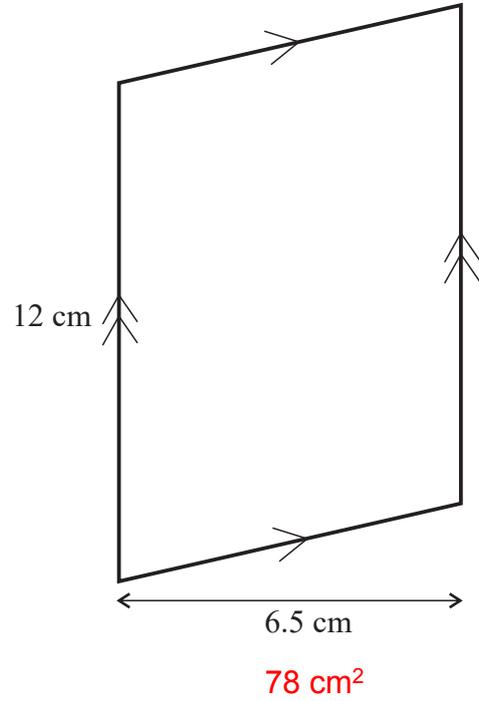
a)

7 cm

10 cm

b)

12 cm

6.5 cm

2) Find the missing lengths in these two parallelograms.

a)

?

Area = 36 cm^2

4 cm

b)

13 cm

Area = 195 cm^2

?

1) Find the area of each of these parallelograms.

a)

7 cm

10 cm

70 cm²

b)

12 cm

6.5 cm

78 cm²

2) Find the missing lengths in these two parallelograms.

a)

?

9 cm

Area = 36 cm²

4 cm

b)

13 cm

Area = 195 cm²

?

15 cm

1) Find the area of this trapezium.

4 cm

6 cm

8 cm

2) The diagram shows a field.

270 m

86 m

188 m
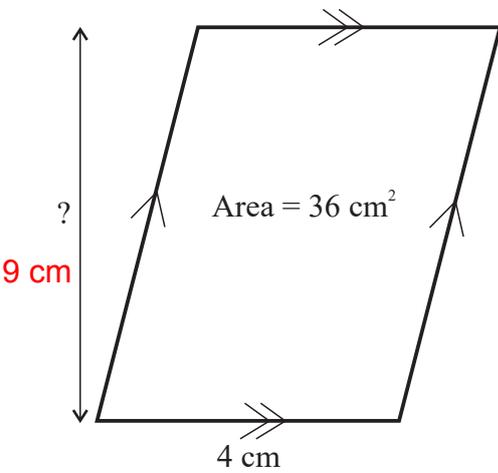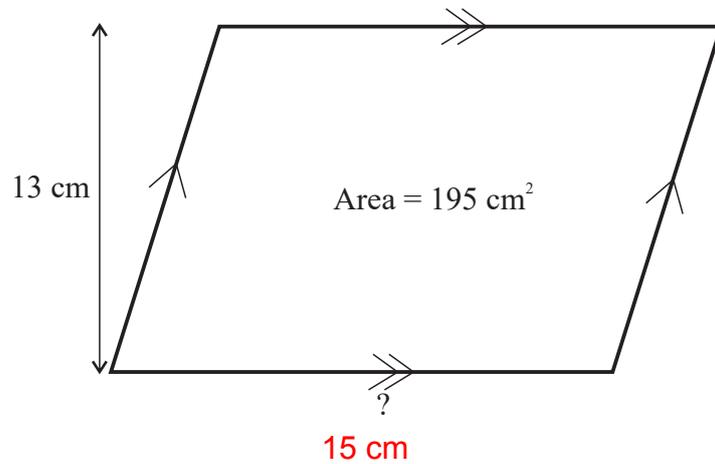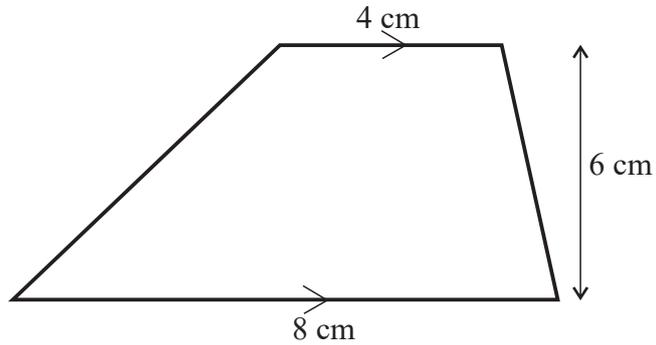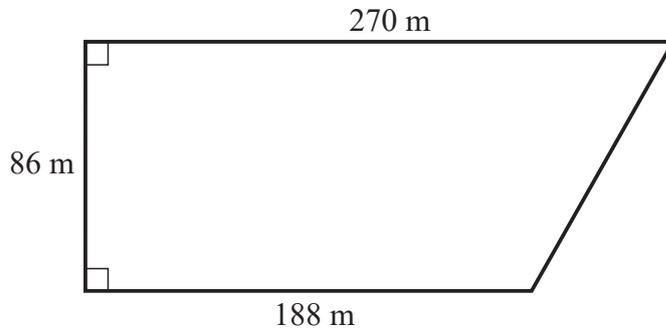
Work out the area of the field.

3) In the trapezium, *a* = 6.6 cm, *b* = 8.4 cm and *h* = 3.6 cm.

a

h

b
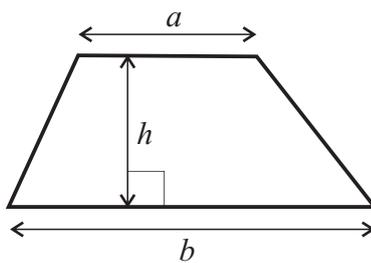
Work out the area of the trapezium.

4) In the trapezium below, the area is 45 cm².
a = 5 cm and *b* = 10 cm.

Calculate the height, *h*, of the trapezium.

a

h

b
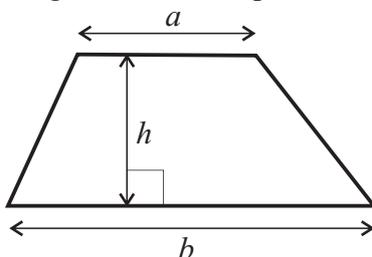
Area of a Trapezium

1) Find the area of this trapezium.

36 cm²

4 cm

6 cm

8 cm

2) The diagram shows a field.

270 m

86 m

188 m
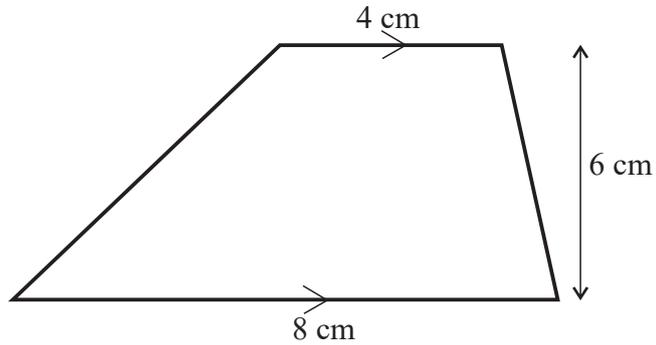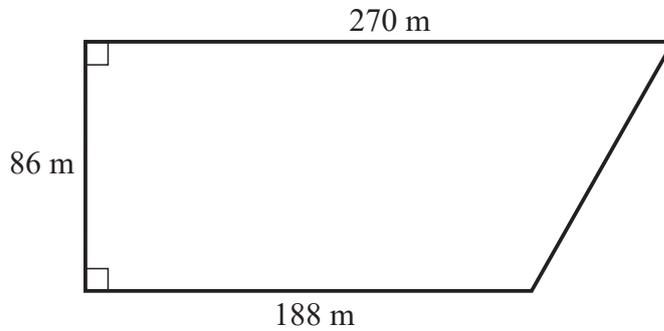
Work out the area of the field.   19694 m²

3) In the trapezium, *a* = 6.6 cm, *b* = 8.4 cm and *h* = 3.6 cm.

a

h

b
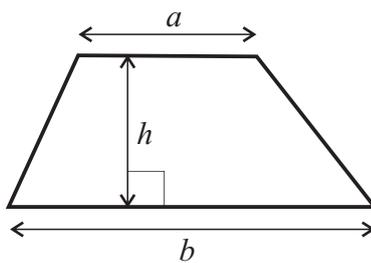
Work out the area of the trapezium.   27 cm²

4) In the trapezium below, the area is 45 cm².
a = 5 cm and *b* = 10 cm.

Calculate the height, *h*, of the trapezium.   6 cm
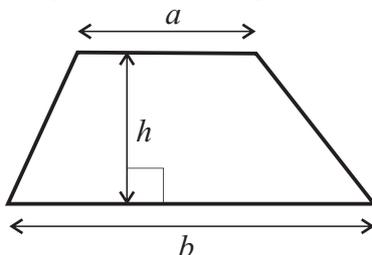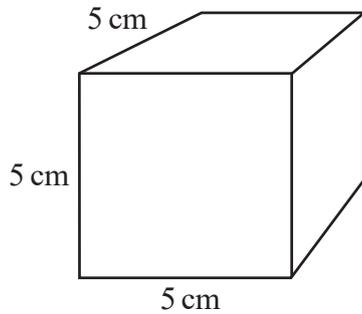
a

h

b

1) A cube has sides of length 5 cm.

Find the total surface area of the cube.

5 cm

5 cm

5 cm

2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid.

6 cm

7 cm

10 cm

3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

Find the total surface area of the cuboid.

4.5 cm

6 cm
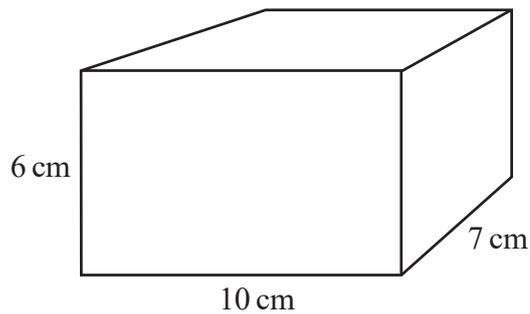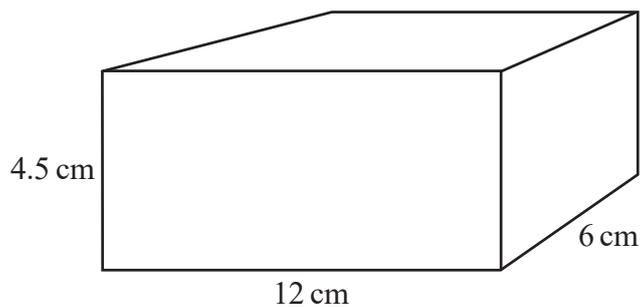
12 cm

1) A cube has sides of length 5 cm.

   Find the total surface area of the cube. 150 cm²
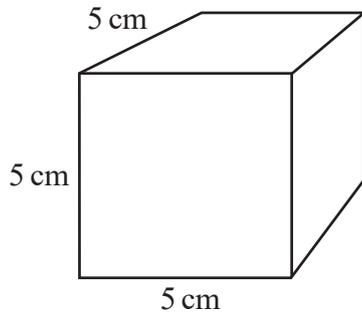
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

   Find the total surface area of the cuboid. 344 cm²
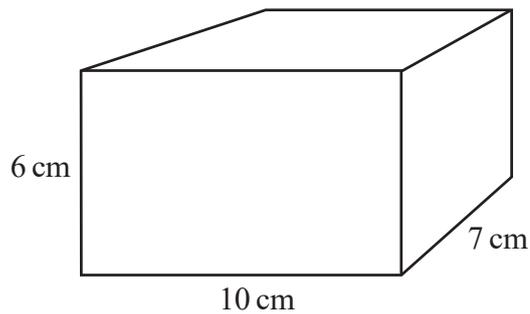
3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

   Find the total surface area of the cuboid. 306 cm²
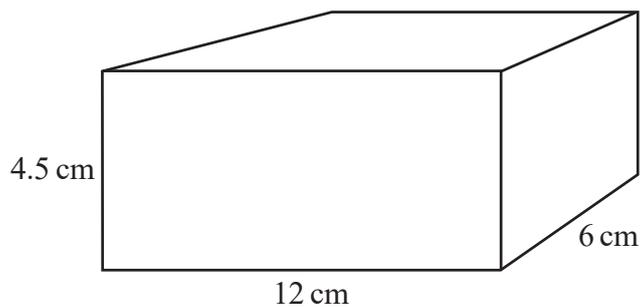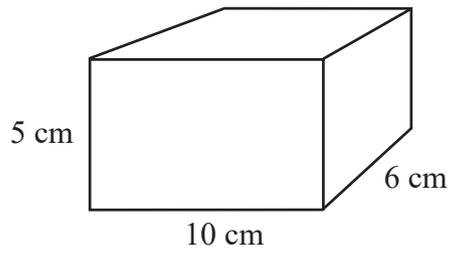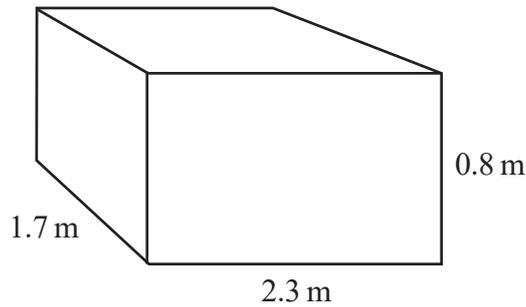
Volume of a Cuboid

1) Find the volume of this cuboid.

5 cm

6 cm

10 cm

2) Find the volume of this cuboid.

0.8 m

1.7 m

2.3 m

3) The volume of this cuboid is 480 cm³.
Find the length of the side marked x.

6 cm

x

8 cm

4) Boxes A and B are both cuboids.
How many of box B could be packed into box A?

50 cm

A

60 cm

80 cm

10 cm

B

15 cm

20 cm
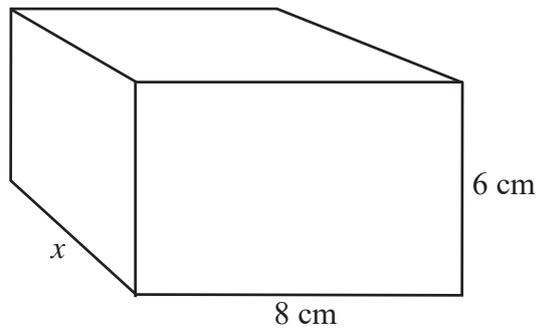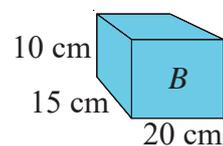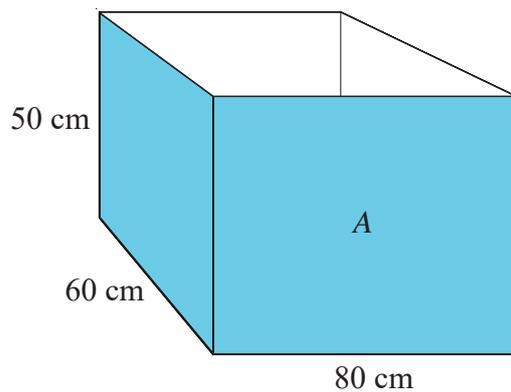
1) Find the volume of this cuboid. **300 cm³**

5 cm

6 cm
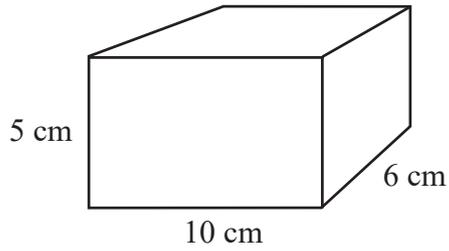
10 cm

2) Find the volume of this cuboid. **3.128 m³**

0.8 m

1.7 m

2.3 m
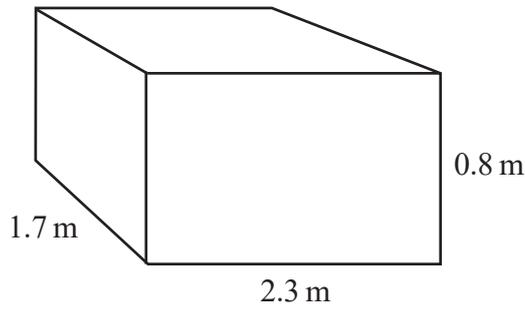
3) The volume of this cuboid is 480 cm³.
   Find the length of the side marked x. **10 cm**
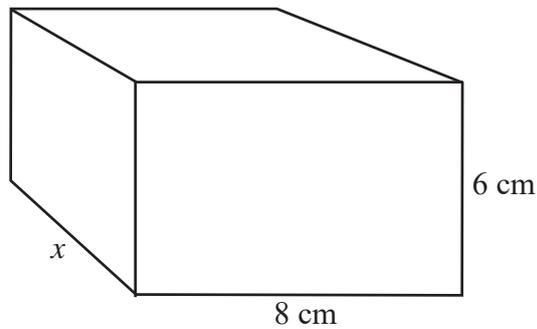
6 cm

x

8 cm

4) Boxes A and B are both cuboids.
   How many of box B could be packed into box A? **80**

50 cm

A

60 cm

80 cm

10 cm

B

15 cm

20 cm

Midpoint of a Line on a Graph
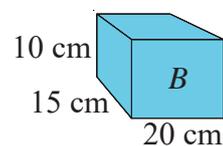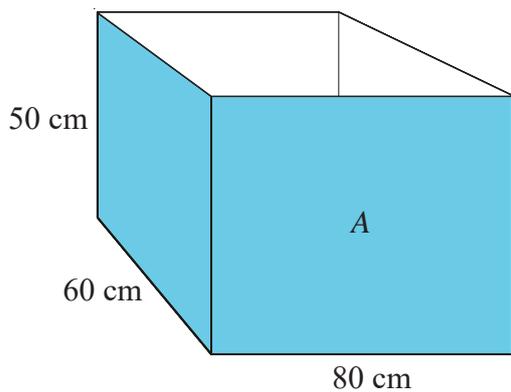
1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and *B* has coordinates (4, -1).
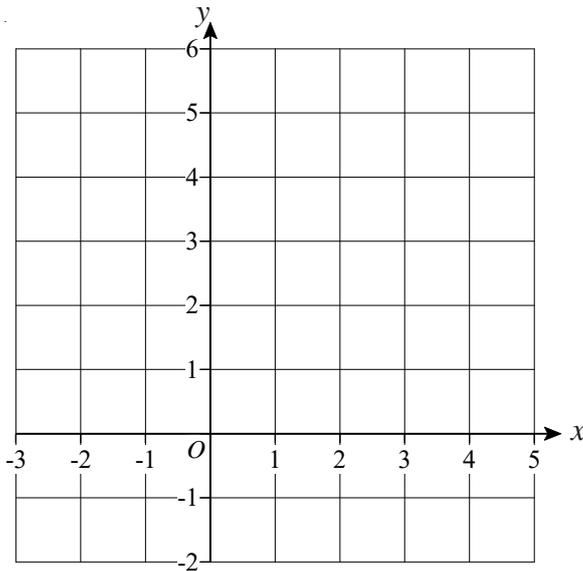
2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and *B* has coordinates (8, 6).

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and *B* has coordinates (2, 4).

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and *B* has coordinates (7, 5).

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and *B* has coordinates (7, 4).

6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and *B* has coordinates (-2, -1).

7) The midpoint of *A* and *B* is at (1, 3).
   The coordinates of *A* are (-2, 4).
   Work out the coordinates of *B*.

8) The midpoint of *A* and *B* is at (3.5, 2.5).
   The coordinates of *A* are (2, 5).
   Work out the coordinates of *B*.

1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and
B has coordinates (4, -1).

(1, 2)

2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and
B has coordinates (8, 6). (5, 3)

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and
B has coordinates (2, 4). (-1, 1)

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and
B has coordinates (7, 5). (2, 1.5)

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and
B has coordinates (7, 4). (4.5, -0.5)

6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and
B has coordinates (-2, -1). (-4.5, -2.5)

7) The midpoint of *A* and *B* is at (1, 3).
The coordinates of *A* are (-2, 4).
Work out the coordinates of *B*. (4, 2)

8) The midpoint of *A* and *B* is at (3.5, 2.5).
The coordinates of *A* are (2, 5).
Work out the coordinates of *B*. (5, 0)

Reflections

1) a) Reflect triangle T in the *x* axis.
Label your new triangle U.

b) Reflect triangle T in the line with
equation *y* = -*x*.
Label your new triangle V.

y = -*x*
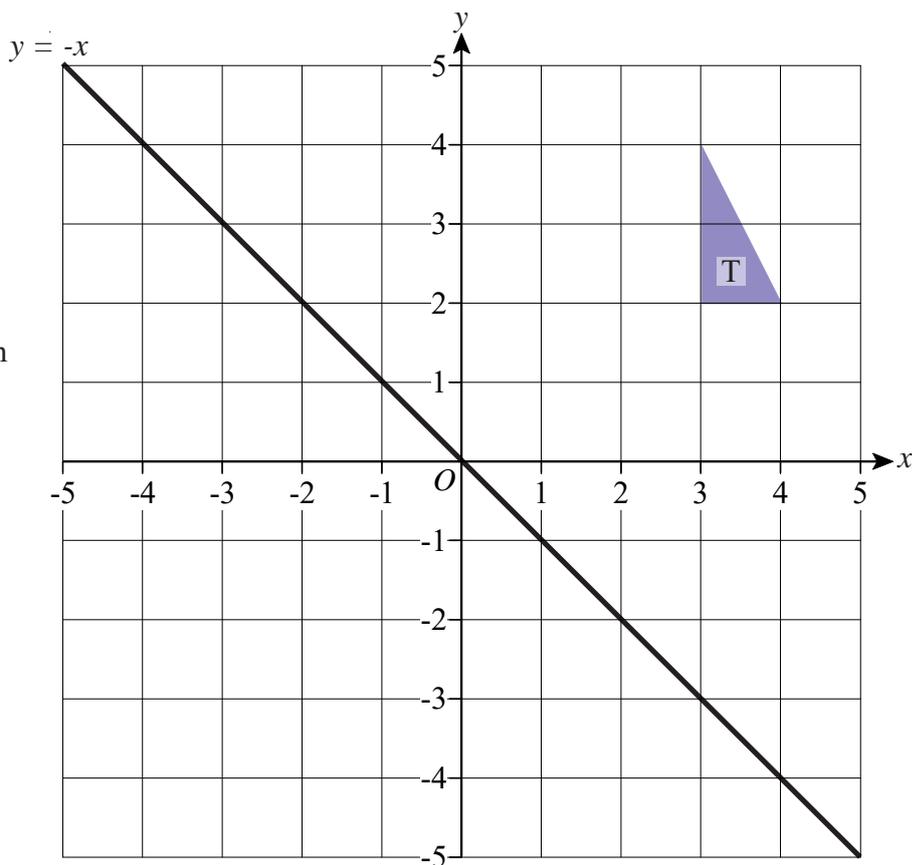
2) a) Describe fully the single
transformation which maps
triangle T to triangle U.

b) Describe fully the single
transformation which maps
triangle T to triangle V.
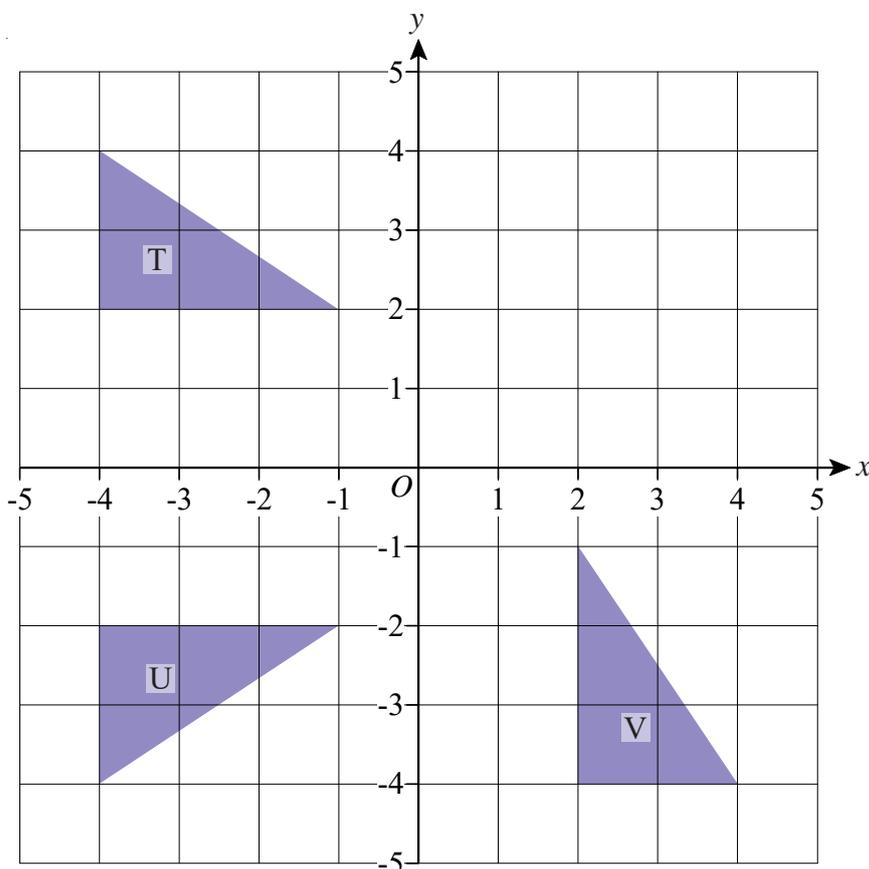
Reflections

1) a) Reflect triangle T in the *x* axis.
   Label your new triangle U.

   b) Reflect triangle T in the line with
   equation *y = -x*.
   Label your new triangle V.

y = -x
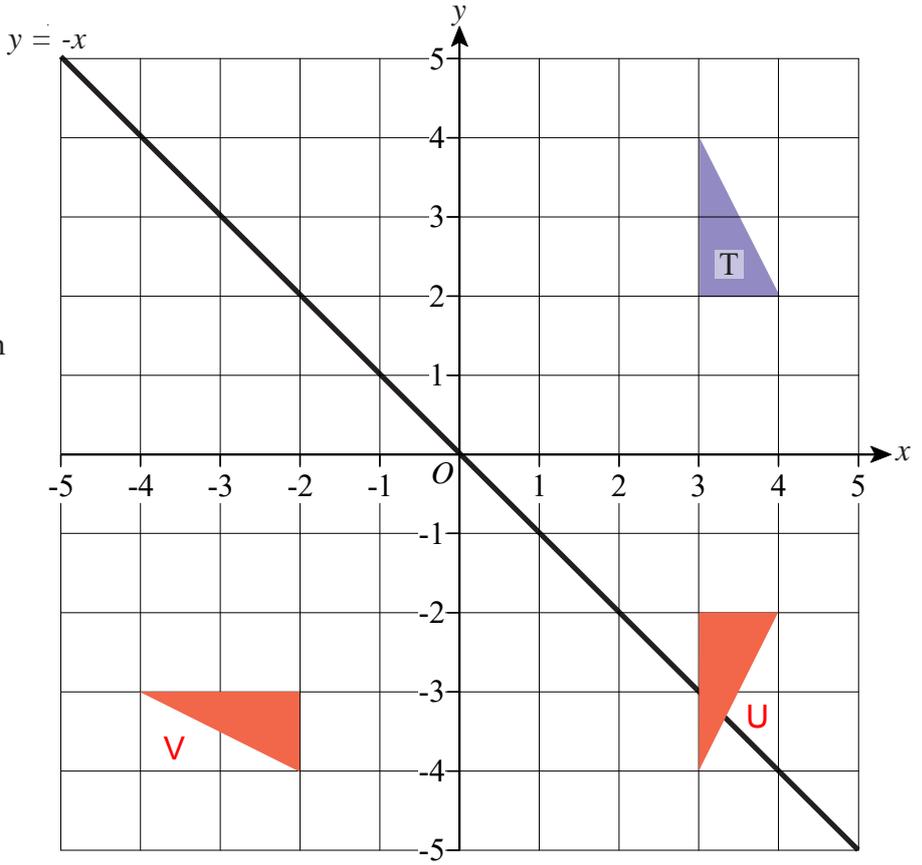
2) a) Describe fully the single
   transformation which maps
   triangle T to triangle U.

   Reflection in the *x* axis.

   b) Describe fully the single
   transformation which maps
   triangle T to triangle V.

   Reflection in the line *y = x*.
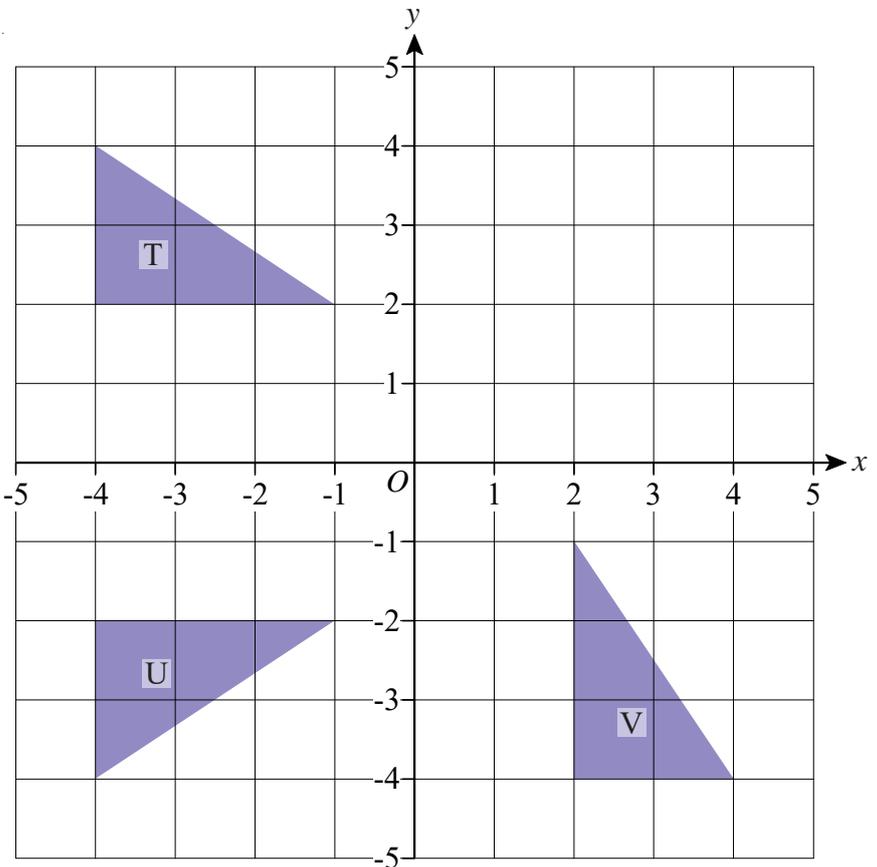
Rotations

1) a) Rotate triangle T 90°
   anti-clockwise about the
   point (0, 0).
   Label your new triangle U.

   b) Rotate triangle T 180°
   about the point (2, 0).
   Label your new triangle V.
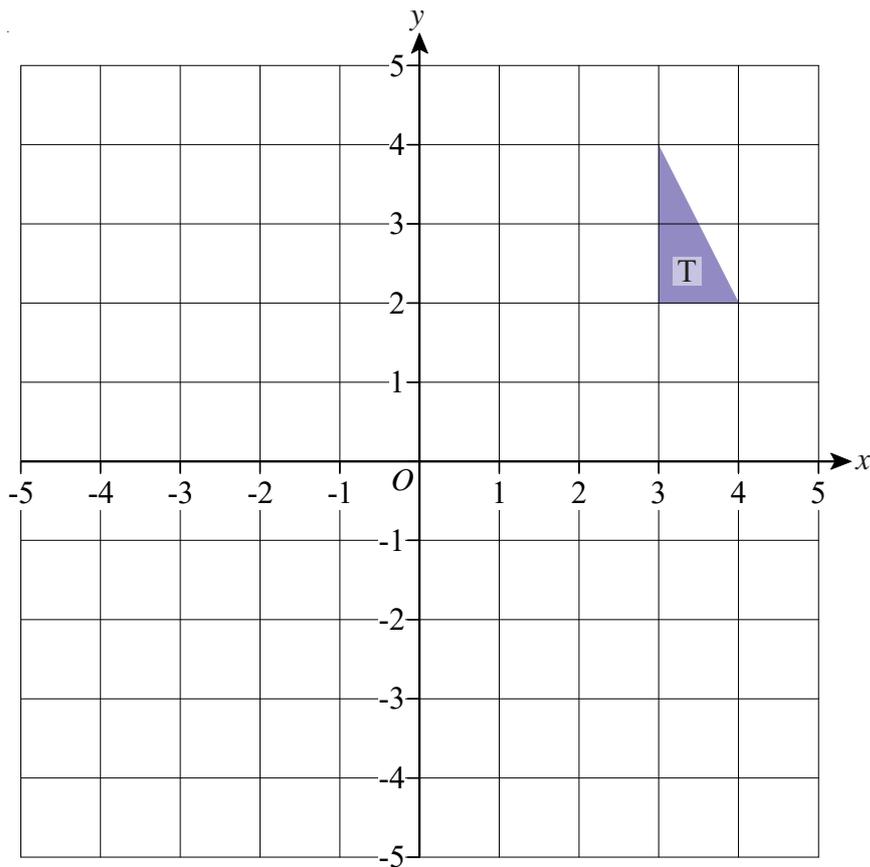
2) Describe fully the single
   transformation which maps
   triangle T to triangle U.
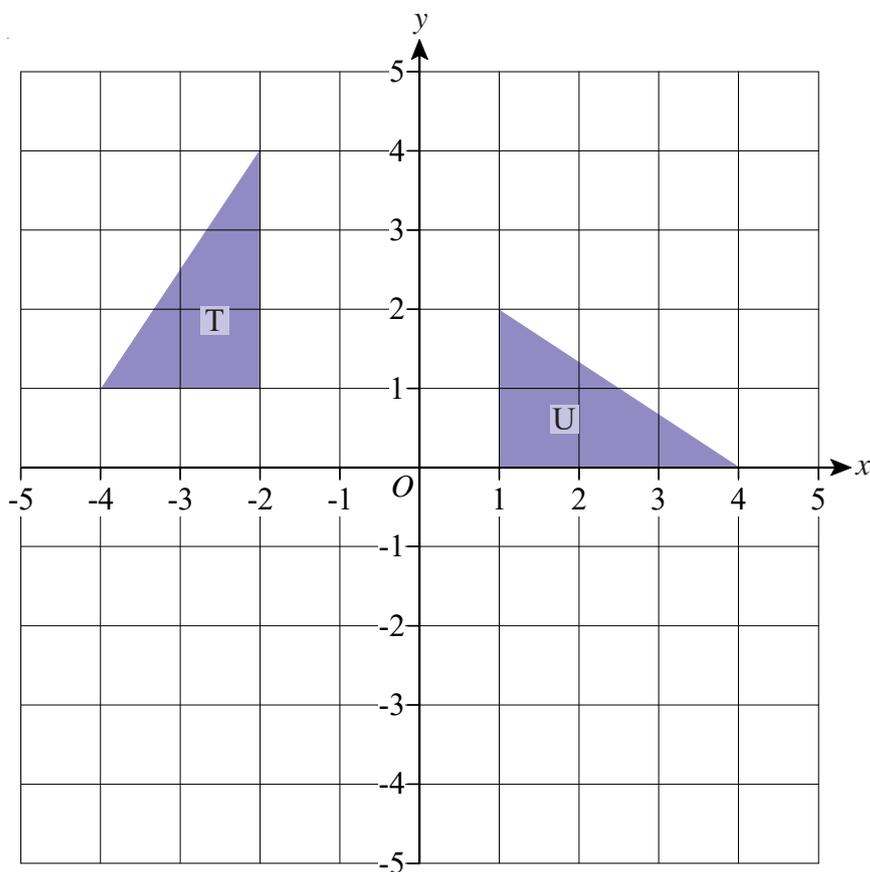
Rotations

1) a) Rotate triangle T 90°
      anti-clockwise about the
      point (0, 0).
      Label your new triangle U.

   b) Rotate triangle T 180°
      about the point (2, 0).
      Label your new triangle V.
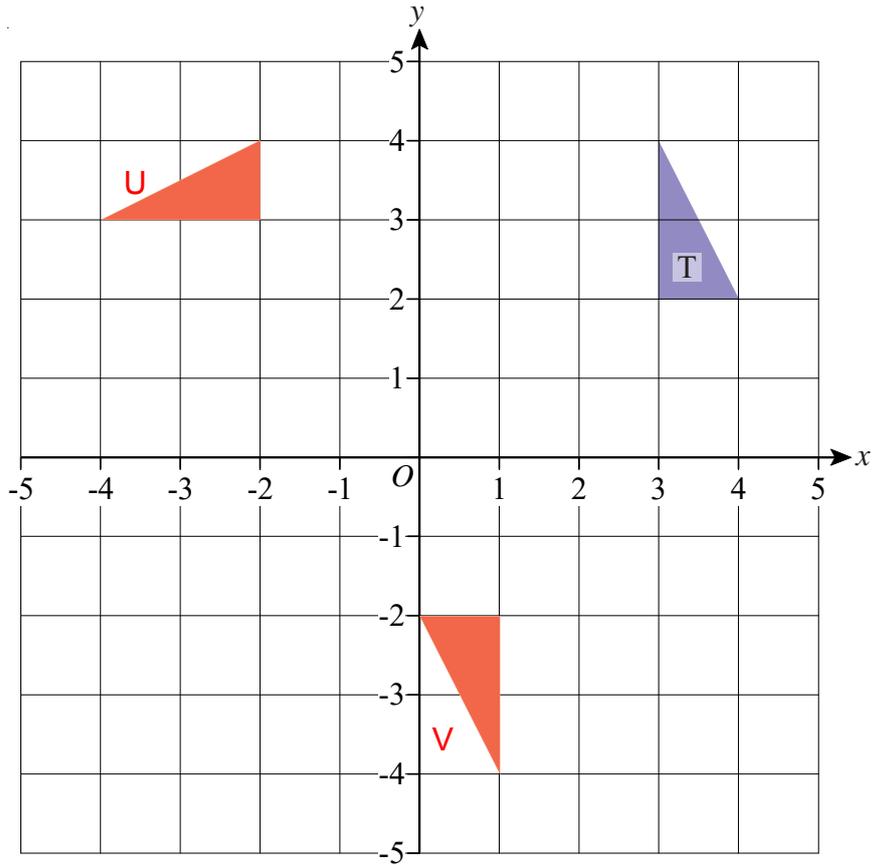
2) Describe fully the single
   transformation which maps
   triangle T to triangle U.

   Rotation
   90° clockwise
   about the point (-1, -1)
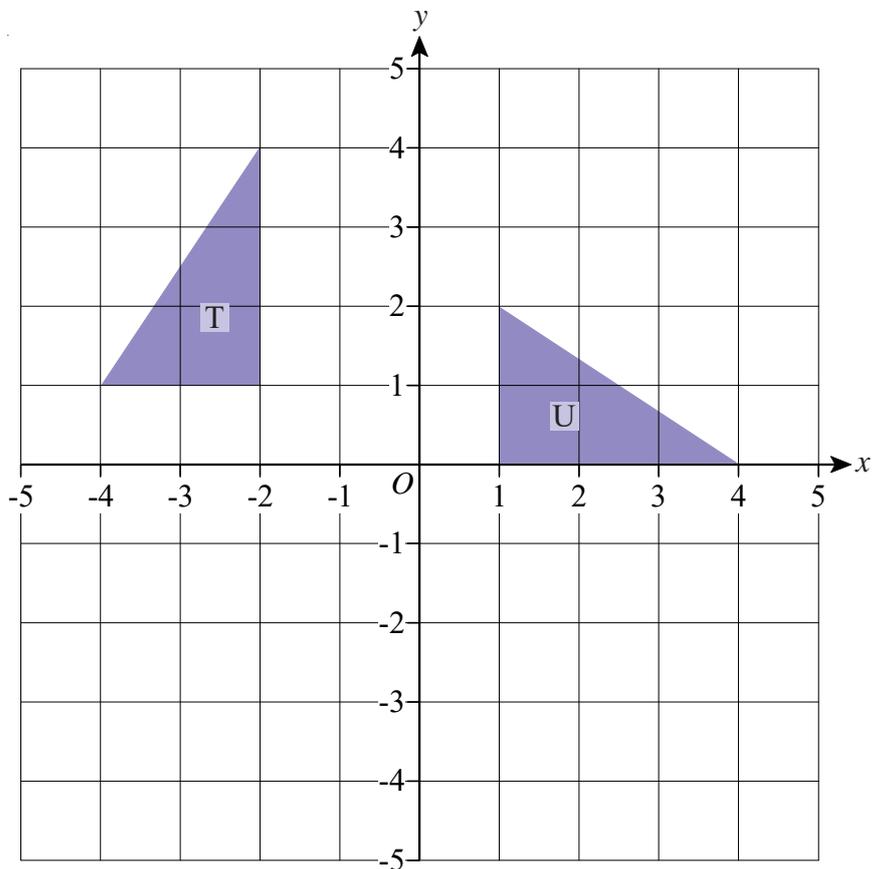
Translations

1) Translate triangle T

a) 4 squares to the left and 2 squares up. Label it U.

b) 3 squares to the right and 2 squares down. Label it V.
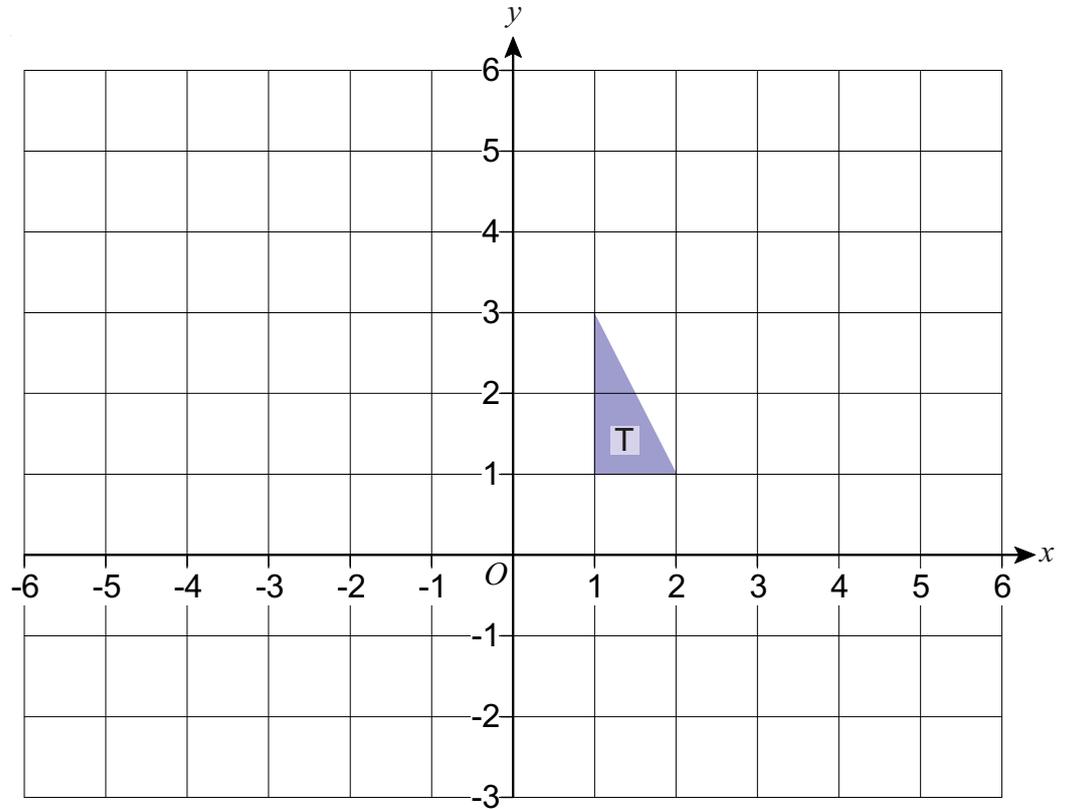
2) a) Describe fully the **single** transformation which maps triangle A to triangle B.

b) Describe fully the **single** transformation which maps triangle A to triangle C.
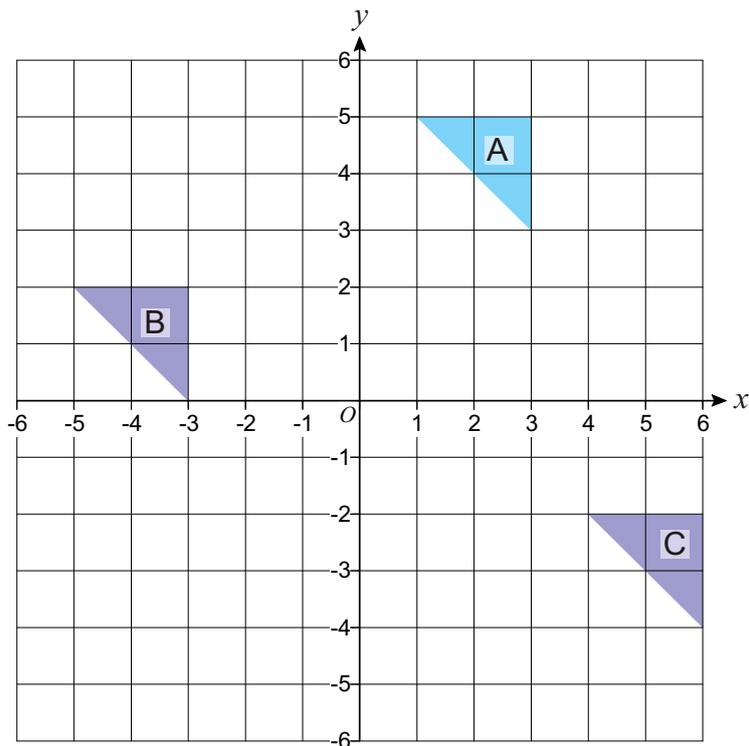
Translations

1) Translate triangle T

   a) 4 squares to the left and 2 squares up. Label it U.

   b) 3 squares to the right and 2 squares down. Label it V.
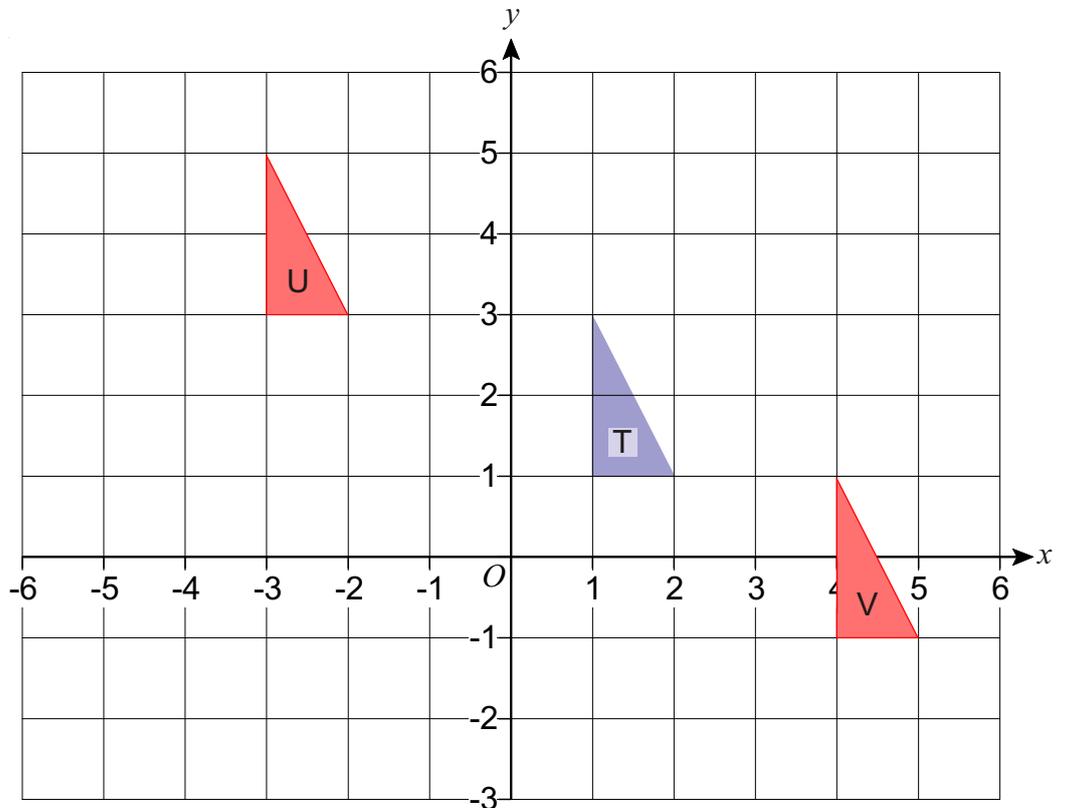
2) a) Describe fully the **single** transformation which maps triangle A to triangle B.

   Translation by 6 squares left and 3 squares down.

   b) Describe fully the **single** transformation which maps triangle A to triangle C.

   Translation by 3 squares right and 7 squares down.
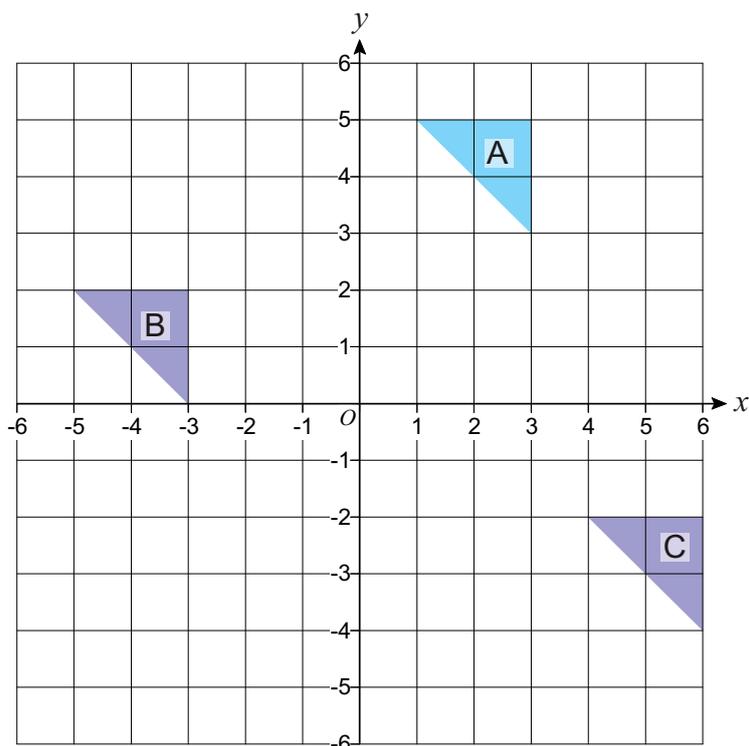
Enlargements

1) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.

Label your new triangle U.
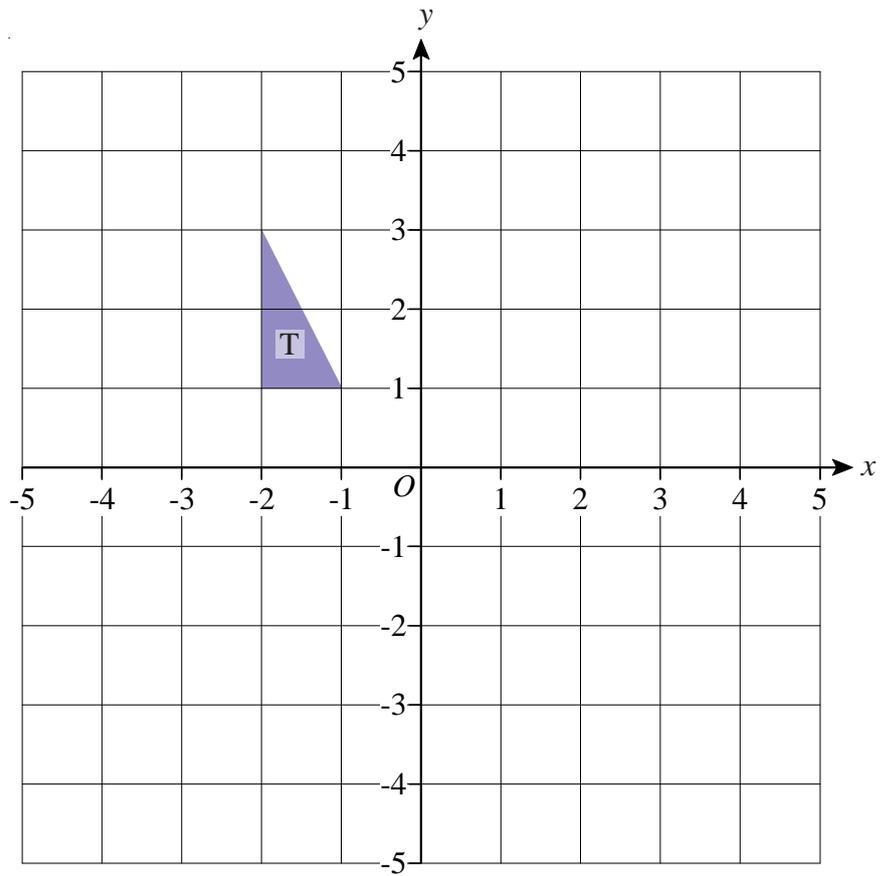
2) Describe fully the single transformation which maps triangle S to triangle T.
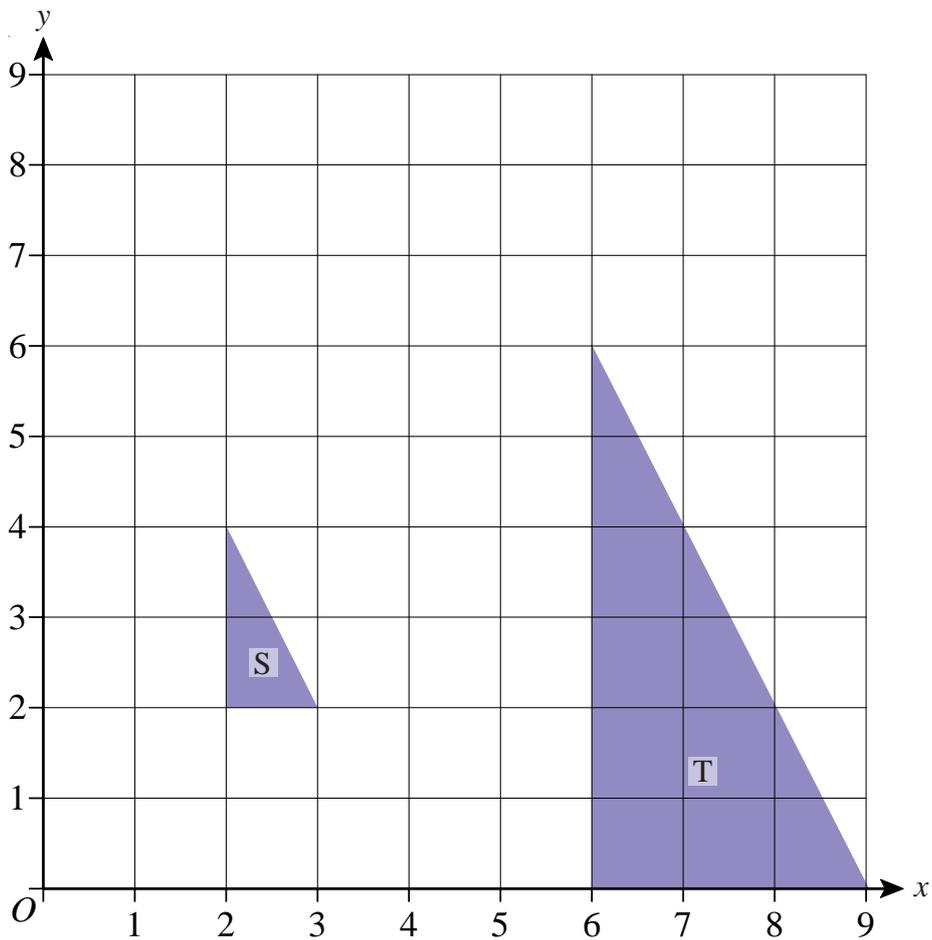
Enlargements

1) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.

Label your new triangle U.
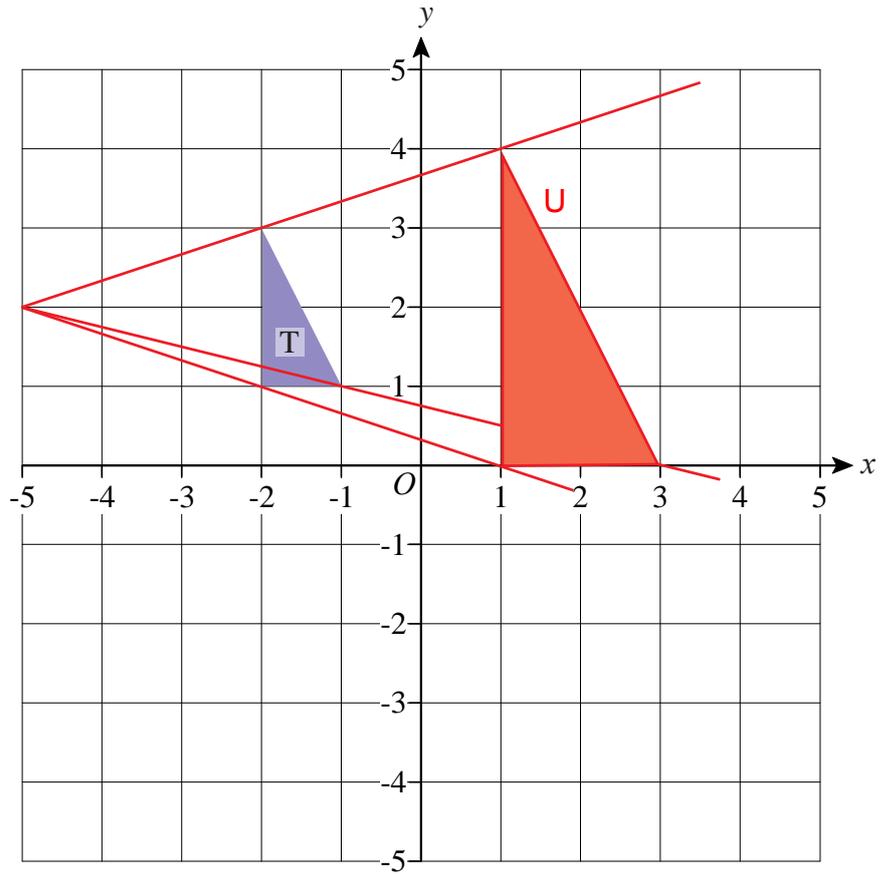
2) Describe fully the single transformation which maps triangle S to triangle T.

Enlargement, scale factor 3, centre of enlargement (0, 3).
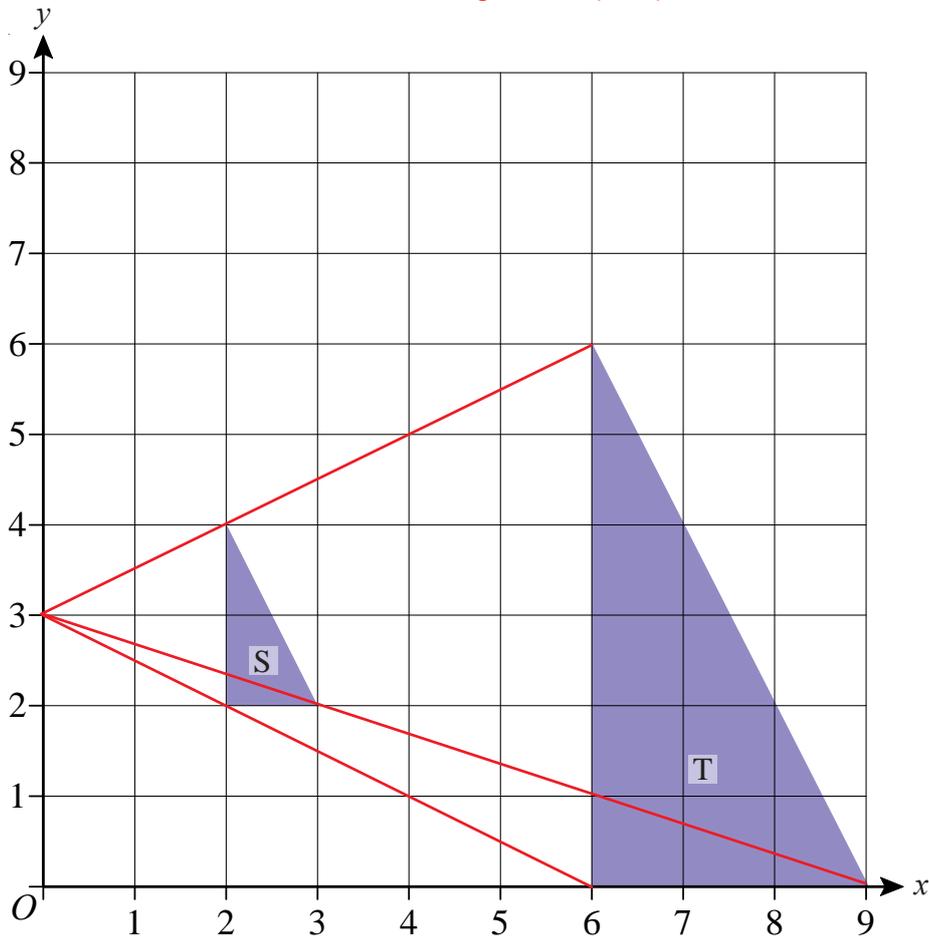
1) A survey into how people communicate with each other is carried out.
A questionnaire is designed and two of the questions used are shown below.
The questions are **not** suitable.
For each question, write down a reason why.

a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

Yes ☐   No ☐

Reason ....
....

b) How many text messages do you send?

1 ☐   2 ☐   3 ☐   4 ☐

Reason ....
....

2) A restaurant owner has made some changes.
He wants to find out what customers think of these changes.
He uses this question on a questionnaire.

"What do you think of the changes in the restaurant?"

☐   ☐   ☐
Excellent   Very good   Good

a) Write down what is wrong with this question.

This is another question on the questionnaire.

"How often do you come to the restaurant?"

☐   ☐
Very often   Not often

b) i)   Write down one thing that is wrong with this question.

ii)   Design a better question to use.
You should include some response boxes.

1) A survey into how people communicate with each other is carried out.
   A questionnaire is designed and two of the questions used are shown below.
   The questions are **not** suitable.
   For each question, write down a reason why.

   a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

   Yes ☐   No ☐

   Reason .....This is not a question you can answer 'yes' or 'no' to.................
   ....

   b) How many text messages do you send?

   1 ☐   2 ☐   3 ☐   4 ☐

   Reason ....Response boxes need to include '0' and 'more than 4'...............
   ....Question needs a time frame eg per day, per week....................

2) A restaurant owner has made some changes.
   He wants to find out what customers think of these changes.

   He uses this question on a questionnaire.

   "What do you think of the changes in the restaurant?"

   ☐   ☐   ☐
   Excellent   Very good   Good

   a) Write down what is wrong with this question.
      There is no negative or neutral response box.

   This is another question on the questionnaire.

   "How often do you come to the restaurant?"

   ☐   ☐
   Very often   Not often

   b) i) Write down one thing that is wrong with this question.
         Question needs a time frame eg per week, per month.
         Response boxes need to be more specific eg once a week, twice a week.

      ii) Design a better question to use.
          You should include some response boxes.
          How many times do you visit this restaurant per month?

      ☐   ☐   ☐   ☐
      None   Once   Twice   More
                              than
                              twice

Time Series

The table on the right shows the sales figures for a manufacturing company over the course of 15 years.

a) Complete the time series graph to show this information.

b) What is the range of the sales figures?

c) Comment on the trend over the course of 15 years.

Year	Sales (£M)
2000	10
2001	5
2002	10
2003	25
2004	22.5
2005	50
2006	27.5
2007	15
2008	35
2009	55
2010	50
2011	25
2012	45
2013	62.5
2014	57.5
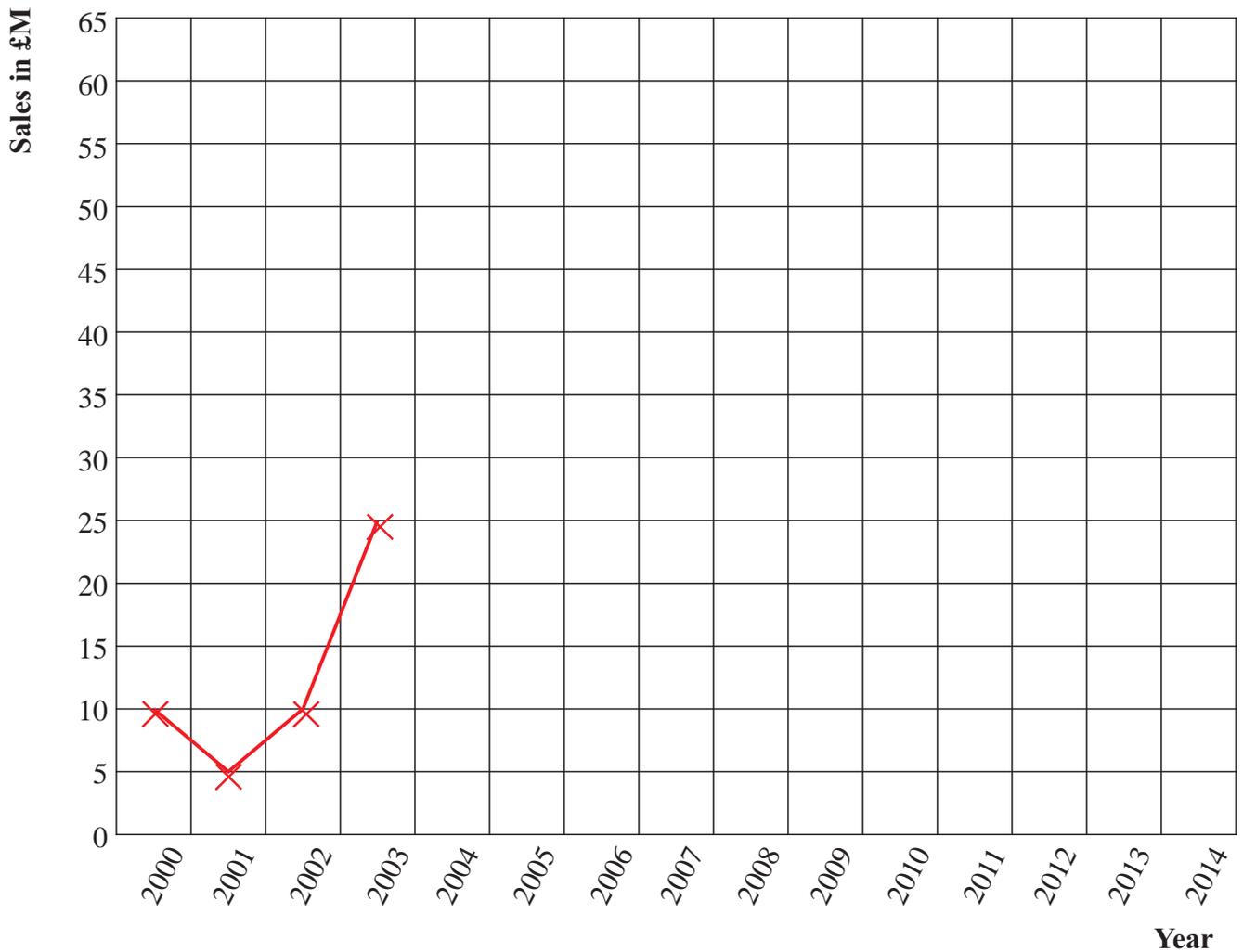
Time Series

The table on the right shows the sales figures for a manufacturing company over the course of 15 years.

a) Complete the time series graph to show this information.

b) What is the range of the sales figures? £57.5M

c) Comment on the trend over the course of 15 years.
The sales are increasing.

Year	Sales (£M)
2000	10
2001	5
2002	10
2003	25
2004	22.5
2005	50
2006	27.5
2007	15
2008	35
2009	55
2010	50
2011	25
2012	45
2013	62.5
2014	57.5
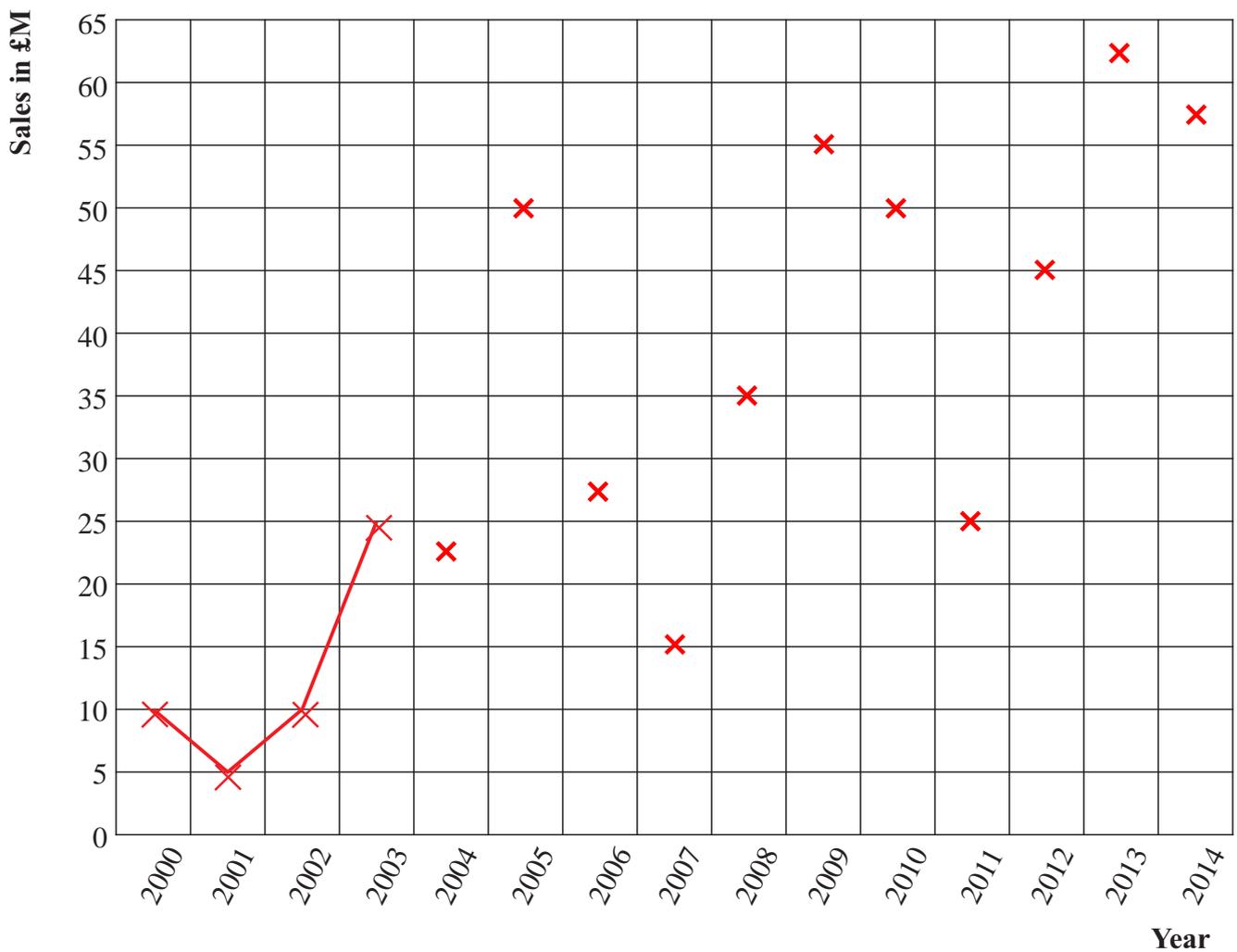
Frequency Tables and Diagrams
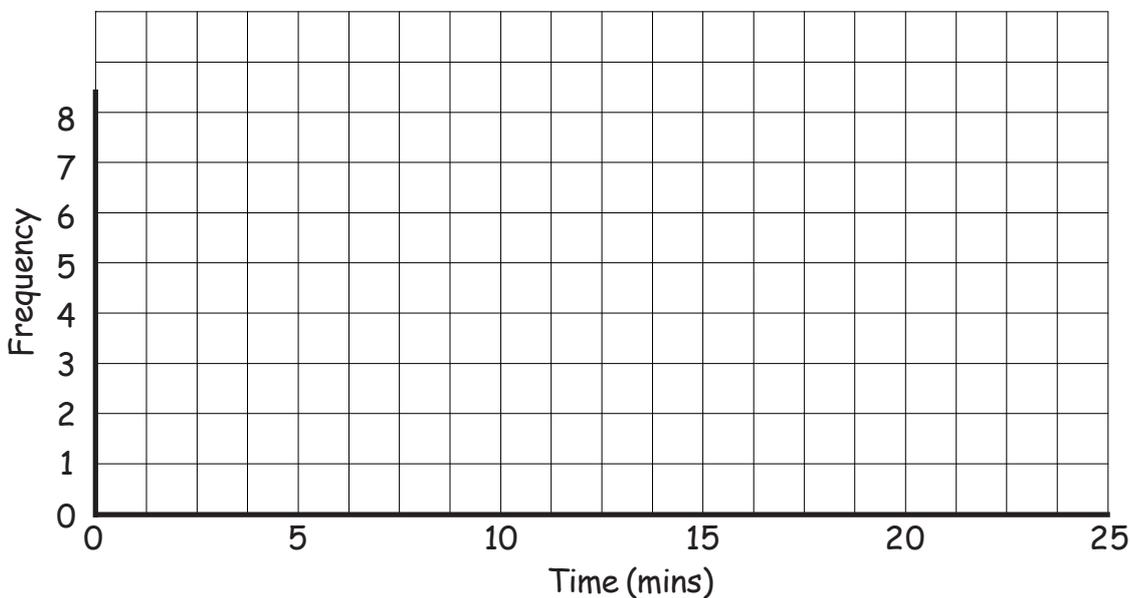
A class of pupils is asked to solve a puzzle.
The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.

b) Draw a frequency polygon to show this information.

Frequency Tables and Diagrams

A class of pupils is asked to solve a puzzle.
The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.

b) Draw a frequency polygon to show this information.

Page 91 A
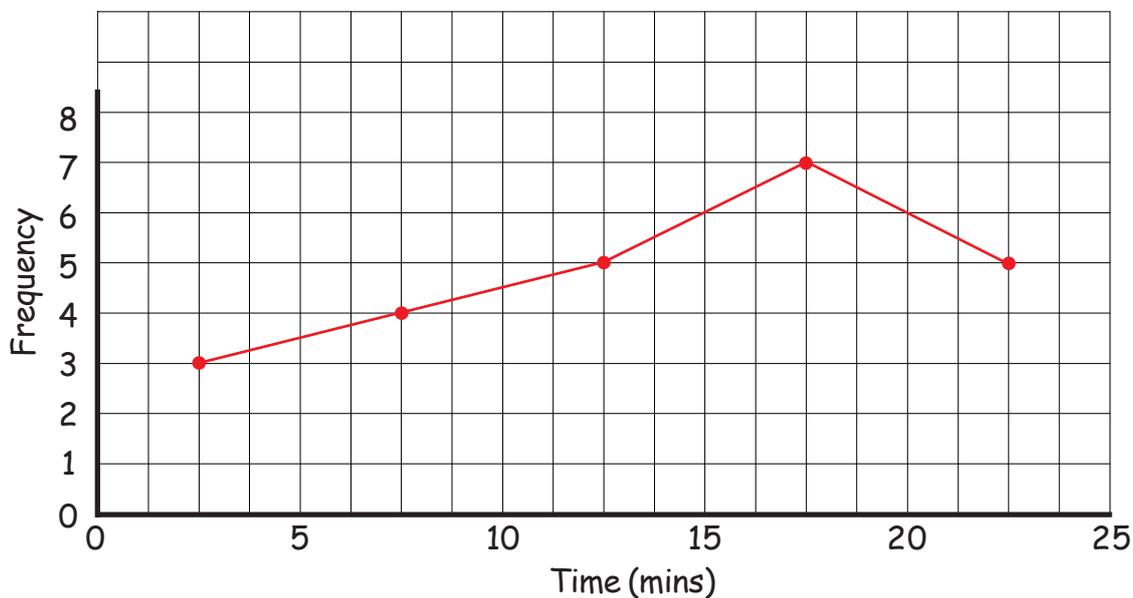
30 students took a test.

The table shows information about how many marks they gained in the test.

Marks (m)	Frequency
$0 < m < 10$	4
$10 < m < 20$	8
$20 < m < 30$	9
$30 < m < 40$	6
$40 < m < 50$	3

On the grid, draw a frequency polygon for this information.
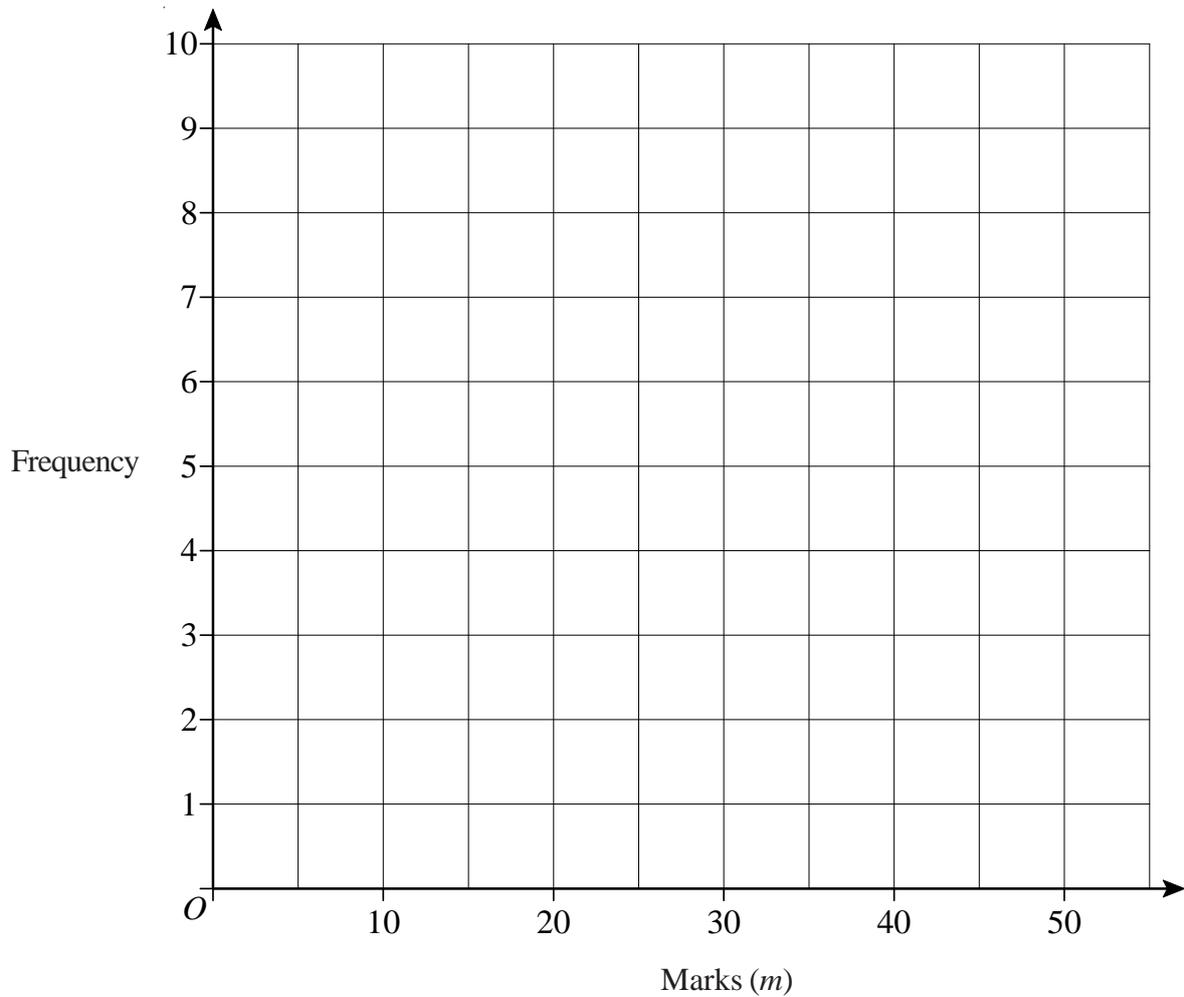
Marks (m)

30 students took a test.

The table shows information about how many marks they gained in the test.

Marks (m)		Frequency
$0 < m < 10$	5	4
$10 < m < 20$	15	8
$20 < m < 30$	25	9
$30 < m < 40$	35	6
$40 < m < 50$	45	3

On the grid, draw a frequency polygon for this information.
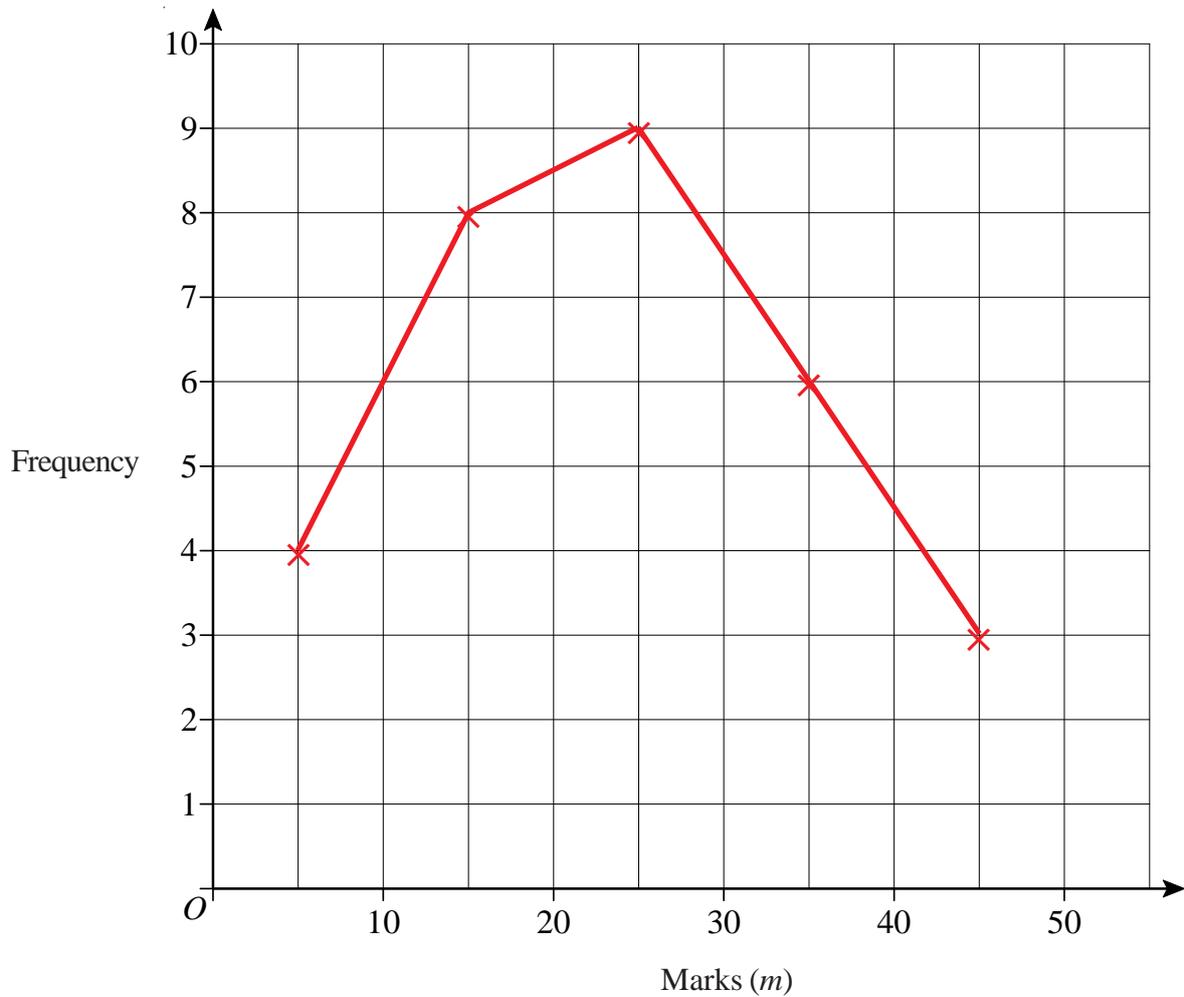
Marks (m)

60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.
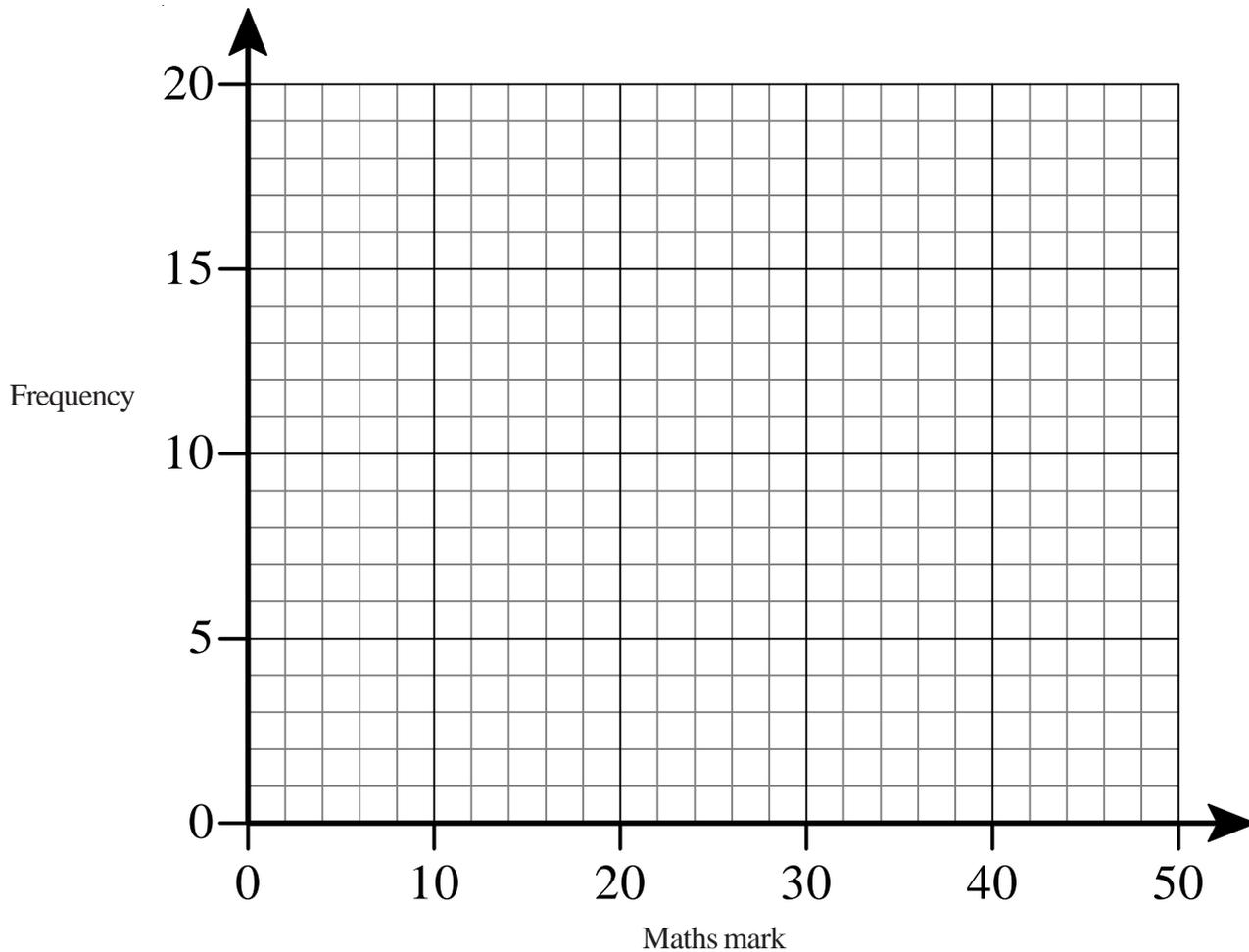
60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

	5	15.5	25.5	35.5	45.5
Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.

Scatter Diagrams

1) The scatter graph shows some information about the marks of six students.
It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

a) On the scatter graph, plot the information from the table.

b) Draw a line of best fit.

c) Describe the correlation between the marks in Maths and the marks in Science.

Another student has a mark of 18 in Science.

d) Use the line of best fit to estimate the mark in Maths of this student.

2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

The first five results have been plotted on the scatter diagram.

a) Plot the next five points.

b) Draw a line of best fit.

c) Describe the relationship between the age of the children and their number of hours sleep per day.

d) Use your scatter graph to estimate the number of hours sleep for a 3 year old child.

Scatter Diagrams

1) The scatter graph shows some information about the marks of six students.

It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

a) On the scatter graph, plot the information from the table.

b) Draw a line of best fit.

c) Describe the correlation between the marks in Maths and the marks in Science.
There is a positive correlation

Another student has a mark of 18 in Science.

d) Use the line of best fit to estimate the mark in Maths of this student.
My answer is 14. Yours will depend on your line of best fit.

2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

The first five results have been plotted on the scatter diagram.

a) Plot the next five points.

b) Draw a line of best fit.

c) Describe the relationship between the age of the children and their number of hours sleep per day.
A negative correlation

d) Use your scatter graph to estimate the number of hours sleep for a 3 year old child.
My answers is 13.6 Yours will depend on your line of best fit.
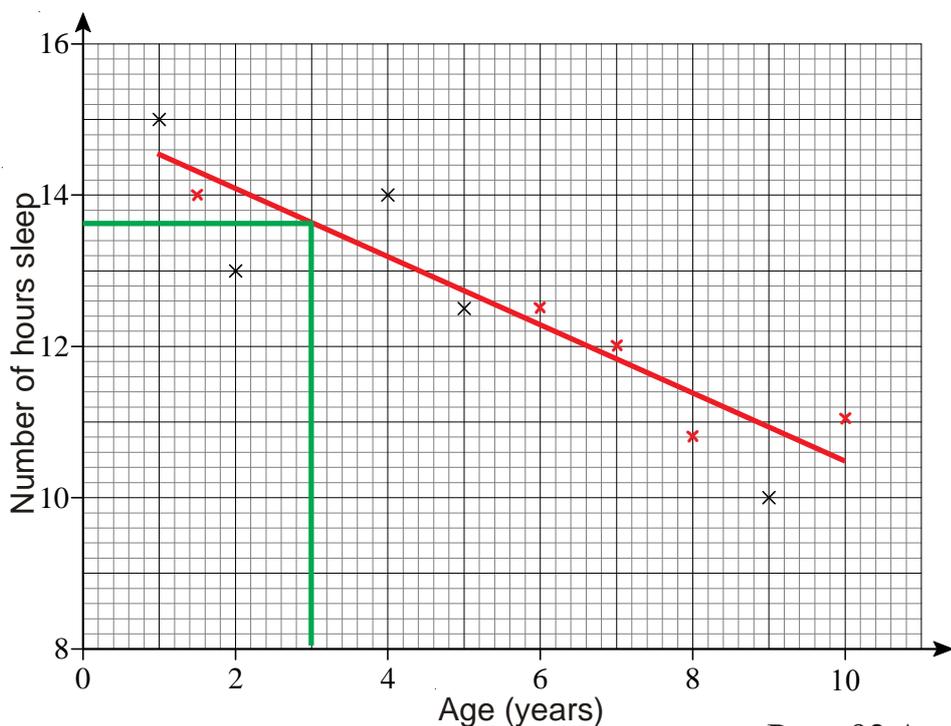
Scatter Diagrams

1) Sue did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.
   Some information about her results is given in the scatter graph.
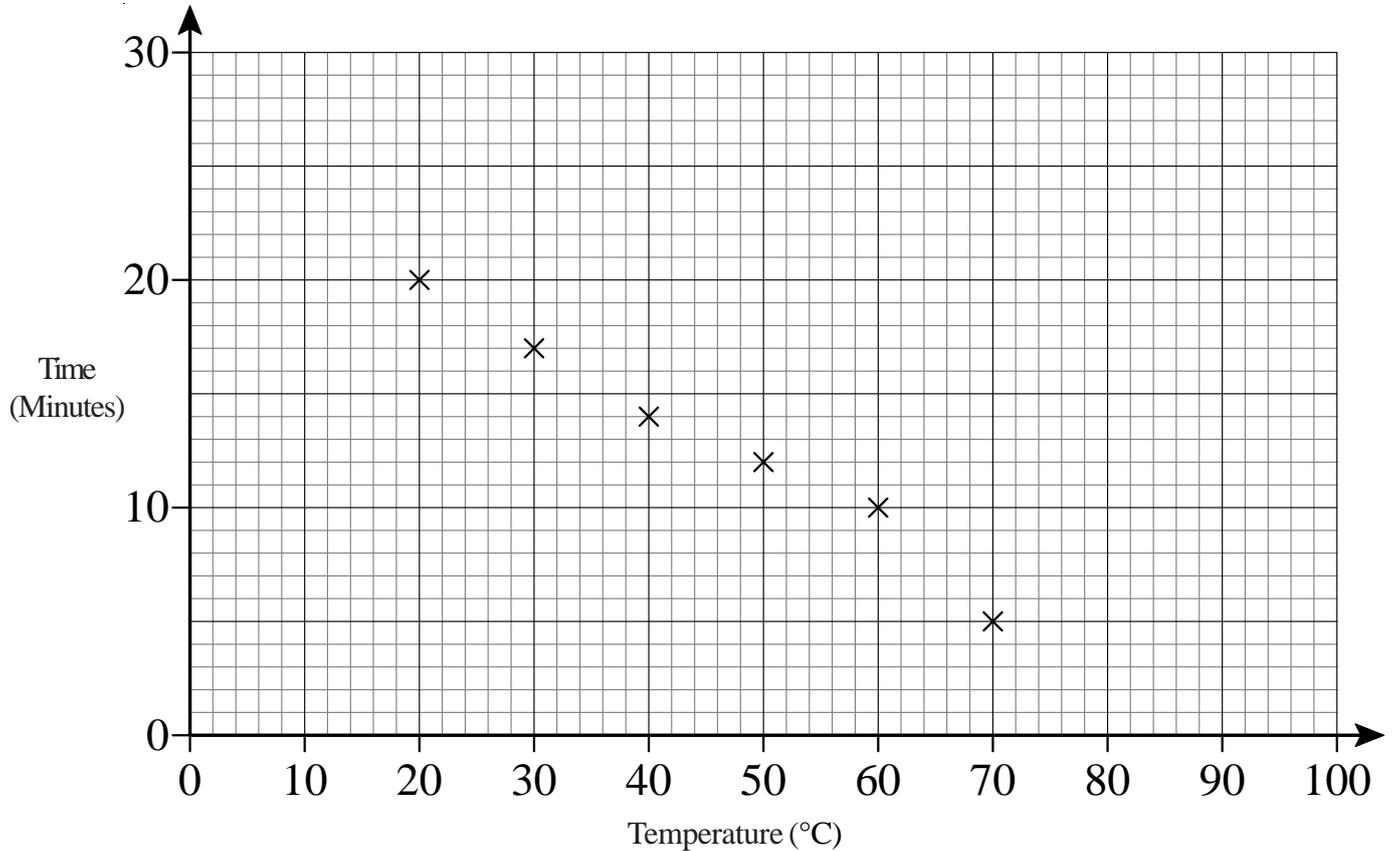
The table shows the results from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	21	15

a) On the scatter graph, plot the results from the table.

b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt.

c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C.

Sue's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

d) Explain why.

Scatter Diagrams

1) Sue did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.
   Some information about her results is given in the scatter graph.
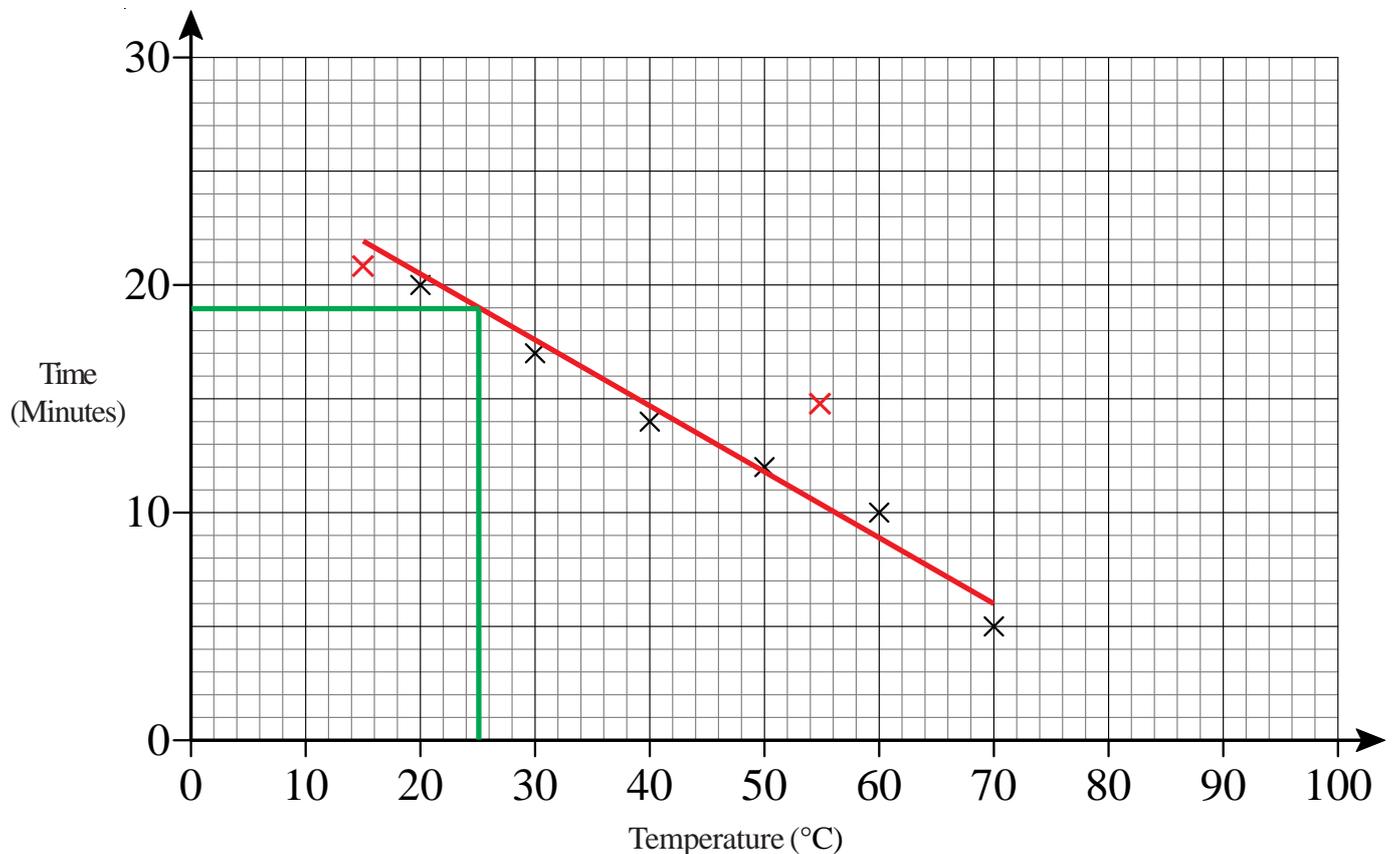
The table shows the results from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	21	15

a) On the scatter graph, plot the results from the table.

b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt. Negative correlation

c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C. 19 minutes (your answer will depend on your line of best fit)

Sue's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

d) Explain why. Line of best fit would give a negative time
or
You cannot draw and use a line of best fit which goes beyond the values.

1) Henry reads eight books.

For each book he recorded the number of pages and the time he took to read it.

The scatter graph shows information about his results.
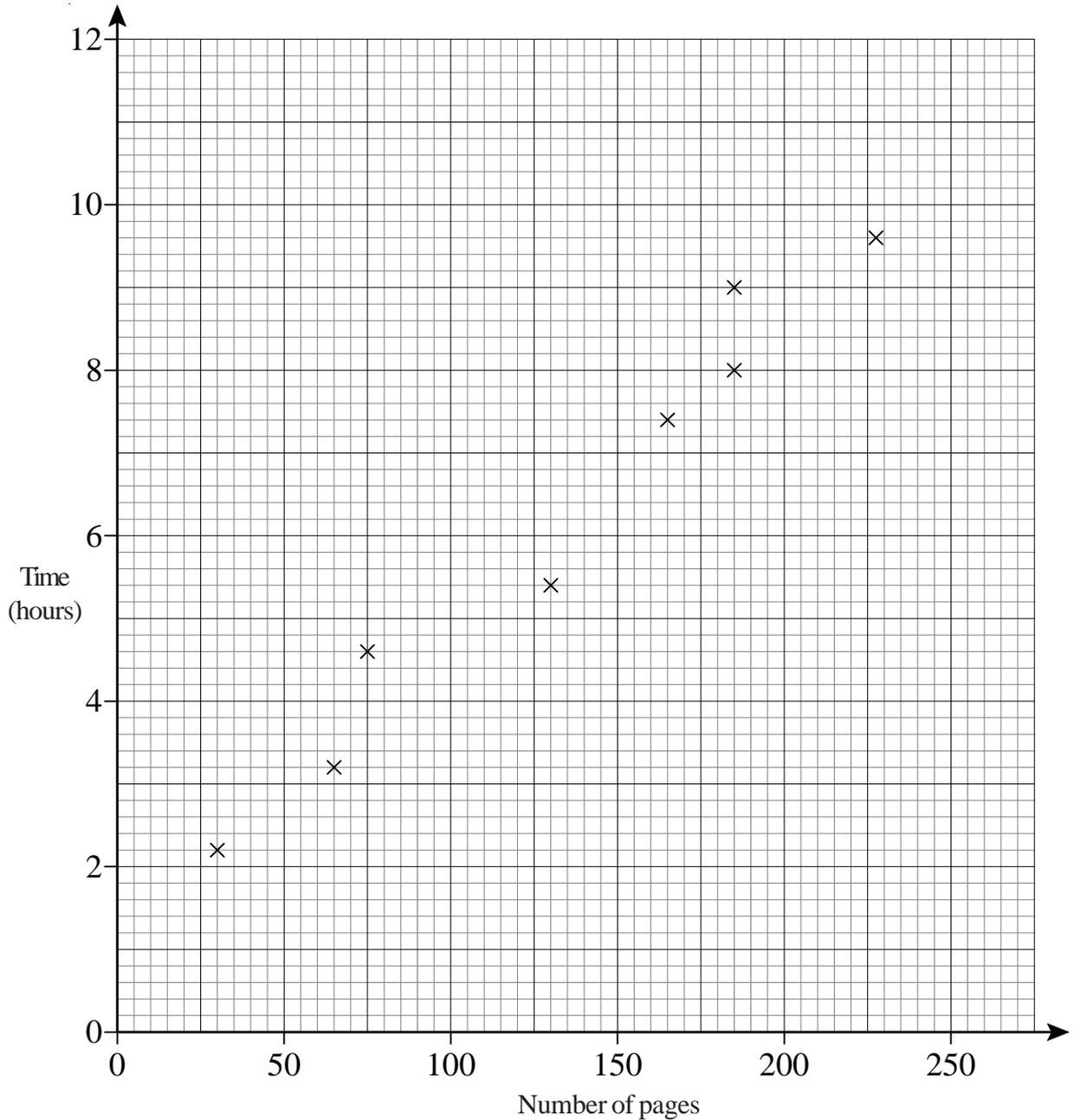
a) Describe the relationship between the number of pages in a book and the time Henry takes to read it.

Henry reads another book.

The book has 150 pages.

b) Estimate the time it takes Henry to read it.

1) Henry reads eight books.

For each book he recorded the number of pages and the time he took to read it.

The scatter graph shows information about his results.
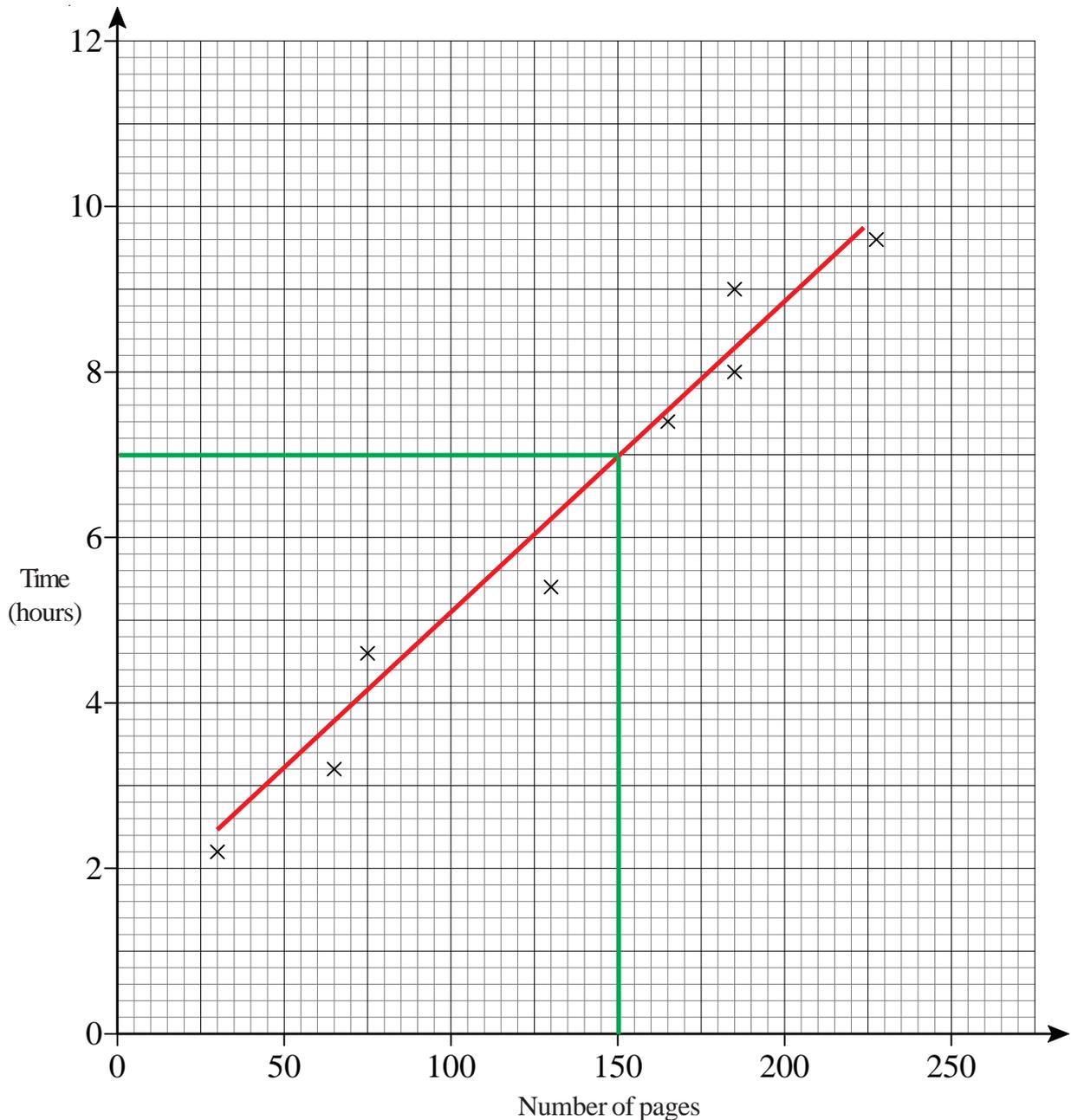
a) Describe the relationship between the number of pages in a book and the time Henry takes to read it. **Positive correlation**

Henry reads another book.

The book has 150 pages.

b) Estimate the time it takes Henry to read it. **7 hours (your answer will depend on your line of best fit)**

1) Mr Jones sells umbrellas.

The scatter graph shows some information about the number of umbrellas he sold and the rainfall, in cm, each month last year.
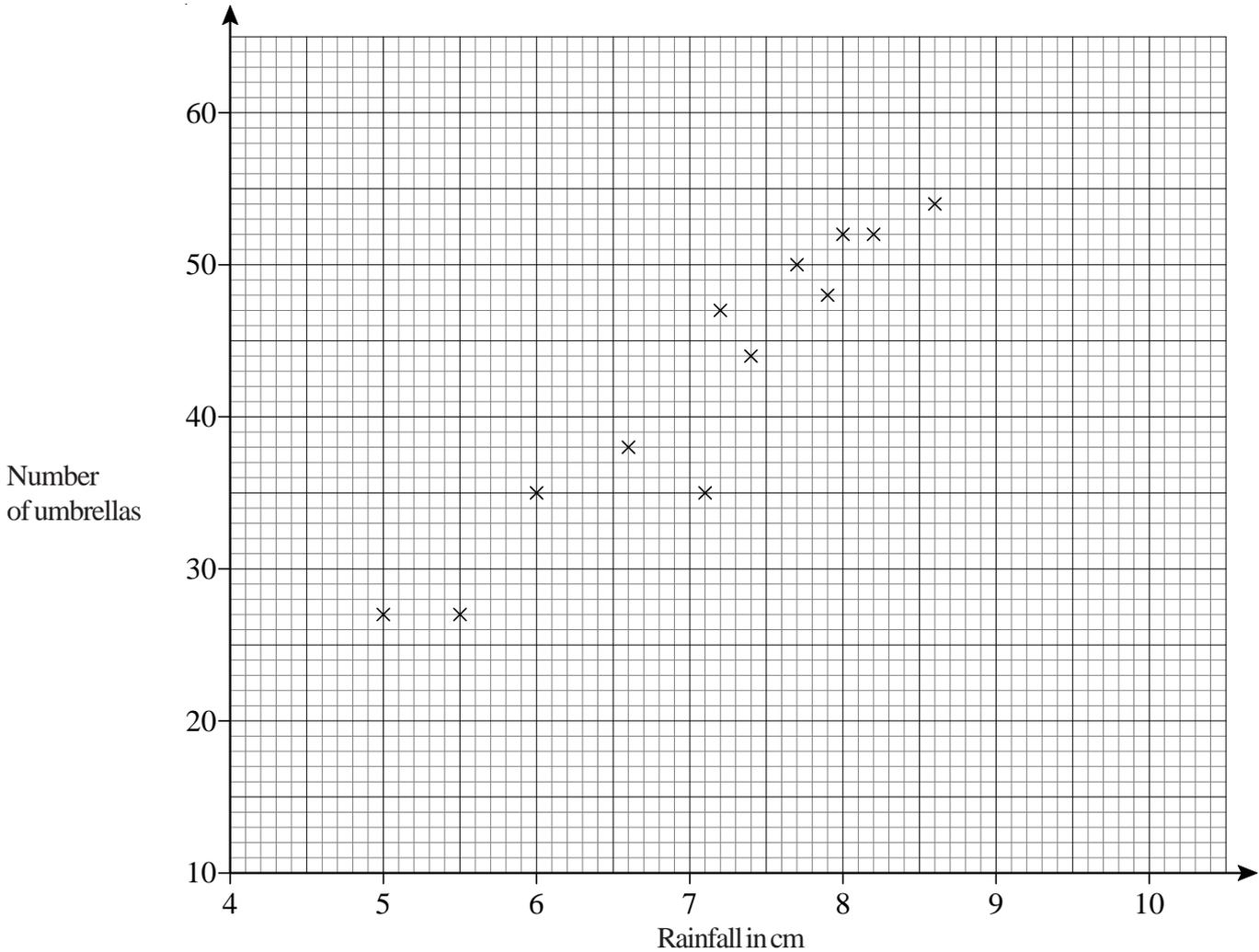
In January of this year, the rainfall was 6.2 cm.

During January, Mr Jones sold 32 umbrellas.

a) Show this information on the scatter graph.

b) What type of correlation does this scatter graph show?

In February of this year, Mr Jones sold 40 umbrellas.

c) Estimate the rainfall for February.

Scatter Diagrams

1) Mr Jones sells umbrellas.

The scatter graph shows some information about the number of umbrellas he sold and the rainfall, in cm, each month last year.
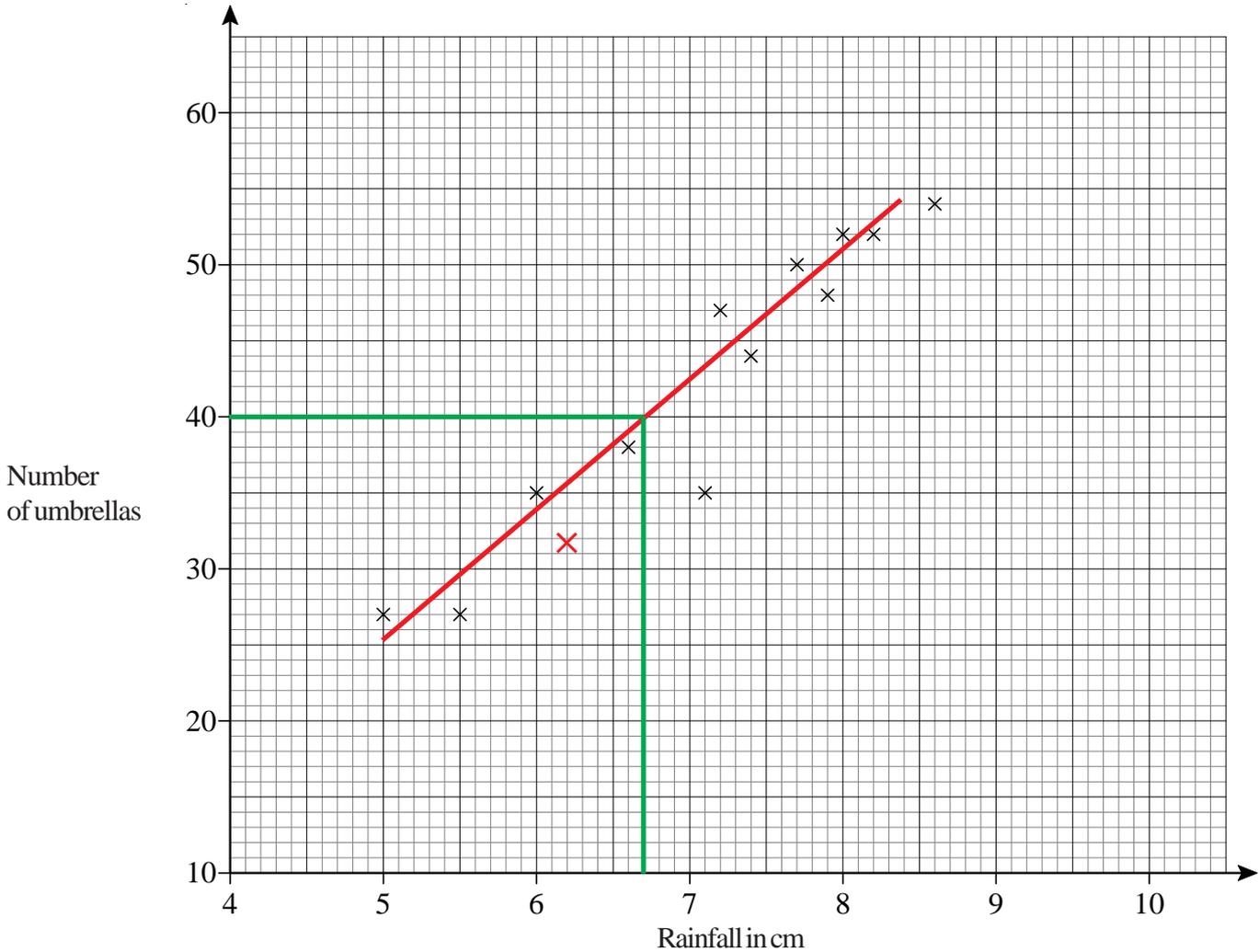
In January of this year, the rainfall was 6.2 cm.

During January, Mr Jones sold 32 umbrellas.

a) Show this information on the scatter graph.

b) What type of correlation does this scatter graph show? Positive correlation

In February of this year, Mr Jones sold 40 umbrellas.

c) Estimate the rainfall for February. 6.7 cm (your answer will depend on your line of best fit)

1) Kaya made a list of his homework marks.

   3   2

   a) Write down the mode of Kaya's marks.

   b) Work out his mean homework mark.

2) Lydia rolled an 8-sided dice ten times.
   Here are her scores.

   5   1

   a) Work out Lydia's median score.

   b) Work out the mean of her scores.

3) In a two-week period, a train was this many minutes late each day:

   3   0   4   0   5   1

   a) What was the mean average number of minutes late?

   b) What was the median average number of minutes late?

4) Two small Year 10 classes, Set A and Set B, sat the same Science test.

   Set A had these scores for the test:

   63%, 71%, 48%, 95%, 46%, 82%, 77%, 36%, 73%

   Set B had these scores:

   58%, 63%, 85%, 61%, 59% 38%, 90%, 84%, 75%, 48%

   How much bigger was Set B's mean average score than Set A's mean average score?
   Give your answer correct to 1 decimal place.

5) A rugby team played six games.
   The mean score for the six games is 15
   The rugby team played one more game.
   The mean score for all seven games is 16
   Work out the number of points the team scored in the seventh game.

1)   Kaya made a list of his homework marks.

      3   2

   a) Write down the mode of Kaya's marks.   4

   b) Work out his mean homework mark.   3.25

2)   Lydia rolled an 8-sided dice ten times.
    Here are her scores.

      5   1

   a) Work out Lydia's median score.   4

   b) Work out the mean of her scores.   4.1

3)   In a two-week period, a train was this many minutes late each day:

      3   0   4   0   5   1

   a) What was the mean average number of minutes late?   3 minutes late

   b) What was the median average number of minutes late?   1.5 minutes late

4)   Two small Year 10 classes, Set A and Set B, sat the same Science test.

   Set A had these scores for the test:

   63%, 71%, 48%, 95%, 46%, 82%, 77%, 36%, 73%

   Set B had these scores:

   58%, 63%, 85%, 61%, 59% 38%, 90%, 84%, 75%, 48%

   How much bigger was Set B's mean average score than Set A's mean average score?
   Give your answer correct to 1 decimal place.   0.4%

5)   A rugby team played six games.
    The mean score for the six games is 15
    The rugby team played one more game.
    The mean score for all seven games is 16
    Work out the number of points the team scored in the seventh game.   22

1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer

2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail.

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.

The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six.

4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three.

5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

a) She throws the dice once more.
   Find an estimate for the probability that she will get a four.

b) If the dice is rolled 250 times, how many times would you expect to get a five?

Experimental Probabilities

1) Ahmad does a statistical experiment.

   He throws a dice 600 times.

   He scores one, 200 times.

   Is the dice fair? Explain your answer   Two possible answers:
   No, you would expect to score 1 about 100 times.
   Yes, although you would expect 1 about 100 times, you could still get it 200 times.

2) Chris has a biased coin.

   The probability that the biased coin will land on a tail is 0.3

   Chris is going to flip the coin 150 times.

   Work out an estimate for the number of times the coin will land on a tail.   45 times

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.

   The dice is rolled 300 times.

   Work out an estimate for the number of times the dice will land on a six.   200 times

4) On a biased dice, the probability of getting a three is 0.5

   The dice is rolled 350 times.

   Work out an estimate for the number of times the dice will land on a three.   175 times

5) Jenny throws a biased dice 100 times.

   The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

   a) She throws the dice once more.

   Find an estimate for the probability that she will get a four. $\frac{24}{100}$ or 0.24

   b) If the dice is rolled 250 times, how many times would you expect to get a five?   45 times

1) If the probability of passing a driving test is 0.54,
   what is the probability of failing it?

2) The probability that a football team will win their next game is $\frac{2}{11}$.
   The probability they will lose is $\frac{3}{11}$.
   What is the probability the game will be a draw?

3) On the school dinner menu there is only ever one of four options.
   Some of the options are more likely to be on the menu than others.
   The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41		0.09

   a) Work out the probability of the dinner option being Fish.

   b) Which option is most likely?

   c) Work out the probability that it is a Curry or Sausages on any particular day.

   d) Work out the probability that it is **not** Casserole.

4) Julie buys a book every week.
   Her favourite types are Novel, Drama, Biography and Romance.
   The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

   a) Work out the probability that she will choose a Novel or a Drama.

   b) Work out the probability that she will choose a Biography or a Romance.

   The probability that she will choose a Biography is the same as the probability
   she will choose a Romance.

   c) Work out the probability that she will choose a Biography.

Mutually Exclusive Events

1) If the probability of passing a driving test is 0.54,
   what is the probability of failing it?   0.46

2) The probability that a football team will win their next game is $\frac{2}{11}$.
   The probability they will lose is $\frac{3}{11}$.
   What is the probability the game will be a draw? $\frac{6}{11}$

3) On the school dinner menu there is only ever one of four options.
   Some of the options are more likely to be on the menu than others.
   The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41	0.14	0.09

   a) Work out the probability of the dinner option being Fish.   0.14

   b) Which option is most likely?   Sausages

   c) Work out the probability that it is a Curry or Sausages on any particular day.   0.77

   d) Work out the probability that it is **not** Casserole.   0.91

4) Julie buys a book every week.
   Her favourite types are Novel, Drama, Biography and Romance.
   The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

   a) Work out the probability that she will choose a Novel or a Drama.   0.4

   b) Work out the probability that she will choose a Biography or a Romance.   0.6

   The probability that she will choose a Biography is the same as the probability
   she will choose a Romance.

   c) Work out the probability that she will choose a Biography.   0.3

1)   A number, *x*, rounded to 1 decimal place is 4.7

Write down the error interval for *x*.

2)   A number, *y*, rounded to 2 decimal places is 12.36

Write down the error interval for *y*.

3)   A number, *x*, rounded to 1 significant figure is 400.

Write down the error interval for *x*.

4)   A number, *y*, rounded to 2 significant figures is 67000.

Write down the error interval for *y*.

5)   A number, *x*, rounded to 3 significant figures is 24100.

Write down the error interval for *x*.

1) A number, *x*, rounded to 1 decimal place is 4.7

Write down the error interval for *x*. $4.65 \leq x < 4.75$

2) A number, *y*, rounded to 2 decimal places is 12.36

Write down the error interval for *y*. $12.355 \leq y < 12.365$

3) A number, *x*, rounded to 1 significant figure is 400.

Write down the error interval for *x*. $350 \leq x < 450$

4) A number, *y*, rounded to 2 significant figures is 67000.

Write down the error interval for *y*. $66500 \leq y < 67500$

5) A number, *x*, rounded to 3 significant figures is 24100.

Write down the error interval for *x*. $24050 \leq x < 24150$

Reciprocals

1) Write down the reciprocal of

   a) 8

   b) 3

   c) 1

   d) 12

2) Write down the reciprocal of

   a) $\frac{1}{2}$

   b) $\frac{1}{3}$

   c) $\frac{4}{3}$

   d) $\frac{5}{8}$

3) Write down the reciprocal of

   a) 0.1

   b) 0.5

   c) 0.2

4) Why can't we have a reciprocal of 0?

Reciprocals

1) Write down the reciprocal of

   a) 8 $\frac{1}{8}$

   b) 3 $\frac{1}{3}$

   c) 1 1

   d) 12 $\frac{1}{12}$

2) Write down the reciprocal of

   a) $\frac{1}{2}$ 2

   b) $\frac{1}{3}$ 3

   c) $\frac{4}{3}$ $\frac{3}{4}$

   d) $\frac{5}{8}$ $\frac{8}{5}$

3) Write down the reciprocal of

   a) 0.1 10

   b) 0.5 2

   c) 0.2 5

4) Why can't we have a reciprocal of 0? Because division by "0" does not exist.

1)   a) List all the factors of 12

        b) List all the factors of 20

        c) What is the highest common factor of 12 and 20?

2)   a) List all the factors of 24

        b) List all the factors of 32

        c) What is the highest common factor of 24 and 32?

3)   Find the highest common factor of 8 and 12

4)   Find the highest common factor of 36 and 45

5)   Find the highest common factor of 21 and 28

6)   Find the highest common factor of 36 and 60

7)   Find the highest common factor of 60 and 150

8)   Find the highest common factor of 50 and 125

9)   a) Write 96 as the product of its prime factors.

        b) Write 108 as the product of its prime factors.

        c) Find the highest common factor of 96 and 108

10)   a) Write 42 as the product of its prime factors.

        b) Write 63 as the product of its prime factors.

        c) Find the highest common factor of 42 and 63

11)   Using prime factors, find the highest common factor of 108 and 144

1) a) List all the factors of 12   1, 2, 3, 4, 6, 12

b) List all the factors of 20   1, 2, 4, 5, 10, 20

c) What is the highest common factor of 12 and 20?   4

2) a) List all the factors of 24   1, 2, 3, 4, 6, 8, 12, 24

b) List all the factors of 32   1, 2, 4, 8, 16, 32

c) What is the highest common factor of 24 and 32?   8

3) Find the highest common factor of 8 and 12   4

4) Find the highest common factor of 36 and 45   9

5) Find the highest common factor of 21 and 28   7

6) Find the highest common factor of 36 and 60   12

7) Find the highest common factor of 60 and 150   30

8) Find the highest common factor of 50 and 125   25

9) a) Write 96 as the product of its prime factors. $2 \times 2 \times 2 \times 2 \times 2 \times 3$

b) Write 108 as the product of its prime factors. $2 \times 2 \times 3 \times 3 \times 3$

c) Find the highest common factor of 96 and 108 $2 \times 2 \times 3 = 12$

10) a) Write 42 as the product of its prime factors. $2 \times 3 \times 7$

b) Write 63 as the product of its prime factors. $3 \times 3 \times 7$

c) Find the highest common factor of 42 and 63 $3 \times 7 = 21$

11) Using prime factors, find the highest common factor of 108 and 144 $2 \times 2 \times 3 \times 3 = 36$

1)   a) List the first five multiples of 6

        b) List the first five multiples of 8

        c) Find the lowest common multiple of 6 and 8?

2)   a) List the first five multiples of 10

        b) List the first five multiples of 15

        c) Find the lowest common multiple of 10 and 15?

3)   Find the lowest common multiple of 4 and 9

4)   Find the lowest common multiple of 20 and 60

5)   a) Write 35 as the product of its prime factors.

        b) Write 55 as the product of its prime factors.

        c) Find the lowest common multiple of 35 and 55

6)   a) Write 28 as the product of its prime factors.

        b) Write 72 as the product of its prime factors.

        c) Find the lowest common multiple of 28 and 72

7)   Find the lowest common multiple of 70 and 240

8)   Find the lowest common multiple of 42 and 63

9)   Find the lowest common multiple of 150 and 180

10)   Find the lowest common multiple of 54 and 96

1) a) List the first five multiples of 6   6, 12, 18, 24, 30

    b) List the first five multiples of 8   8, 16, 24, 32, 40

    c) Find the lowest common multiple of 6 and 8? 24

2) a) List the first five multiples of 10   10, 20, 30, 40, 50

    b) List the first five multiples of 15   15, 30, 45, 60, 75

    c) Find the lowest common multiple of 10 and 15? 30

3) Find the lowest common multiple of 4 and 9 36

4) Find the lowest common multiple of 20 and 60   60

5) a) Write 35 as the product of its prime factors. 5×7

    b) Write 55 as the product of its prime factors. 5×11

    c) Find the lowest common multiple of 35 and 55 $5 \times 7 \times 11 = 385$

6) a) Write 28 as the product of its prime factors. $2 \times 2 \times 7$

    b) Write 72 as the product of its prime factors. $2 \times 2 \times 2 \times 3 \times 3$

    c) Find the lowest common multiple of 28 and 72 $4 \times 2 \times 3 \times 3 \times 7 = 504$

7) Find the lowest common multiple of 70 and 240   1680

8) Find the lowest common multiple of 42 and 63   126

9) Find the lowest common multiple of 150 and 180   900

10) Find the lowest common multiple of 54 and 96   864

1) a) Express 84 as a product of its prime factors.

    b) Find the Highest Common Factor (HCF) of 84 and 35.

2) Express 72 as the product of its prime factors.

3) Express 180 as the product of its prime factors.

4) a) Express 66 as a product of its prime factors.

    b) Express 132^2 as a product of its prime factors.

5) Express 252 as a product of its prime factors.

6) Find the Lowest Common Multiple (LCM) of 24 and 36.

7) a) Write 56 as a product of its prime factors.

    b) Find the Highest Common Factor (HCF) of 56 and 42.

8) a) Express 45 as a product of its prime factors.

    b) Find the Highest Common Factor (HCF) of 45 and 30.

9) a) Find the Highest Common Factor (HCF) of 24 and 30.

    b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6.

1) a) Express 84 as a product of its prime factors.   2 × 2 × 3 × 7

   b) Find the Highest Common Factor (HCF) of 84 and 35.   7

2) Express 72 as the product of its prime factors.   2 × 2 × 2 × 3 × 3

3) Express 180 as the product of its prime factors.   2 × 2 × 3 × 3 × 5

4) a) Express 66 as a product of its prime factors.   2 × 3 × 11

   b) Express 132^2 as a product of its prime factors.   2 × 2 × 2 × 2 × 3 × 3 × 11 × 11

5) Express 252 as a product of its prime factors.   2 × 2 × 3 × 3 × 7

6) Find the Lowest Common Multiple (LCM) of 24 and 36.   72

7) a) Write 56 as a product of its prime factors.   2 × 2 × 2 × 7

   b) Find the Highest Common Factor (HCF) of 56 and 42.   14

8) a) Express 45 as a product of its prime factors.   3 × 3 × 5

   b) Find the Highest Common Factor (HCF) of 45 and 30.   15

9) a) Find the Highest Common Factor (HCF) of 24 and 30.   6

   b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6.   60

1) 1 person can cut a large area of grass in 5 hours.

   a) At the same rate, how long would it take 2 people to cut the grass?

   b) At the same rate, how long would it take 5 people to cut the grass?

2) 2 people can assemble a shed in 1 hour.

   a) Work out how long it would take 4 people (working at the same rate).

   b) Work out how long it would take just 1 person (working at the same rate).

3) A local lottery draw is won by 5 people and they each receive £125 300

   Work out how much they would each have got if only 4 people had won.

4) It takes 5 people 12 hours to build a wall.

   a) Work out how long it would take 3 people to build the wall (working at the same rate).

   b) Work out how long it would take 6 people to build the wall (working at the same rate).

5) It takes 3 people 8 hours to complete a job.

   a) At the same rate, how long would it take 4 people to complete the same job?

   b) At the same rate, how long would it take 2 people to complete the same job?

6) 6 people can paint a bridge in 18 days.

   a) At the same rate, how long would it take 9 people?

   b) At the same rate, how long would it take 36 people?

7) It takes 24 minutes for a person riding at 30 km/h to get to work from home.

   How long would it take that person if they travelled at 36 km/h instead?

1) 1 person can cut a large area of grass in 5 hours.

a) At the same rate, how long would it take 2 people to cut the grass?   2.5 hours

b) At the same rate, how long would it take 5 people to cut the grass?   1 hour

2) 2 people can assemble a shed in 1 hour.

a) Work out how long it would take 4 people (working at the same rate).   30 minutes

b) Work out how long it would take just 1 person (working at the same rate).   2 hours

3) A local lottery draw is won by 5 people and they each receive £125 300

Work out how much they would each have got if only 4 people had won.   £156 625

4) It takes 5 people 12 hours to build a wall.

a) Work out how long it would take 3 people to build the wall (working at the same rate).   20 hours

b) Work out how long it would take 6 people to build the wall (working at the same rate).   10 hours

5) It takes 3 people 8 hours to complete a job.

a) At the same rate, how long would it take 4 people to complete the same job?   6 hours

b) At the same rate, how long would it take 2 people to complete the same job?   12 hours

6) 6 people can paint a bridge in 18 days.

a) At the same rate, how long would it take 9 people?   12 days

b) At the same rate, how long would it take 36 people?   3 days

7) It takes 24 minutes for a person riding at 30 km/h to get to work from home.

How long would it take that person if they travelled at 36 km/h instead?   20 minutes

1) Tom and Julie share £48 in the ratio 5 : 3
   Work out how much more money Tom gets than Julie gets.

2) Ben and Sue share £60 in the ratio 2 : 3
   Work out how much each person gets.

3) A box contains milk chocolates and plain chocolates only.
   The number of milk chocolates to the number of plain chocolates is
   in the ratio 2 : 1
   There are 24 milk chocolates.
   Work out the total number of chocolates.

4) Andy, Ben and Claire share £54

   Ben gets three times as much money as Andy.

   Claire gets twice as much money as Ben.

   How much money does Claire get?

5) There are some marbles in a bag.
   18 of the marbles are blue.
   12 of the marbles are red.
   a) Write down the ratio of the number of blue marbles to the number
      of red marbles.
      Give your ratio in its simplest form.

   There are some apples and pears in a box.
   The total number of apples and pears is 54.
   The ratio of the number of apples to the number of pears is 1 : 5

   b) Work out the number of pears in the box.

6) A piece of string is 180 cm long.
   Jim cuts it into three pieces in the ratio 2 : 3 : 4
   Work out the length of the longest piece.

7) Sally is 13 years old.
   Tammy is 12 years old.
   Danny is 10 years old.

   Sally, Tammy and Danny share £28 in the ratio of their ages.
   Tammy gives a third of her share to her mother.
   How much should Tammy now have?

1) Tom and Julie share £48 in the ratio 5 : 3
   Work out how much more money Tom gets than Julie gets.   £12

2) Ben and Sue share £60 in the ratio 2 : 3
   Work out how much each person gets.   Ben gets £24 and Sue gets £36

3) A box contains milk chocolates and plain chocolates only.
   The number of milk chocolates to the number of plain chocolates is
   in the ratio 2 : 1
   There are 24 milk chocolates.
   Work out the total number of chocolates.   36 chocolates altogether

4) Andy, Ben and Claire share £54
   Ben gets three times as much money as Andy.
   Claire gets twice as much money as Ben.

   How much money does Claire get?   £32.40

5) There are some marbles in a bag.
   18 of the marbles are blue.
   12 of the marbles are red.
   a) Write down the ratio of the number of blue marbles to the number
      of red marbles.
      Give your ratio in its simplest form.   3 : 2

   There are some apples and pears in a box.
   The total number of apples and pears is 54.
   The ratio of the number of apples to the number of pears is 1 : 5
   b) Work out the number of pears in the box.   45 pears

6) A piece of string is 180 cm long.
   Jim cuts it into three pieces in the ratio 2 : 3 : 4
   Work out the length of the longest piece.   80 cm

7) Sally is 13 years old.
   Tammy is 12 years old.
   Danny is 10 years old.

   Sally, Tammy and Danny share £28 in the ratio of their ages.
   Tammy gives a third of her share to her mother.
   How much should Tammy now have?   £6.40

1)   In a box of chocolates, the ratio of plain chocolates to milk chocolates is 2 : 5.

   a) What fraction of the chocolates are plain ones?

   b) What fraction of the chocolates are milk ones?

2)   If the ratio of $x : y$ is 3 : 7, which of the following statements are correct?

   a) x is $\frac{3}{7}$ of $(x + y)$

   b) x is $\frac{3}{10}$ $x + y)$

   c) y is $\frac{7}{10}$ x

   d) y is $\frac{7}{10}$ $x + y)$

3)   Pounds can be converted to kilograms using the ratio 11 : 5.

   a) Use the squares, below, to draw a conversion graph to illustrate this.

   b) Convert 24 pounds to kilograms.

   c)   Convert 14 kilograms to pounds.
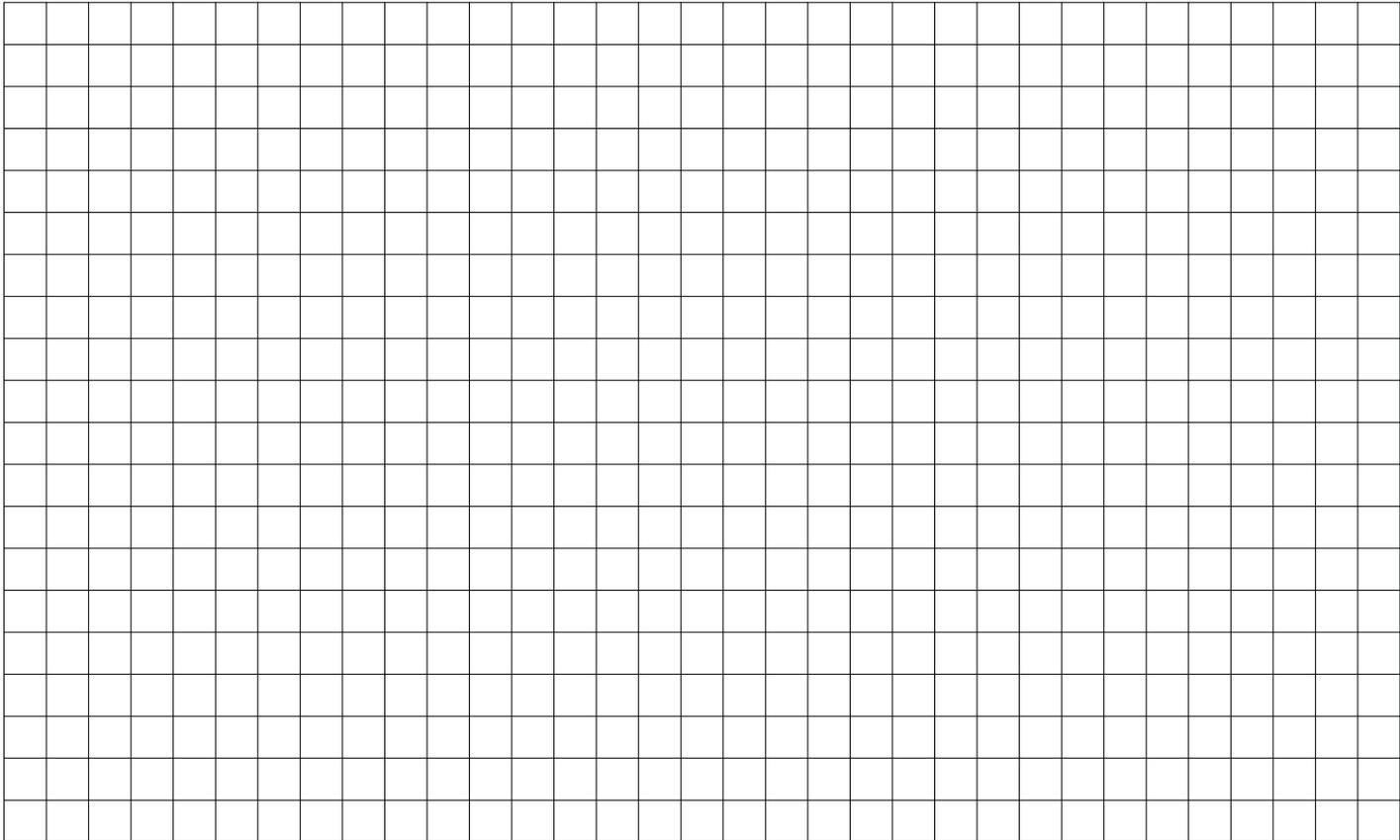
1) In a box of chocolates, the ratio of plain chocolates to milk chocolates is 2 : 5.

  a) What fraction of the chocolates are plain ones? $\frac{2}{7}$

  b) What fraction of the chocolates are milk ones? $\frac{5}{7}$

2) If the ratio of $x : y$ is 3 : 7, which of the following statements are correct? b and d

  a) x is $\frac{3}{7}$ of $(x + y)$

  b) x is $\frac{3}{10}$ $x + y)$

  c) y is $\frac{7}{10}$ x

  d) y is $\frac{7}{10}$ $x + y)$

3) Pounds can be converted to kilograms using the ratio 11 : 5.

  a) Use the squares, below, to draw a conversion graph to illustrate this.

  b) Convert 24 pounds to kilograms. 11 kg

  c) Convert 14 kilograms to pounds. 30.8 lb
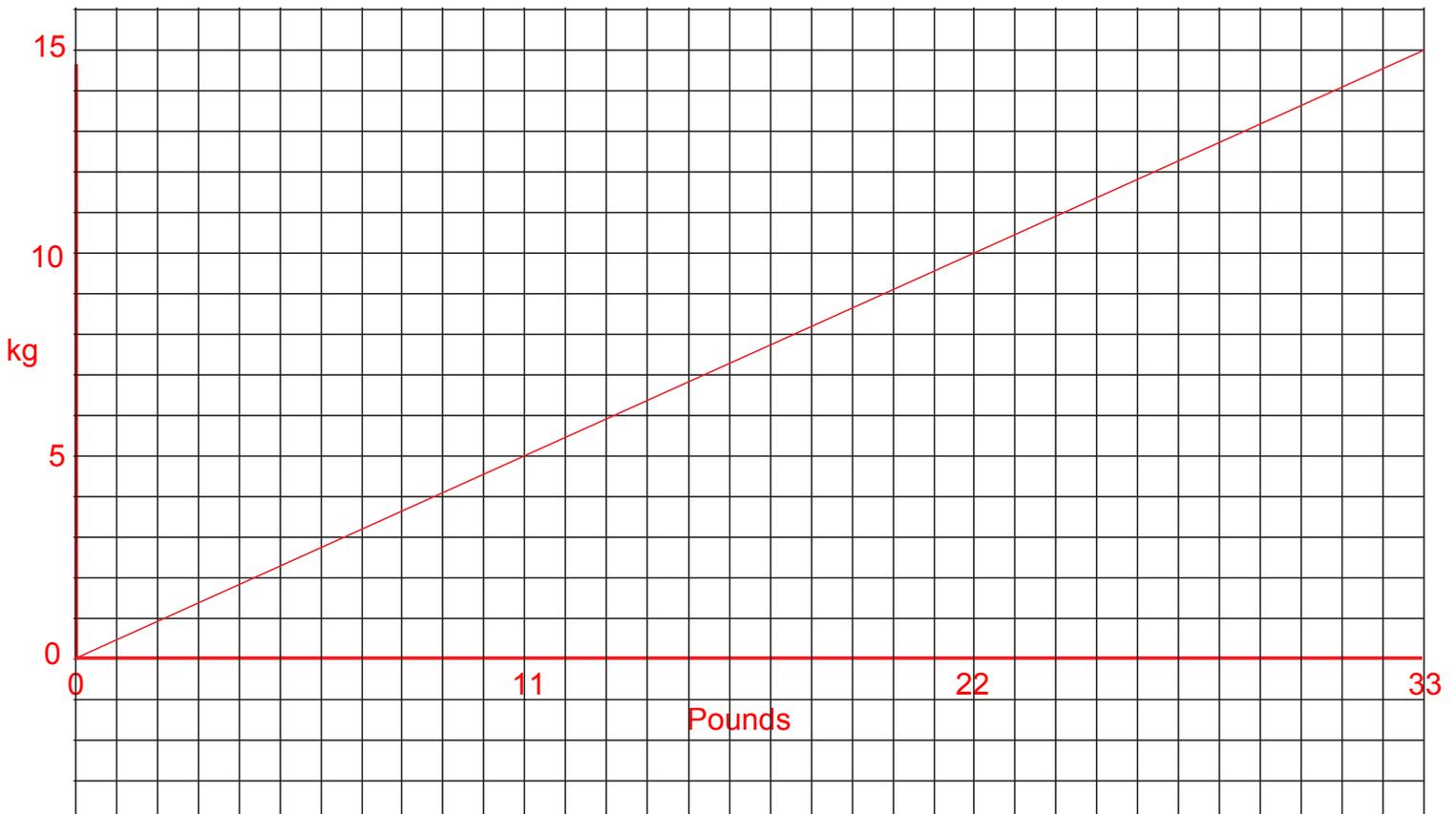
1) Lance goes on holiday to France.
The exchange rate is £1 = 1.15 Euros.

He changes £350 into Euros.

a) How many Euros should he get?

In France, Lance buys a digital camera for 115 Euros.

b) Work out the cost of the camera in pounds.

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?
Show all your working.

3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£).

4) The exchange rate in London is £1 = €1.14
The exchange rate in Paris is €1 = £0.86

Tony wants to change some pounds into euros.

In which of these cities would Tony get the most euros?
All working must be shown.

Exchanging Money

1) Lance goes on holiday to France.
   The exchange rate is £1 = 1.15 Euros.

   He changes £350 into Euros.

   a) How many Euros should he get?   €402.50

   In France, Lance buys a digital camera for 115 Euros.

   b) Work out the cost of the camera in pounds.   £100

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
   In England, an identical pair of sunglasses costs £59.99.
   The exchange rate is £1 = 1.40 Euros.

   In which country were the glasses the cheapest, and by how much?
   Show all your working.   Spain, by £4.99

   77 ÷ 1.40 = 55   59.99 - 55.00 = 4.99

3) Luke buys a pair of trainers in Switzerland.
   He can pay either 86 Swiss Francs or 56 Euros.
   The exchange rates are:
   £1 = 2.10 Swiss Francs
   £1 = 1.40 Euros

   Which currency should he choose to get the best price, and how much would he save?
   Give your answer in pounds (£).   Euros, saving £0.95

4) The exchange rate in London is £1 = €1.14
   The exchange rate in Paris is €1 = £0.86

   Tony wants to change some pounds into euros.

   In which of these cities would Tony get the most euros?
   All working must be shown.   Paris

   eg Suppose Tony changes £100.
   In London he would get 100 × 1.14 = €114
   In Paris he would get 100 ÷ 0.86 = €116.28

Percentage Change

1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold.

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College.

3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction?

4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate.

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures.

6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20

b) DVD recorder bought for £42, sold for £60.90

c) Gold necklace bought for £90, sold for £78.30

d) A DVD collection bought for £120, sold for £81.60

Percentage Change

1) A car dealer is comparing his sales over the past two years.
   In 2006, he sold 175 cars.
   In 2007, he sold 196 cars.

   Work out the percentage increase in the number of cars sold.   **12%**

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
   In September 2006, the number of pupils attending MathsWatch College was 1014.

   Work out the percentage decrease in the number of pupils attending MathsWatch College.   **25%**

3) The usual price of a shirt is £32.50
   In a sale, the shirt is reduced to £29.25

   What is the percentage reduction?   **10%**

4) Olivia opened an account with £750 at the MathsWatch Bank.
   After one year, the bank paid her interest.
   She then had £795 in her account.

   Work out, as a percentage, MathsWatch Bank's interest rate.   **6%**

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

   What is his percentage profit?
   Give your answer to 2 significant figures.   **11%**

6) Shelley bought some items at a car boot sale and then sold them on ebay.
   Work out the percentage profit or loss she made on each of these items.

   a) Trainers bought for £15, sold for £20   **33.3% profit**

   b) DVD recorder bought for £42, sold for £60.90   **45% profit**

   c) Gold necklace bought for £90, sold for £78.30   **13% loss**

   d) A DVD collection bought for £120, sold for £81.60   **32% loss**

1) Increase:
   a) 500 by 10%   c) 80 by 15%

   b) 320 by 10%   d) 75 by 20%

2) Decrease:
   a) 400 by 10%   c) 140 by 15%

   b) 380 by 10%   d) 35 by 20%

3) The price of a laptop is increased by 15%.
   The old price of the laptop was £300.
   Work out the new price.

4) The price of a £6800 car is reduced by 10%.
   What is the new price?

5) Increase:
   a) 65 by 12%   c) 600 by 17.5%

   b) 120 by 23%   d) 370 by 17.5%

6) Decrease:
   a) 42 by 15%   c) 52 by 8.5%

   b) 79 by 12%   d) 8900 by 18%

7) The price of a mobile phone is £78.40 plus VAT.
   VAT is charged at a rate of 17.5%.
   What is the total price of the mobile phone?

8) In a sale, normal prices are reduced by 7%.
   The normal price of a camera is £89.
   Work out the sale price of the camera.

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
   Peter intends to buy a car which usually costs £6800.
   He intends to pay by cash.
   Work out how much he will pay.

10) A month ago, John weighed 97.5 kg.
    He now weighs 4.5% more.
    Work out how much John now weighs.
    Give your answer to 1 decimal place.

1) Increase:
   a) 500 by 10%
      550
   b) 320 by 10%
      352
   c) 80 by 15%
      92
   d) 75 by 20%
      90

2) Decrease:
   a) 400 by 10%
      360
   b) 380 by 10%
      342
   c) 140 by 15%
      119
   d) 35 by 20%
      28

3) The price of a laptop is increased by 15%.
   The old price of the laptop was £300.
   Work out the new price.   £345

4) The price of a £6800 car is reduced by 10%.
   What is the new price?   £6120

5) Increase:
   a) 65 by 12%   72.8
   b) 120 by 23%   147.6
   c) 600 by 17.5%   705
   d) 370 by 17.5%   434.75

6) Decrease:
   a) 42 by 15%   35.7
   b) 79 by 12%   69.52
   c) 52 by 8.5%   47.58
   d) 8900 by 18%   7 298

7) The price of a mobile phone is £78.40 plus VAT.
   VAT is charged at a rate of 17.5%.
   What is the total price of the mobile phone?   £92.12

8) In a sale, normal prices are reduced by 7%.
   The normal price of a camera is £89.
   Work out the sale price of the camera.   £82.77

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
   Peter intends to buy a car which usually costs £6800.
   He intends to pay by cash.
   Work out how much he will pay.   £5440

10) A month ago, John weighed 97.5 kg.
    He now weighs 4.5% more.
    Work out how much John now weighs.   101.9 kg
    Give your answer to 1 decimal place.

1)   Meg has £1200 in her savings account.
       The account pays 5% simple interest per year.

       How much interest will she earn in 4 years?

2)   Dan has £4000 in his savings account.
       This account pays 2% interest per year.

       How much interest will he earn in 6 years?

3)   Chris borrows £6000 at a simple interest rate of 10% per year.
       He pays the money back after 4 years.

       How much does he pay back in total?

4)   Lisa borrows £3000 at a simple interest rate of 2.5% per year.
       She pays the money back after 3 years.

       How much does she pay back in total?

5)   Kate borrows £2000 at a simple interest rate of 16% per year.
       She pays the money back after 3 months.

       How much does she pay back in total?

6)   Neil invested £8000 in a savings account for 2 years.
       He earned £640 simple interest over the two years.

       What was the interest rate?

1)   Meg has £1200 in her savings account.
     The account pays 5% simple interest per year.

     How much interest will she earn in 4 years?

       £240

2)   Dan has £4000 in his savings account.
     This account pays 2% interest per year.

     How much interest will he earn in 6 years?

       £480

3)   Chris borrows £6000 at a simple interest rate of 10% per year.
     He pays the money back after 4 years.

     How much does he pay back in total?

       £8400

4)   Lisa borrows £3000 at a simple interest rate of 2.5% per year.
     She pays the money back after 3 years.

     How much does she pay back in total?

       £3225

5)   Kate borrows £2000 at a simple interest rate of 16% per year.
     She pays the money back after 3 months.

     How much does she pay back in total?

       £2080

6)   Neil invested £8000 in a savings account for 2 years.
     He earned £640 simple interest over the two years.

     What was the interest rate?

       4%

1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years.

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years.

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years?

4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years?

5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether?

6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years?

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years?

8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it?

9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.69 in the bank?

10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66?

1) Henry places £6000 in an account which pays 4.6% compound interest each year.

Calculate the amount in his account after 2 years. **£6564.70**

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.

Calculate the amount Sarah has in her account after 4 years. **£9983.62**

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.

How much will Mary have in her account after 5 years? **£13131.66**

4) Susan places £7900 in an account which pays 2.4% compound interest per year.

How much interest does she earn in 3 years? **£582.56**

5) Harry puts money into an account which pays 6% compound interest per year.

If he puts £23000 in the account for 5 years how much interest will he earn altogether? **£7779.19**

6) Laura buys a new car for £14600.

The annual rate of depreciation is 23%.

How much is the car worth after 3 years? **£6665.38**

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years? **£79.63**

8) Sharon pays £3500 for a secondhand car.

The annual rate of depreciation of the car is 24%

How much will it be worth four years after she has bought it? **£1167.68**

9) Dave places £17000 in an account which pays 4% compound interest per year.

How many years will it take before he has £19122.69 in the bank? **3 years**

10) A new motorbike costs £8900.

The annual rate of depreciation is 18% per year.

After how many years will it be worth £2705.66? **6 years**

Write each recurring decimal as an exact fraction,
in its lowest terms.

a) $0.\dot{5}$

b) $0.\dot{7}$

c) $0.\dot{4}$

d) $0.\dot{2}\dot{4}$

e) $0.\dot{7}\dot{5}$

f) $0.\dot{8}\dot{2}$

g) $0.\dot{6}1\dot{7}$

h) $0.\dot{2}1\dot{6}$

i) $0.\dot{7}1\dot{4}$

j) $0.\dot{3}2\dot{4}$

k) $0.\dot{7}235\dot{7}$

l) $0.\dot{6}521\dot{4}$

Write each recurring decimal as an exact fraction,
in its lowest terms.

a) $0.\dot{5}$ $\dfrac{5}{9}$

b) $0.\dot{7}$ $\dfrac{7}{9}$

c) $0.\dot{4}$ $\dfrac{4}{9}$

d) $0.\dot{2}\dot{4}$ $\dfrac{8}{33}$

e) $0.\dot{7}\dot{5}$ $\dfrac{25}{33}$

f) $0.\dot{8}\dot{2}$ $\dfrac{82}{99}$

g) $0.\dot{6}1\dot{7}$ $\dfrac{617}{999}$

h) $0.\dot{2}1\dot{6}$ $\dfrac{8}{37}$

i) $0.\dot{7}1\dot{4}$ $\dfrac{238}{333}$

j) $0.\dot{3}2\dot{4}$ $\dfrac{12}{37}$

k) $0.\dot{7}235\dot{7}$ $\dfrac{89}{123}$

l) $0.\dot{6}521\dot{4}$ $\dfrac{7246}{11111}$

1) Expand these brackets

   a) $2(x + 3)$

   b) $3(2x + 4)$

   c) $5(3p - 2q)$

   d) $4(x^2 + 2y^2)$

   e) $6(r - r^2)$

2) Expand these brackets

   a) $x(x - 2)$

   b) $x(3x + 5)$

   c) $p(3p - 7q)$

   d) $y(y + 6y^2)$

   e) $x(r + r^2)$

3) Expand these brackets

   a) $2x(x - 5)$

   b) $4x(2x + 3)$

   c) $5p(4p - 2q)$

   d) $2y(3y + 4x^2)$

   e) $x(x + r^2)$

4) Expand these brackets

   a) $x(x^2 - 2)$

   b) $3x(2x^3 + 1)$

   c) $5p^2(4p - 2)$

   d) $2y^2(3y^3 + 4y)$

   e) $2xy(x + y^2)$

5) Expand and simplify

   a) $2(x + y) + 3(x + y)$

   b) $3(2x + y) + 2(5x + 3y)$

   c) $5(x + y) + 3(2x + y)$

   d) $3(2c + d) + 2(c + d)$

   e) $4(2p + q) + 3(2p + q)$

6) Expand and simplify

   a) $2(x + y) + 3(x - y)$

   b) $5(2x + y) + 2(3x - 2y)$

   c) $4(x - y) + 3(2x + y)$

   d) $6(2c - d) + 2(c - d)$

   e) $2(5p - q) + 3(p - 2q)$

7) Expand and simplify

   a) $3(x + 2y) - 3(x - y)$

   b) $5(2x - y) - 2(3x - 2y)$

   c) $7(x - 2y) - 3(2x + y)$

   d) $6(2x - y) - 2(x + 2y)$

   e) $2(5p - q) - (p - 3q)$

Expanding and Simplifying Brackets - Single Set of Brackets

1) Expand these brackets

  a) $2(x + 3)$ $2x + 6$

  b) $3(2x + 4)$ $6x + 12$

  c) $5(3p - 2q)$ $15p - 10q$

  d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

  e) $6(r - r^2)$ $6r - 6r^2$

2) Expand these brackets

  a) $x(x - 2)$ $x^2 - 2x$

  b) $x(3x + 5)$ $3x^2 + 5x$

  c) $p(3p - 7q)$ $3p^2 - 7pq$

  d) $y(y + 6y^2)$ $y^2 + 6y^3$

  e) $x(r + r^2)$ $xr + xr^2$

3) Expand these brackets

  a) $2x(x - 5)$ $2x^2 - 10x$

  b) $4x(2x + 3)$ $8x^2 + 12x$

  c) $5p(4p - 2q)$ $20p^2 - 10pq$

  d) $2y(3y + 4x^2)$ $6y^2 + 8x^2y$

  e) $x(x + r^2)$ $x^2 + r^2x$

4) Expand these brackets

  a) $x(x^2 - 2)$ $x^3 - 2x$

  b) $3x(2x^3 + 1)$ $6x^4 + 3x$

  c) $5p^2(4p - 2)$ $20p^3 - 10p^2$

  d) $2y^2(3y^3 + 4y)$ $6y^5 + 8y^3$

  e) $2xy(x + y^2)$ $2x^2y + 2xy^3$

5) Expand and simplify

  a) $2(x + y) + 3(x + y)$ $5x + 5y$

  b) $3(2x + y) + 2(5x + 3y)$ $16x + 9y$

  c) $5(x + y) + 3(2x + y)$ $11x + 8y$

  d) $3(2c + d) + 2(c + d)$ $8c + 5d$

  e) $4(2p + q) + 3(2p + q)$ $14p + 7q$

6) Expand and simplify

  a) $2(x + y) + 3(x - y)$ $5x - y$

  b) $5(2x + y) + 2(3x - 2y)$ $16x + y$

  c) $4(x - y) + 3(2x + y)$ $10x - y$

  d) $6(2c - d) + 2(c - d)$ $14c - 8d$

  e) $2(5p - q) + 3(p - 2q)$ $13p - 8q$

7) Expand and simplify

  a) $3(x + 2y) - 3(x - y)$ $9y$

  b) $5(2x - y) - 2(3x - 2y)$ $4x - y$

  c) $7(x - 2y) - 3(2x + y)$ $x - 17y$

  d) $6(2x - y) - 2(x + 2y)$ $10x - 10y$

  e) $2(5p - q) - (p - 3q)$ $9p + q$

Expanding and Simplifying Brackets - Double Set of Brackets

1) Expand and simplify

   a) $(x + 3)(x + 2)$

   b) $(x + 5)(x + 3)$

   c) $(x + 1)(x + 4)$

   d) $(x + 6)(x + 4)$

   e) $(x + 5)(x + 7)$

2) Expand and simplify

   a) $(x + 5)(x - 2)$

   b) $(x - 7)(x + 2)$

   c) $(x - 1)(x + 3)$

   d) $(x + 4)(x - 3)$

   e) $(x - 5)(x + 5)$

3) Expand and simplify

   a) $(x - 3)(x - 4)$

   b) $(x - 2)(x - 6)$

   c) $(x - 1)(x - 1)$

   d) $(x - 7)(x - 2)$

   e) $(x - 4)(x - 5)$

4) Expand and simplify

   a) $(x - 7)(x + 1)$

   b) $(p - 6)(p + 4)$

   c) $(e - 3)(e - 7)$

   d) $(x + 8)(x + 1)$

   e) $(x - 5)(x - 5)$

5) Expand and simplify

   a) $(2x + 3)(2x + 1)$

   b) $(3p - 4)(2p + 5)$

   c) $(e - 3)(3e - 4)$

   d) $(4x - 6)(2x + 1)$

   e) $(2x - 3)(2x + 3)$

6) Expand and simplify

   a) $(2x + y)(3x + 2y)$

   b) $(3p - 2q)(4p + 5q)$

   c) $(4e - 3f)(2e - 2f)$

   d) $(6x - y)(6x + y)$

   e) $(3x - 2y)(x - 5y)$

1) Expand and simplify

   a) $(x + 3)(x + 2)$ $x^2 + 5x + 6$

   b) $(x + 5)(x + 3)$ $x^2 + 8x + 15$

   c) $(x + 1)(x + 4)$ $x^2 + 5x + 4$

   d) $(x + 6)(x + 4)$ $x^2 + 10x + 24$

   e) $(x + 5)(x + 7)$ $x^2 + 12x + 35$

2) Expand and simplify

   a) $(x + 5)(x - 2)$ $x^2 + 3x - 10$

   b) $(x - 7)(x + 2)$ $x^2 - 5x - 14$

   c) $(x - 1)(x + 3)$ $x^2 + 2x - 3$

   d) $(x + 4)(x - 3)$ $x^2 + x - 12$

   e) $(x - 5)(x + 5)$ $x^2 - 25$

3) Expand and simplify

   a) $(x - 3)(x - 4)$ $x^2 - 7x + 12$

   b) $(x - 2)(x - 6)$ $x^2 - 8x + 12$

   c) $(x - 1)(x - 1)$ $x^2 - 2x + 1$

   d) $(x - 7)(x - 2)$ $x^2 - 9x + 14$

   e) $(x - 4)(x - 5)$ $x^2 - 9x + 20$

4) Expand and simplify

   a) $(x - 7)(x + 1)$ $x^2 - 6x - 7$

   b) $(p - 6)(p + 4)$ $p^2 - 2p - 24$

   c) $(e - 3)(e - 7)$ $e^2 - 10e + 21$

   d) $(x + 8)(x + 1)$ $x^2 + 9x + 8$

   e) $(x - 5)(x - 5)$ $x^2 - 10x + 25$

5) Expand and simplify

   a) $(2x + 3)(2x + 1)$ $4x^2 + 8x + 3$

   b) $(3p - 4)(2p + 5)$ $6p^2 + 7p - 20$

   c) $(e - 3)(3e - 4)$ $3e^2 - 13e + 12$

   d) $(4x - 6)(2x + 1)$ $8x^2 - 8x - 6$

   e) $(2x - 3)(2x + 3)$ $4x^2 - 9$

6) Expand and simplify

   a) $(2x + y)(3x + 2y)$ $6x^2 + 7xy + 2y^2$

   b) $(3p - 2q)(4p + 5q)$ $12p^2 + 7pq - 10q^2$

   c) $(4e - 3f)(2e - 2f)$ $8e^2 - 14ef + 6f^2$

   d) $(6x - y)(6x + y)$ $36x^2 - y^2$

   e) $(3x - 2y)(x - 5y)$ $3x^2 - 17xy + 10y^2$

Solving Equations

1) Solve $2x - 3 = 17$

2) Solve $3x + 2 = 14$

3) Solve $5x - 7 = 33$

4) Solve $4x + 7 = 19$

5) Solve $x + x + x + x = 20$

6) Solve $x + 3x = 24$

7) Solve $2(x + 3) = 8$

8) Solve $2(3x - 4) = 22$

9) Solve $5(t - 1) = 20$

10) Solve $3(2x + 5) = 36$

11) Solve $2x + 7 = x + 11$

12) Solve $5y - 2 = 3y + 10$

13) Solve $2x + 1 = 5x - 20$

14) Solve $p - 3 = 3p - 11$

15) Solve $2d + 5 = 20 - 3d$

16) Solve $4 - e = 2e - 8$

17) Solve $2(x + 3) = x + 9$

18) Solve $x - 7 = 3(2x - 4)$

19) Solve $5(x + 3) = 2(x + 6)$

20) Solve $4(2y + 1) = 2(12 - y)$

21) Solve $7 - 3x = 2(x + 1)$

22) Solve $\dfrac{x}{2} = 5$

23) Solve $\dfrac{x}{5} = 6$

24) Solve $\dfrac{2x}{3} = 4$

25) Solve $\dfrac{5x}{2} = 15$

26) Solve $\dfrac{x - 2}{3} = 1$

27) Solve $\dfrac{x + 5}{2} = 7$

28) Solve $\dfrac{2x + 1}{4} = 2$

29) Solve $\dfrac{5x - 3}{3} = 4$

30) Solve $\dfrac{x + 2}{3} = x + 4$

31) Solve $\dfrac{3x - 1}{4} = 2x - 3$

32) Solve $\dfrac{4x + 3}{5} = \dfrac{2x - 1}{2}$

Solving Equations

1) Solve $2x - 3 = 17$
   $x = 10$

2) Solve $3x + 2 = 14$
   $x = 4$

3) Solve $5x - 7 = 33$
   $x = 8$

4) Solve $4x + 7 = 19$
   $x = 3$

5) Solve $x + x + x + x = 20$
   $x = 5$

6) Solve $x + 3x = 24$
   $x = 6$

7) Solve $2(x + 3) = 8$
   $x = 1$

8) Solve $2(3x - 4) = 22$
   $x = 5$

9) Solve $5(t - 1) = 20$
   $t = 5$

10) Solve $3(2x + 5) = 36$
    $x = 3.5$

11) Solve $2x + 7 = x + 11$
    $x = 4$

12) Solve $5y - 2 = 3y + 10$
    $y = 6$

13) Solve $2x + 1 = 5x - 20$
    $x = 7$

14) Solve $p - 3 = 3p - 11$
    $p = 4$

15) Solve $2d + 5 = 20 - 3d$
    $d = 3$

16) Solve $4 - e = 2e - 8$
    $e = 4$

17) Solve $2(x + 3) = x + 9$
    $x = 3$

18) Solve $x - 7 = 3(2x - 4)$
    $x = 1$

19) Solve $5(x + 3) = 2(x + 6)$
    $x = -1$

20) Solve $4(2y + 1) = 2(12 - y)$
    $y = 2$

21) Solve $7 - 3x = 2(x + 1)$
    $x = 1$

22) Solve $\dfrac{x}{2} = 5$
    $x = 10$

23) Solve $\dfrac{x}{5} = 6$
    $x = 30$

24) Solve $\dfrac{2x}{3} = 4$
    $x = 6$

25) Solve $\dfrac{5x}{2} = 15$
    $x = 6$

26) Solve $\dfrac{x - 2}{3} = 1$
    $x = 5$

27) Solve $\dfrac{x + 5}{2} = 7$
    $x = 9$

28) Solve $\dfrac{2x + 1}{4} = 2$
    $x = 3.5$

29) Solve $\dfrac{5x - 3}{3} = 4$
    $x = 3$

30) Solve $\dfrac{x + 2}{3} = x + 4$
    $x = -5$

31) Solve $\dfrac{3x - 1}{4} = 2x - 3$
    $x = 2.2$

32) Solve $\dfrac{4x + 3}{5} = \dfrac{2x - 1}{2}$
    $x = 5.5$

Page 108

1) Make c the subject of the formula.

$a = b + cd$

2) Make t the subject of the formula.

$u = v + 2t$

3) Make n the subject of the formula.

$M = 3n + 5$

4) Make z the subject of the formula.

$x = 3y + z$

5) $r = 5s + 3t$

a) Make t the subject of the formula.

b) Make s the subject of the formula.

6) Rearrange $y = 3x + 1$ to make x the subject.

7) Rearrange $y = \dfrac{1}{2}x + 2$ to make x the subject.

8) Rearrange $y = \dfrac{1}{3}x + 1$ to make x the subject.

1) Make c the subject of the formula.

$a = b + cd$

$c = \dfrac{a - b}{d}$

2) Make t the subject of the formula.

$u = v + 2t$

$t = \dfrac{u - v}{2}$

3) Make n the subject of the formula.

$M = 3n + 5$

$n = \dfrac{M - 5}{3}$

4) Make z the subject of the formula.

$x = 3y + z$

$z = x - 3y$

5) $r = 5s + 3t$

a) Make t the subject of the formula. $\quad t = \dfrac{r - 5s}{3}$

b) Make s the subject of the formula. $\quad s = \dfrac{r - 3t}{5}$

6) Rearrange $y = 3x + 1$ to make x the subject.

$x = \dfrac{y - 1}{3}$

7) Rearrange $y = \dfrac{1}{2}x + 2$ to make x the subject.

$x = 2(y - 2)$

8) Rearrange $y = \dfrac{1}{3}x + 1$ to make x the subject.

$x = 3(y - 1)$

Forming Formulae and Equations

1) The width of a rectangle is x centimetres.
   The length of the rectangle is $(x + 5)$ centimetres.

$x + 5$

x
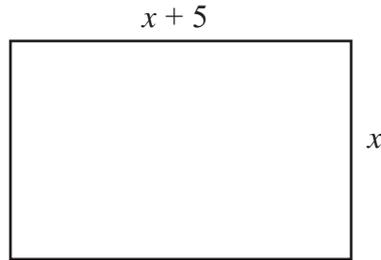
a) Find an expression, in terms of x, for the perimeter of the rectangle.
   Give your answer in its simplest form.

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle.

2)

$x + 80$

$x + 30$

$x + 10$ *Diagram **NOT**
               accurately drawn*

$2x$

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$
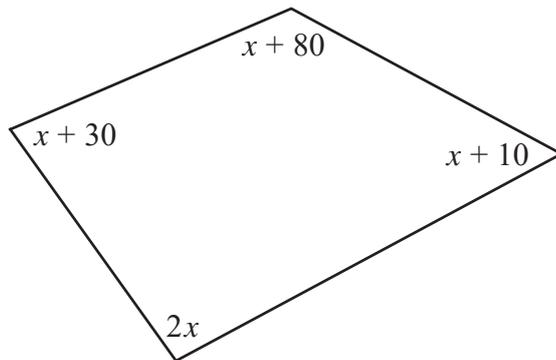
a) Use this information to write down an equation in terms of x.

b) Use your answer to part (a) to work out the size of the smallest angle of
   the quadrilateral.

3) Sarah buys 6 cups and 6 mugs
   A cup costs £x
   A mug costs £$(x + 3)$
   a) Write down an expression, in terms of x, for the total cost, in pounds,
      of 6 cups and 6 mugs.
   b) If the total cost of 6 cups and 6 mugs is £48, write an equation in
      terms of x.
   c) Solve your equation to find the cost of a cup and the cost of a mug.

1) The width of a rectangle is *x* centimetres.
The length of the rectangle is $(x + 5)$ centimetres.
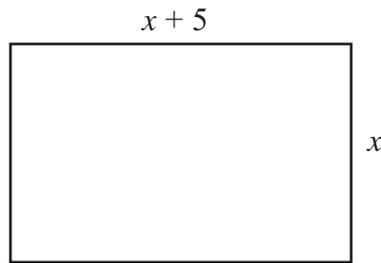
$x + 5$

x

a) Find an expression, in terms of *x*, for the perimeter of the rectangle.
Give your answer in its simplest form. **4x + 10**

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle. **12 cm**

2)
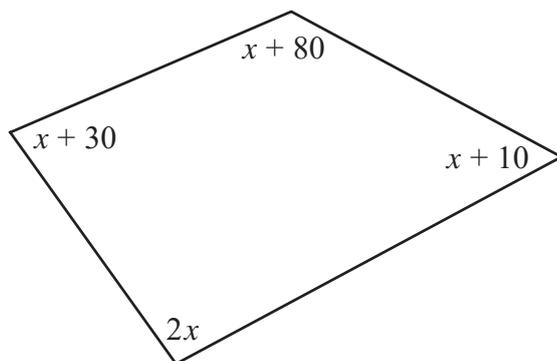
$x + 80$

$x + 30$

$x + 10$ *Diagram NOT accurately drawn*

$2x$

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$

a) Use this information to write down an equation in terms of *x*. **5x +120 = 360**

b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral. **58°**

3) Sarah buys 6 cups and 6 mugs
A cup costs £*x*
A mug costs $£(x + 3)$

a) Write down an expression, in terms of *x*, for the total cost, in pounds, of 6 cups and 6 mugs. **12x + 18**

b) If the total cost of 6 cups and 6 mugs is £48, write an equation in terms of *x*. **12x + 18 = 48**

c) Solve your equation to find the cost of a cup and the cost of a mug.
Cup: £2.50, Mug: £5.50

1)
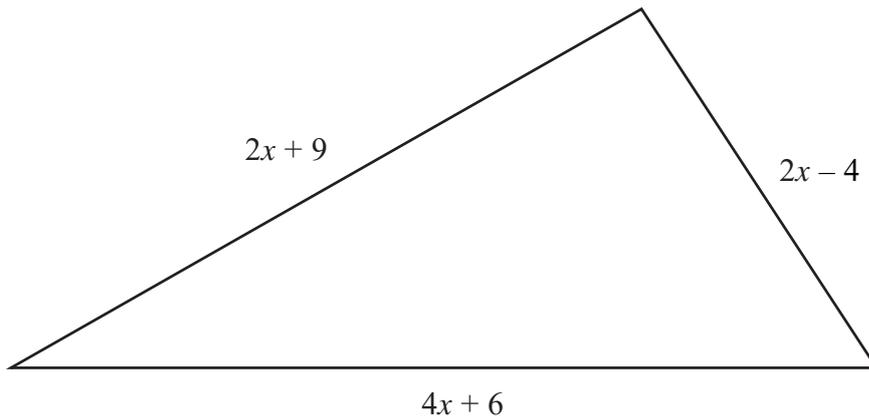
In the diagram, all measurements are in centimetres.

The lengths of the sides are

$2x + 9$
$2x - 4$
$4x + 6$

a)   Find an expression, in terms of x, for the perimeter of the triangle.
       Give your expression in its simplest form.

The perimeter of the triangle is 39 cm.

b)   Find the value of x.

2)   The diagram shows a right-angled triangle and a rectangle.
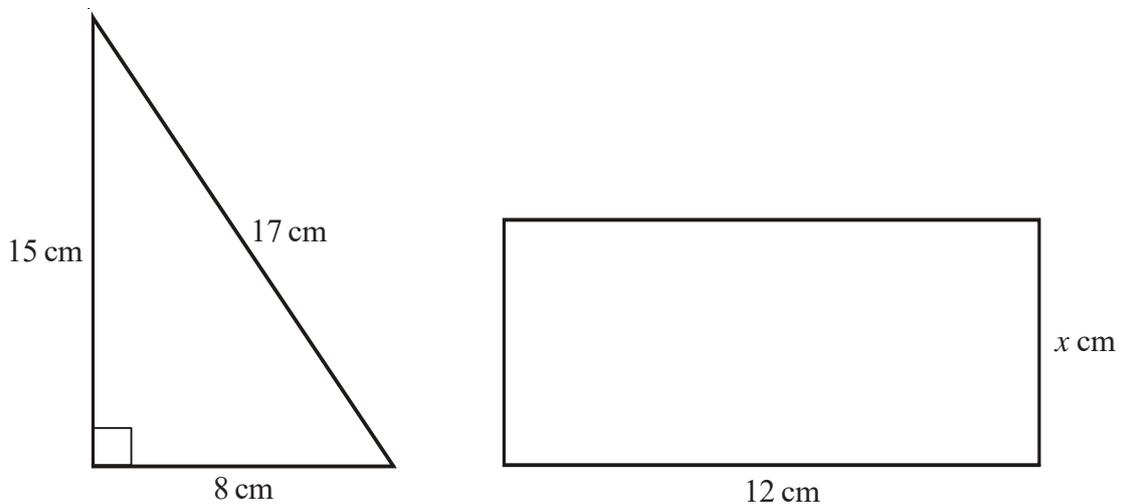
The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x.

1)

In the diagram, all measurements are in centimetres.

The lengths of the sides are

$2x + 9$
$2x - 4$
$4x + 6$
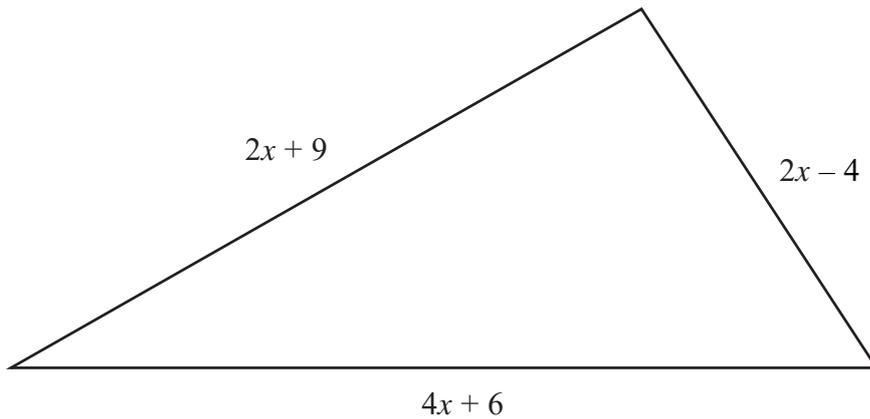
a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form. 8x + 11

The perimeter of the triangle is 39 cm.

b) Find the value of x. 3.5

2) The diagram shows a right-angled triangle and a rectangle.
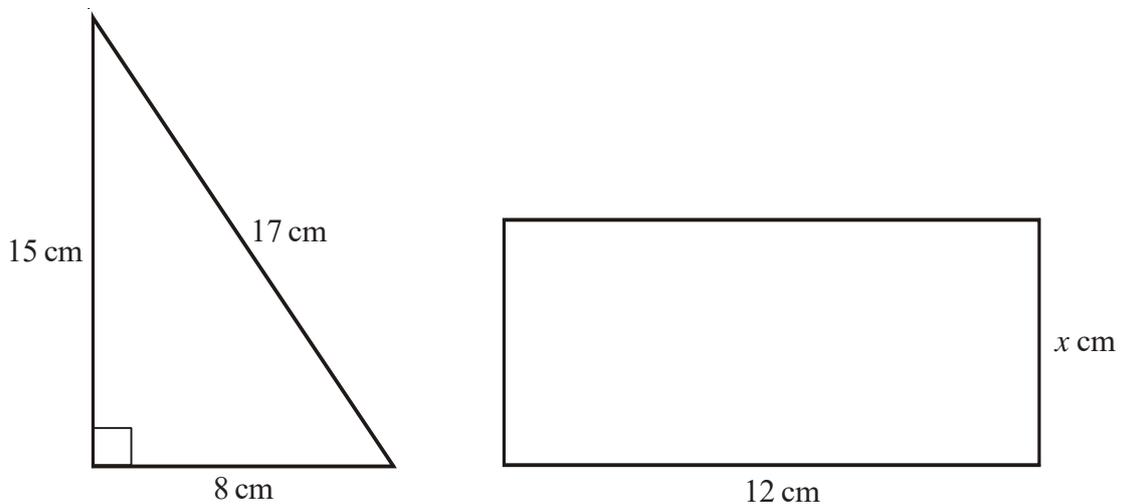
The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x. 5

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y.

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b.

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers.

4)

ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$
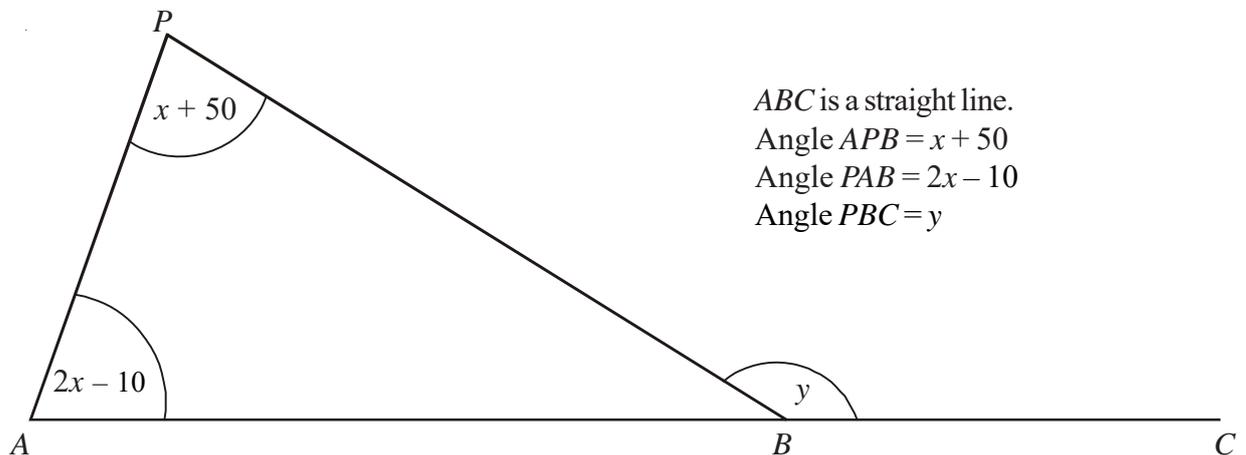
a) Show that $y = 3x + 40$
   Give reasons for each stage of your working.

b) Given that y equals 145 degrees

   (i) Work out the value of x.

   (ii) Work out the size of the largest angle in triangle APB.

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y. $T = 8x + 5y$

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b. $N = 4p + 20b$

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers. $2c + 4r$

4)
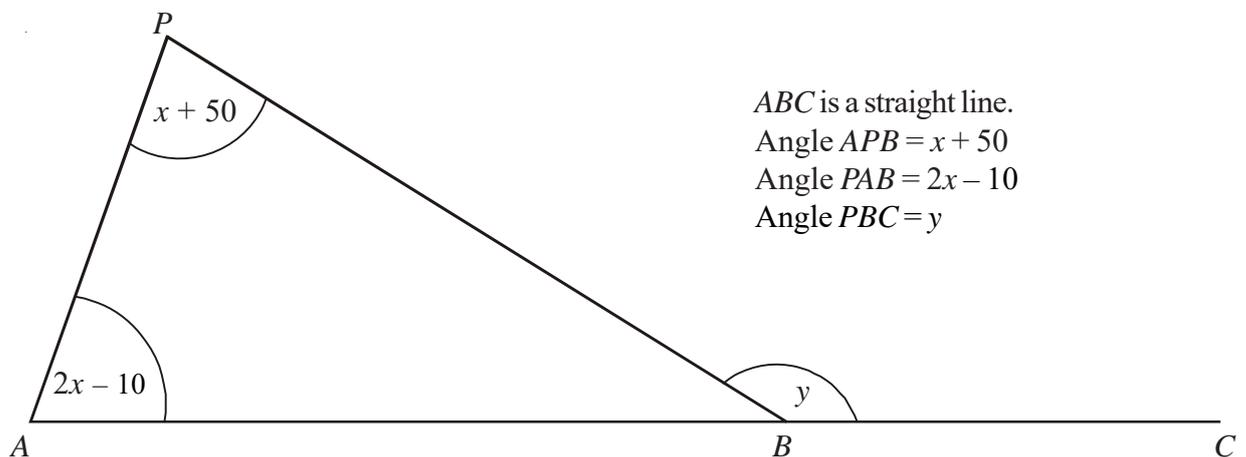
ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$

a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

Angle PAB + Angle $APB = 3x + 40$
Angle $PBA = 180 - (3x + 40)$
$\quad = 140 - 3x$
Angle $y = 180 -$ angle PBA
$\quad = 180 - (140 - 3x)$
$\quad = 40 + 3x$
$\quad = 3x + 40$

b) Given that y equals 145 degrees

(i) Work out the value of x. 35°

(ii) Work out the size of the largest angle in triangle APB. 85°

1) Represent this inequality on the number line

$$-3 < x \leqslant 2$$

-5 -4 -3 -2 -1 0 1 2 3 4 5 6

2) Represent this inequality on the number line

$$-1 \leqslant x < 5$$

-5 -4 -3 -2 -1 0 1 2 3 4 5 6

3) Write down the inequality shown

-5 -4 -3 -2 -1 0 1 2 3 4 5 6

4) Write down the inequality shown

-5 -4 -3 -2 -1 0 1 2 3 4 5 6

5) If y is an integer, write down all the possible values of

$$-2 < y \leqslant 5$$

6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

1) Represent this inequality on the number line

$$-3 < x \leqslant 2$$
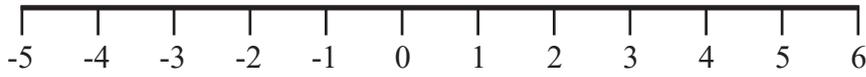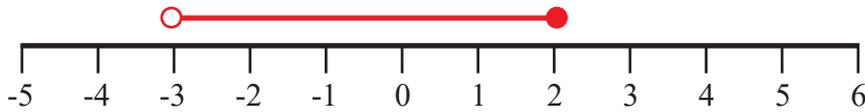
2) Represent this inequality on the number line

$$-1 \leqslant x < 5$$
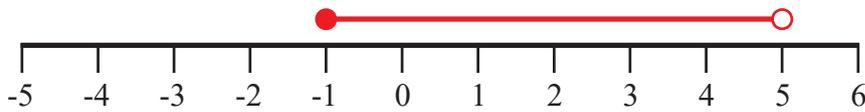
3) Write down the inequality shown $-4 < x \leq 4$
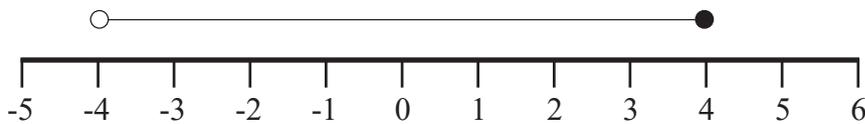
4) Write down the inequality shown $-5 \leq x \leq 3$
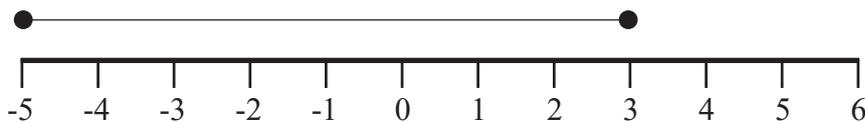
5) If y is an integer, write down all the possible values of

$$-2 < y \leqslant 5$$

-1, 0, 1, 2, 3, 4, 5

6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

-8, -7, -6

1) Solve

a) $3x - 1 > 5$

b) $7y + 2 \le 30$

c) $\dfrac{x}{2} - 3 \ge 2$

d) $5 + 2x > 7$

e) $8 < 5p - 2$

f) $\dfrac{y}{3} + 5 \ge 3$

g) $\dfrac{2x}{3} - 5 \ge -3$

h) $6x - 5 > 2x + 3$

i) $3p - 9 < 6 - 2p$

j) $5 - 3y < 2y - 10$

2) a) Solve the inequality
   $2z + 2 \ge 7$

   b) Write down the smallest **integer** value of z which satisfies the inequality
   $2z + 2 \ge 7$

3) $5x + 2y < 10$
   x and y are both integers.

   Write down two possible pairs of values that satisfy this inequality.
   $x = \text{..........}, y = \text{..........}$
   and
   $x = \text{..........}, y = \text{..........}$

1) Solve

a) $3x - 1 > 5$
   $x > 2$

b) $7y + 2 \leq 30$
   $y \leq 4$

c) $\dfrac{x}{2} - 3 \geq 2$
   $x \geq 10$

d) $5 + 2x > 7$
   $x > 1$

e) $8 < 5p - 2$
   $2 < p$

f) $\dfrac{y}{3} + 5 \geq 3$
   $y \geq -6$

g) $\dfrac{2x}{3} - 5 \geq -3$
   $x \geq 3$

h) $6x - 5 > 2x + 3$
   $x > 2$

i) $3p - 9 < 6 - 2p$
   $p < 3$

j) $5 - 3y < 2y - 10$
   $3 < y$

2) a) Solve the inequality

   $2z + 2 \geq 7$

   $z \geq 2.5$

   b) Write down the smallest **integer** value of z which satisfies the inequality

   $2z + 2 \geq 7$

   $z = 3$

3) $5x + 2y < 10$

   x and y are both integers.

   Write down two possible pairs of values that satisfy this inequality.

   $x = ...\underline{1}...., y = ...\underline{1}....$

   and   other pairs of values are possible.

   $x = ...\underline{1}...., y = ...\underline{2}....$

Solving Equations and Linear Inequalities

1) Solve the inequality $6x - 3 < 9$

2) Solve $4x + 1 = 2x + 12$

3) a) Solve the inequality $3t + 1 < t + 13$

   b) If $2t^2 = 72$ find a value of t

4) Solve $3(x + 2) = 8$

5) Solve the inequality $6y \geqslant y + 10$

6) Solve $4(2x - 3) = 5x + 7$

7) $h = 5t^2 + 3$
   Work out the value of t when $h = 48$

8) Solve $3(2p - 4) = 2p + 12$

9) Solve the equation $4x + 1 = 19$

10) Solve $\dfrac{29 - x}{3} = x + 5$

11) Solve $3x - 10 = x + 30$

12) Solve the inequality $3x - 2 > x + 7$

13) Solve the inequality $\dfrac{2x}{3} < 10$

1) Solve the inequality $6x - 3 < 9$

$x < 2$

2) Solve $4x + 1 = 2x + 12$

$x = 5.5$

3) a) Solve the inequality $3t + 1 < t + 13$

$t < 6$

b) If $2t^2 = 72$ find a value of t

$t = 6$ (or -6)

4) Solve $3(x + 2) = 8$ $x = \dfrac{2}{3}$

5) Solve the inequality $6y \geqslant y + 10$

$y > 2$

6) Solve $4(2x - 3) = 5x + 7$ $x = 6\frac{1}{3}$

7) $h = 5t^2 + 3$

Work out the value of t when $h = 48$ $t = 3$ or -3

8) Solve $3(2p - 4) = 2p + 12$

$p = 6$

9) Solve the equation $4x + 1 = 19$

$x = 4.5$

10) Solve $\dfrac{29 - x}{3} = x + 5$ $x = 3.5$

11) Solve $3x - 10 = x + 30$ $x = 20$

12) Solve the inequality $3x - 2 > x + 7$ $x > 4.5$

13) Solve the inequality $\dfrac{2x}{3} < 10$ $x < 15$

1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4
Use a trial and improvement method to find
this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4
Use a trial and improvement method to find
this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5
Use a trial and improvement method to find
 this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find
 this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

Trial and Improvement

1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - x$		=	29	
$x = 3$	$3^3 - 3$	=	24	too low
$x = 4$	$4^3 - 4$	=	60	too high
$x = 3.1$	$3.1^3 - 3.1$	=	26.691	too low
$x = 3.2$	$3.2^3 - 3.2$	=	29.568	too high
$x = 3.15$	$3.15^3 - 3.15$	=	28.105875	too low

Therefore, x = 3.2 to 1 decimal place.

3.1   3.15   3.2
Low   Low   High

2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - 4x$		=	25	
$x = 3$	$3^3 - 4 \times 3$	=	15	too low
$x = 4$	$4^3 - 4 \times 4$	=	48	too high
$x = 3.4$	$3.4^3 - 4 \times 3.4$	=	25.704	too high
$x = 3.3$	$3.3^3 - 4 \times 3.3$	=	22.737	too low
$x = 3.35$	$3.35^3 - 4 \times 3.35$	=	24.195375	too low

Therefore, x = 3.4 to 1 decimal place.

3.3   3.35   3.4
Low   Low   High

3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5
Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place.
You must show **all** your working.

$x^3 - 2x$		=	68	
$x = 4$	$4^3 - 2 \times 4$	=	56	too low
$x = 5$	$5^3 - 2 \times 5$	= 115		too high
$x = 4.2$	$4.2^3 - 2 \times 4.2$	=	65.688	too low
$x = 4.3$	$4.3^3 - 2 \times 4.3$	=	70.907	too high
$x = 4.25$	$4.25^3 - 2 \times 4.25$	=	68.265625	too high

Therefore, x = 4.2 to 1 decimal place.

4.2   4.25   4.3
Low   High   High

4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find this solution.
Give your answer correct to 1 decimal place. You must show **all** your working.

$x^3 + 4x$		= 101		
$x = 3$	$3^3 + 4 \times 3$	=	39	too low
$x = 4$	$4^3 + 4 \times 4$	=	80	too low
$x = 5$	$5^3 + 4 \times 5$	=145		too high
$x = 4.2$	$4.2^3 + 4 \times 4.2$	=	90.888	too low
$x = 4.3$	$4.3^3 + 4 \times 4.3$	=	96.707	too low
$x = 4.4$	$4.4^3 + 4 \times 4.4$	=102.784		too high
$x = 4.35$	$4.35^3 + 4 \times 4.35$	=	99.712875	too low

Therefore, x = 4.4 to 1 decimal place.

4.3   4.35   4.4
Low   Low   High

1)   The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence.

2)   The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence.

3)   The *n*th term of a number sequence is $11 - n^2$

a)   Find the third term of this sequence.

b)   Find the fifth term of this sequence.

4)   The *n*th term of a number sequence is $n^2 + n$

a)   Find the third term of this sequence.

b)   Find the fifth term of this sequence.

1) The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence. **1, 4, 9**

2) The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence. **4, 7, 12**

3) The *n*th term of a number sequence is $11 - n^2$

a) Find the third term of this sequence. **2**

b) Find the fifth term of this sequence. **-14**

4) The *n*th term of a number sequence is $n^2 + n$

a) Find the third term of this sequence. **12**

b) Find the fifth term of this sequence. **30**

1)   What is the term to term rule for each sequence, below?

      a) 1, 4, 16, 64, 256

      b) 6, 12, 24, 48, 96

      c) 80, 40, 20, 10, 5

      d) 48, 12, 3, 0.75, 0.1875

2)   a) What is the special name for this sequence?

          1, 4, 9, 16, 25

      b) What would be the 10th term of the sequence?

      c) What is the nth term of the sequence?

3)   By comparing the following sequences with the sequence of square numbers,
      find the nth term for each one.

      a) 4, 7, 12, 19, 28

      b) -1, 2, 7, 14, 23

      c) 3, 12, 27, 48, 75

4)   a) What is the special name for this sequence?

          1, 3, 6, 10, 15

      b) What would be the 8th term of the sequence?

      c) What is the nth term of the sequence?

      d) Use the nth term to work out the 21st term of the sequence.

1) What is the term to term rule for each sequence, below?

    a) 1, 4, 16, 64, 256 Multiply by 4

    b) 6, 12, 24, 48, 96   Multiply by 2

    c) 80, 40, 20, 10, 5 Divide by 2

    d) 48, 12, 3, 0.75, 0.1875   Divide by 4

2) a) What is the special name for this sequence?

       1, 4, 9, 16, 25   Square numbers

    b) What would be the 10th term of the sequence? 100

    c) What is the nth term of the sequence? n^2

3) By comparing the following sequences with the sequence of square numbers, find the nth term for each one.

    a) 4, 7, 12, 19, 28 $n^2 + 3$

    b) -1, 2, 7, 14, 23 $n^2 - 2$

    c) 3, 12, 27, 48, 75 $3n^2$

4) a) What is the special name for this sequence?

       1, 3, 6, 10, 15   Triangular numbers

    b) What would be the 8th term of the sequence? 36

    c) What is the nth term of the sequence? $\dfrac{n(n + 1)}{2}$

    d) Use the nth term to work out the 21st term of the sequence. 231

1)   Write down the next two terms of the Fibonacci sequence that begins

     1, 1, 2, 3, 5, 8, 13, . . .

2)   If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

     what is the least value of n for which $x_n > 60$?

3)   If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

     what is the value of n for which $x_n + x_{n+1} = 89$?

4)   If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

     what is the value of n for which $x_n + x_{n+1} + x_{n+2} = 68$?

5)   If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

     what is the value of n for which $x_{n-1} + x_n = 144$?

6)   If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

     what is the least value of n for which $\frac{x_{n+1}}{x_n} = 1.619$ correct to three decimal places?

1) Write down the next two terms of the Fibonacci sequence that begins

1, 1, 2, 3, 5, 8, 13, . . .   21, 34

2) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the least value of n for which $x_n > 60$?   11

3) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_n + x_{n+1} = 89$?   9

4) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_n + x_{n+1} + x_{n+2} = 68$?   7

5) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_{n-1} + x_n = 144$?   11

6) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the least value of n for which $\frac{x_{n+1}}{x_n} = 1.619$ correct to three decimal places? 8

Straight Line Graphs - The Gradient
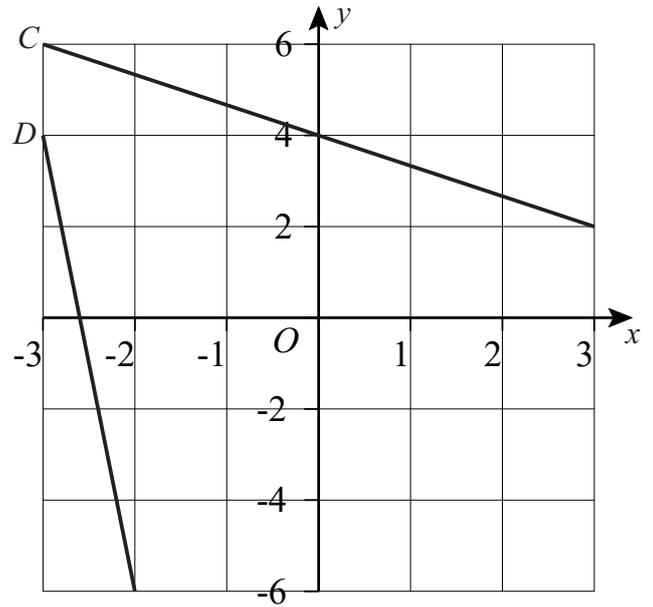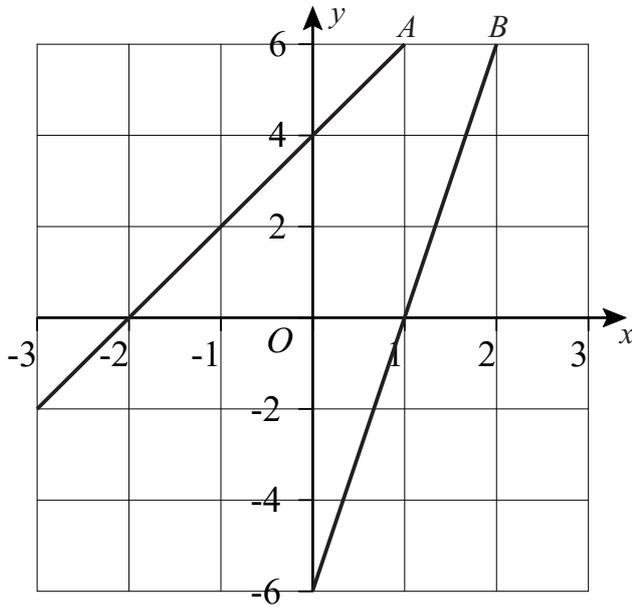
1)   Find the gradient of lines *A*, *B*, *C* and *D*.

2)   The graph shows how Meg cycles at a constant speed for 60 minutes.
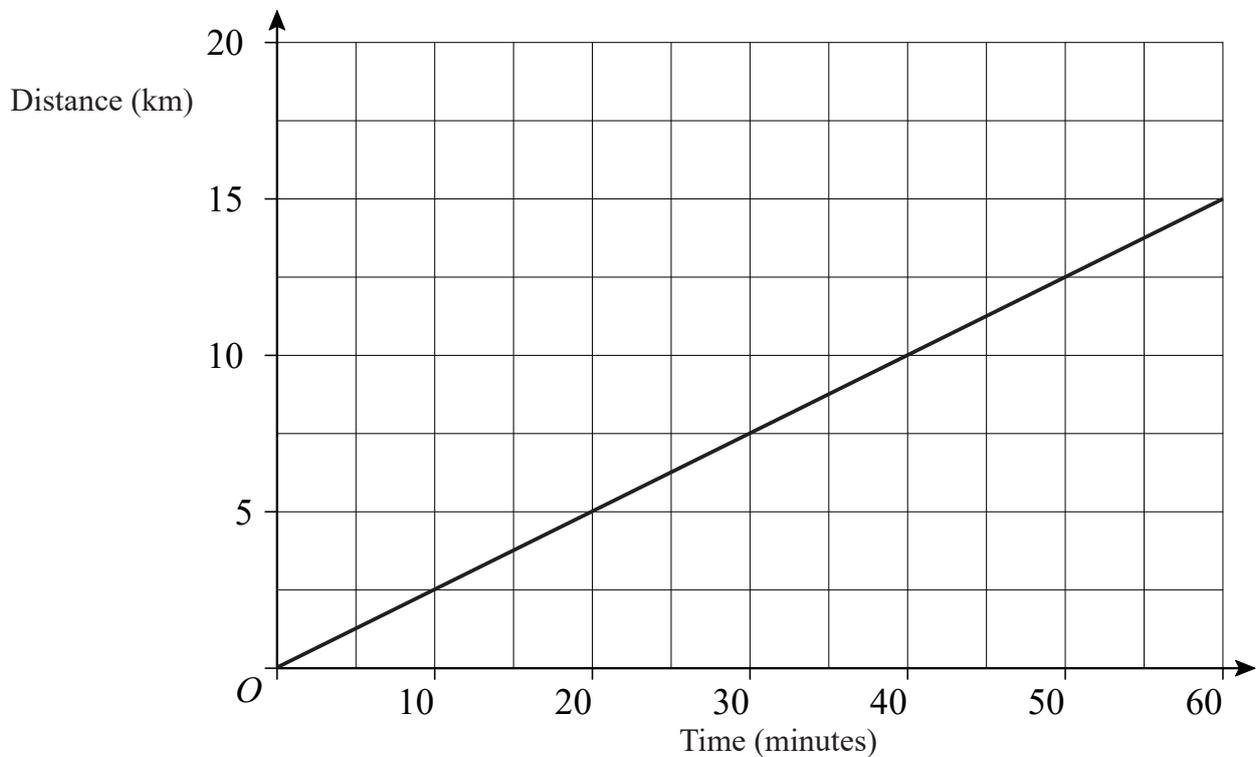
   a) Find the gradient of the line.

   b) What does the gradient show?

Straight Line Graphs - The Gradient
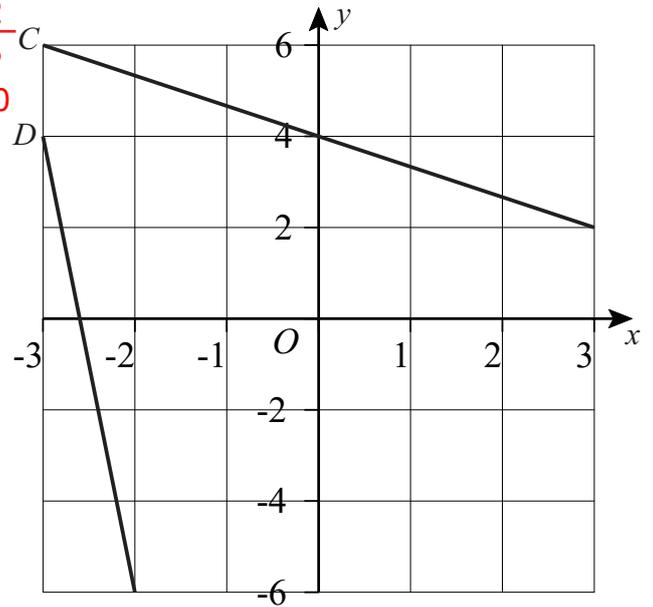
1) Find the gradient of lines *A*, *B*, *C* and *D*.

A: 2

B: 6

C: - $\frac{2}{3}$

D: -10

2) The graph shows how Meg cycles at a constant speed for 60 minutes.
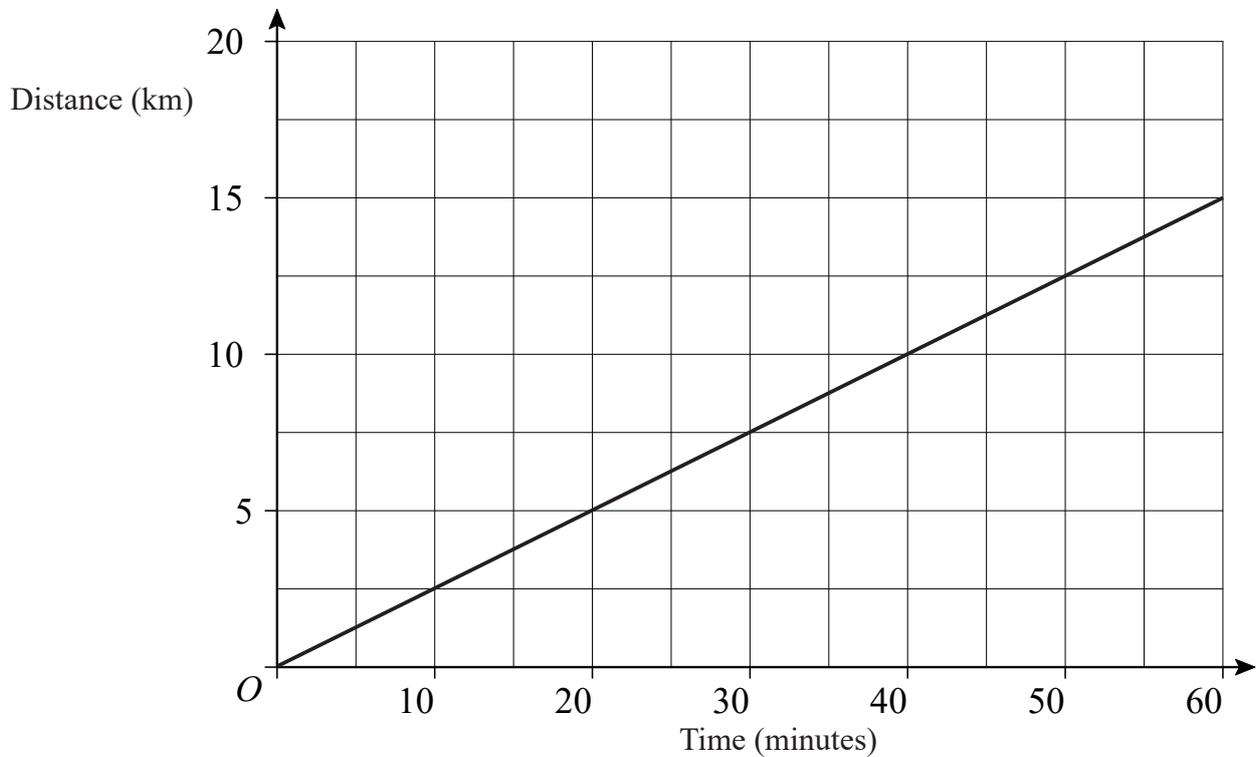
a) Find the gradient of the line. 0.25

b) What does the gradient show? Meg is cycling at 0.25 km per minute.

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2		
y		2	-2	-4		-2	

b) On the grid, draw the graph of $y = x^2 - 3x - 2$
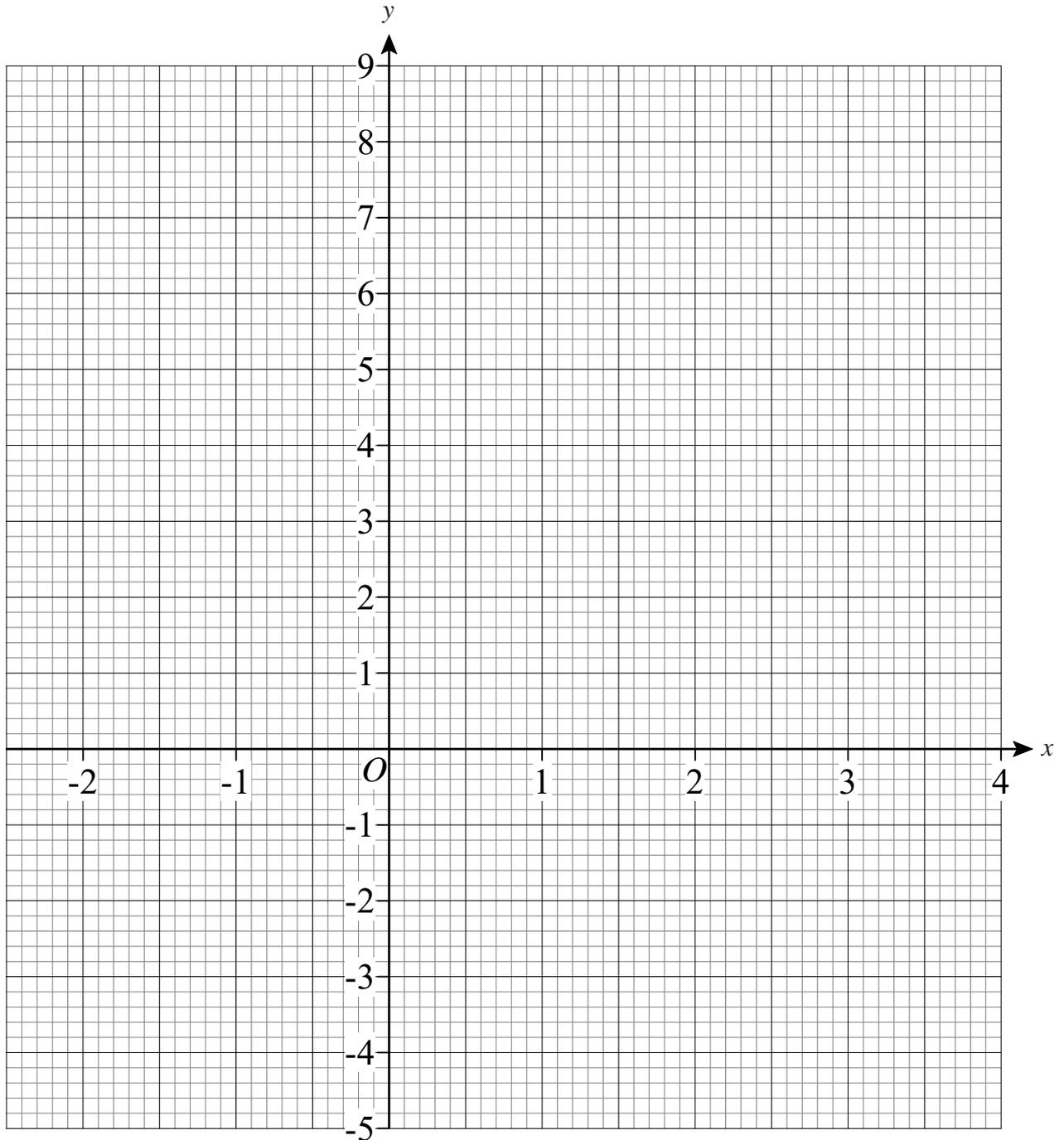
c) Use your graph to estimate the values of x when $y = -1$

Quadratic Graphs - Draw and Interpret

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2		4
y	8	2	-2	-4	-4	-2	2

b) On the grid, draw the graph of $y = x^2 - 3x - 2$
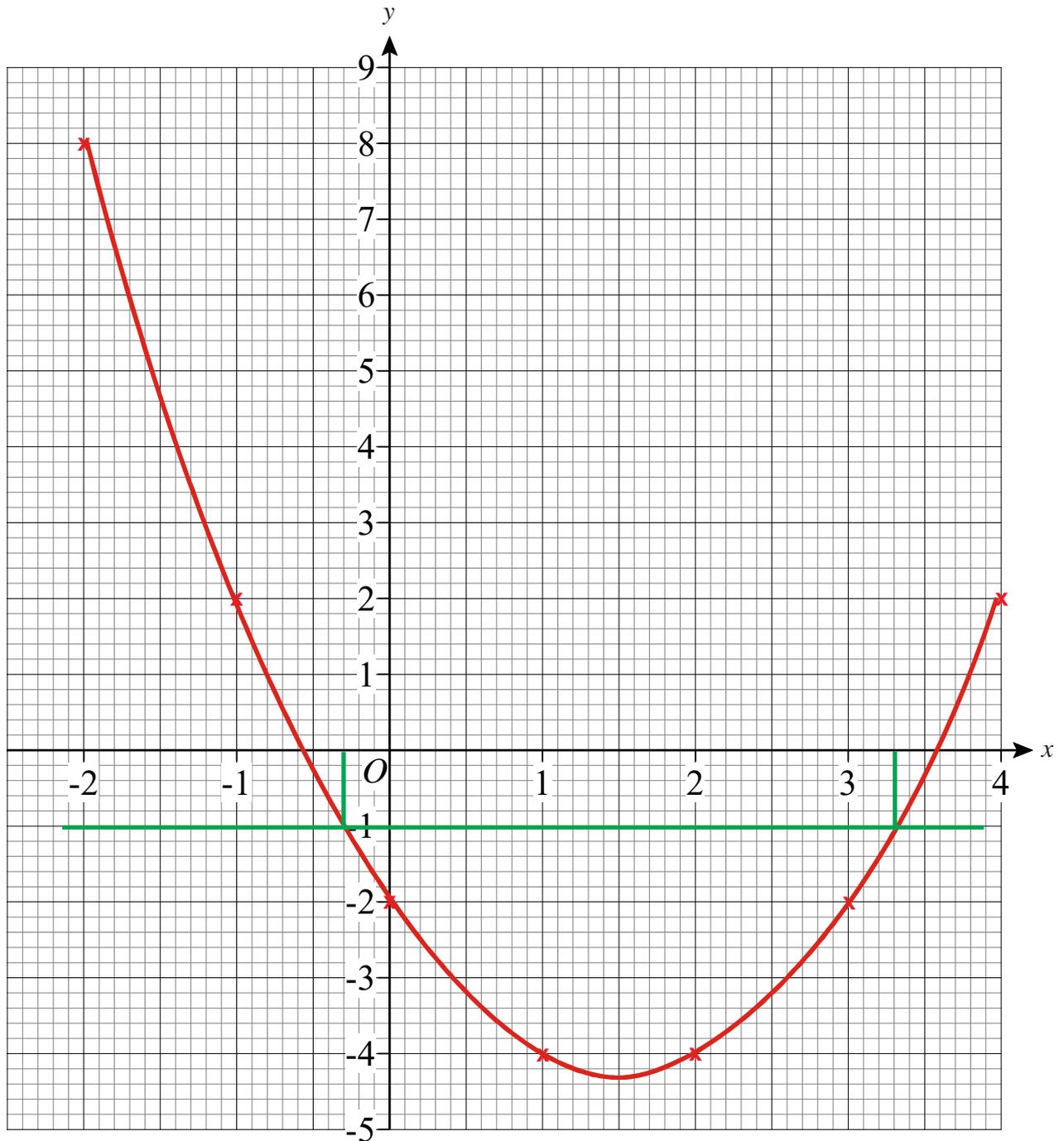
c) Use your graph to estimate the values of x when y = -1   x = -0.3 and x = 3.3

Quadratic Graphs - Draw and Interpret

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8		-2	-4				8

b) On the grid, draw the graph of $y = x^2 + x - 4$
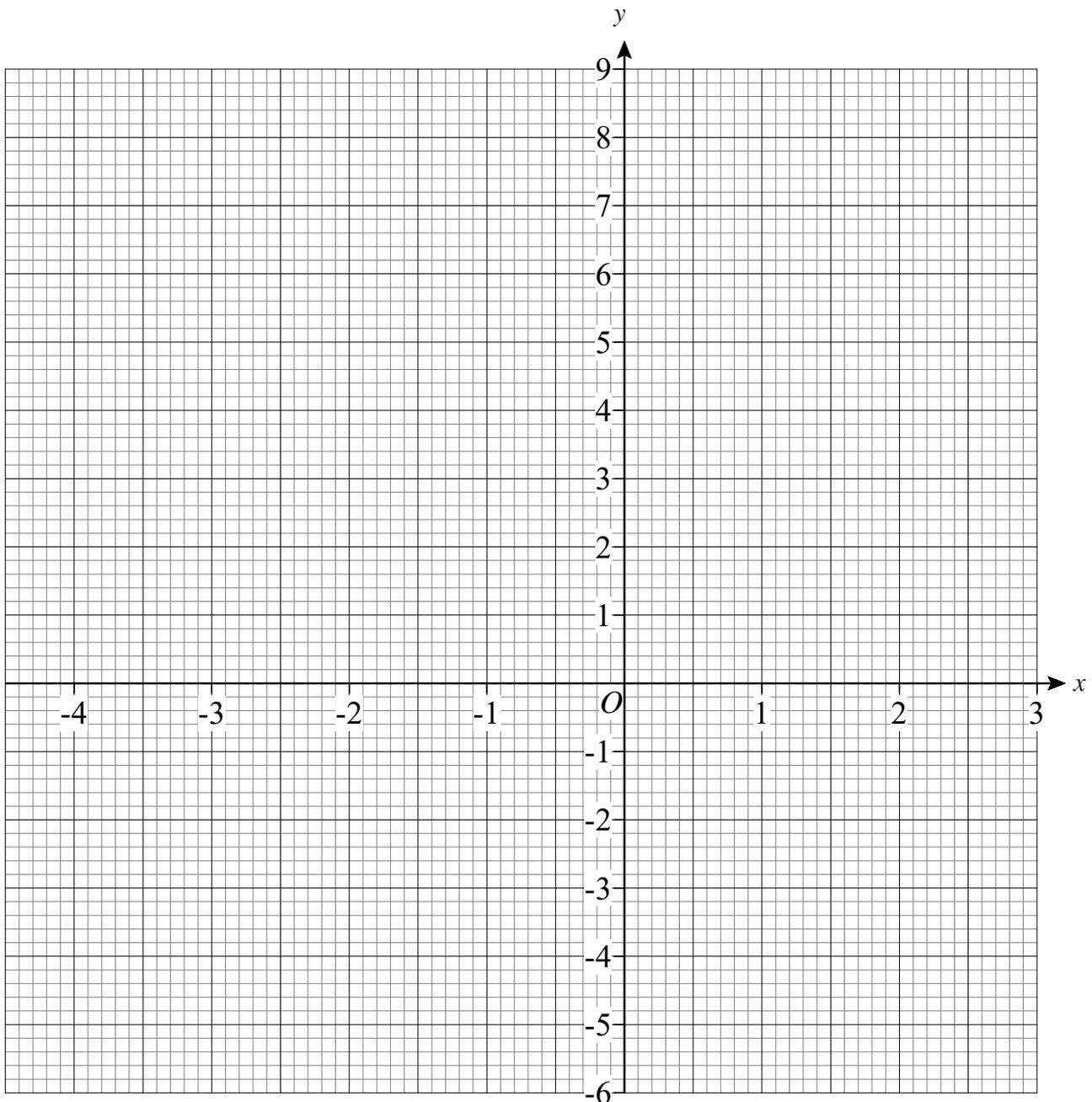
1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8	2	-2	-4	-4	-2	2	8

b) On the grid, draw the graph of $y = x^2 + x - 4$

Quadratic Graphs - Draw and Interpret
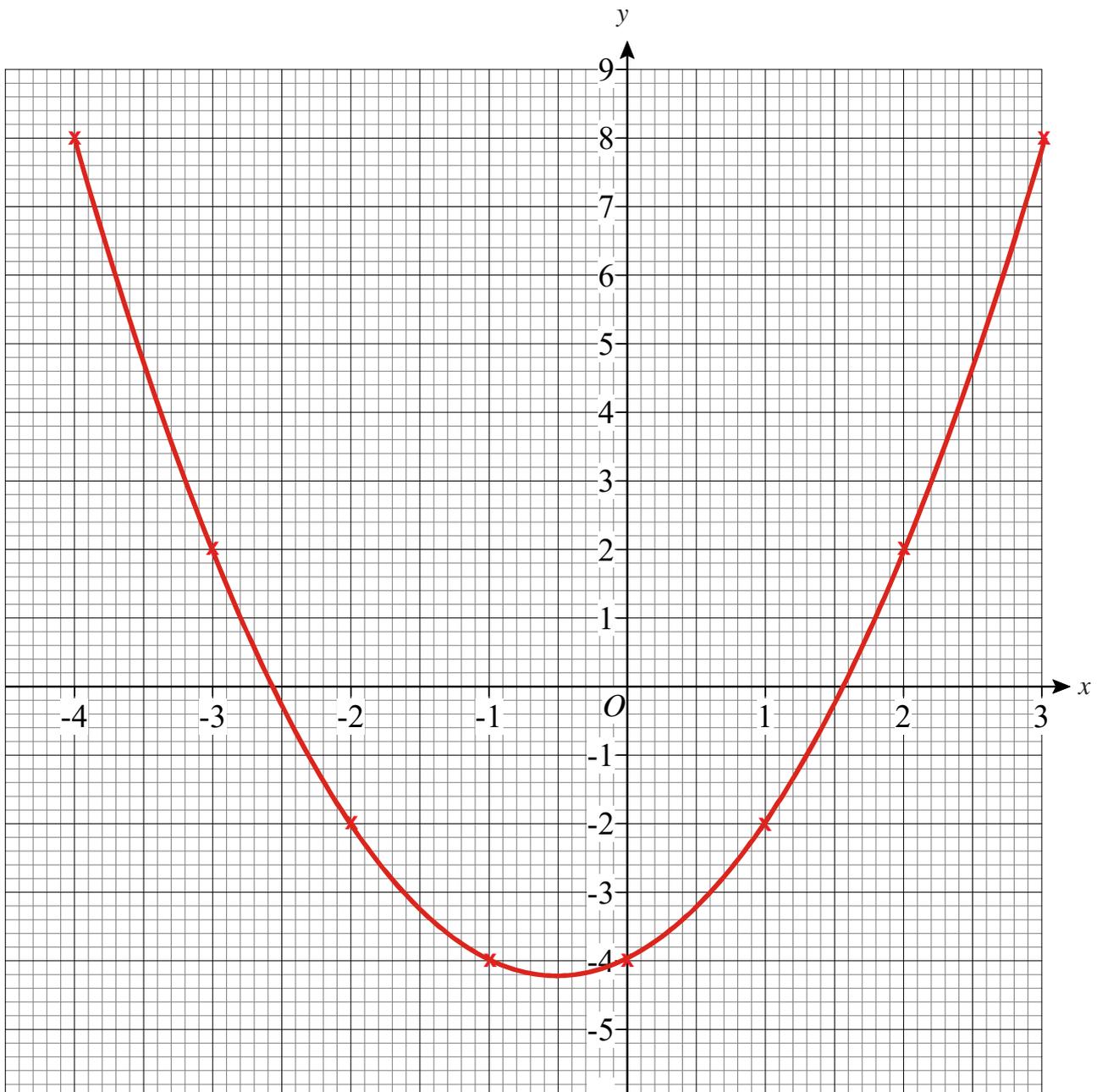
1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14		0			9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3
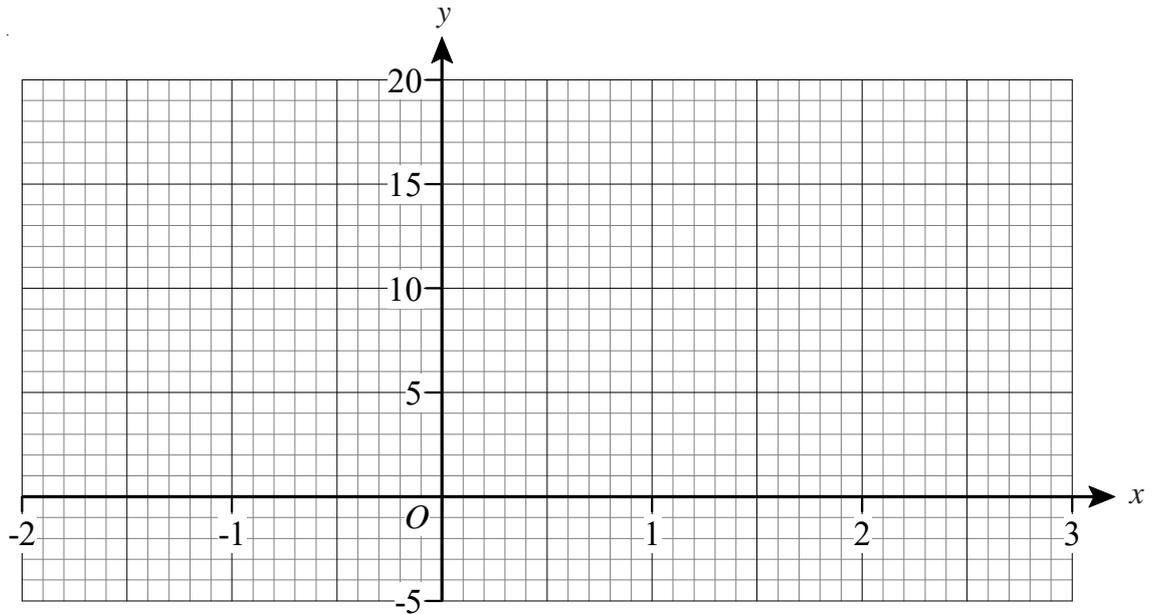
c) Use the graph to find the value of y when x = -1.5

d) Use the graph to find the values of x when y = 4

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8		0			

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3
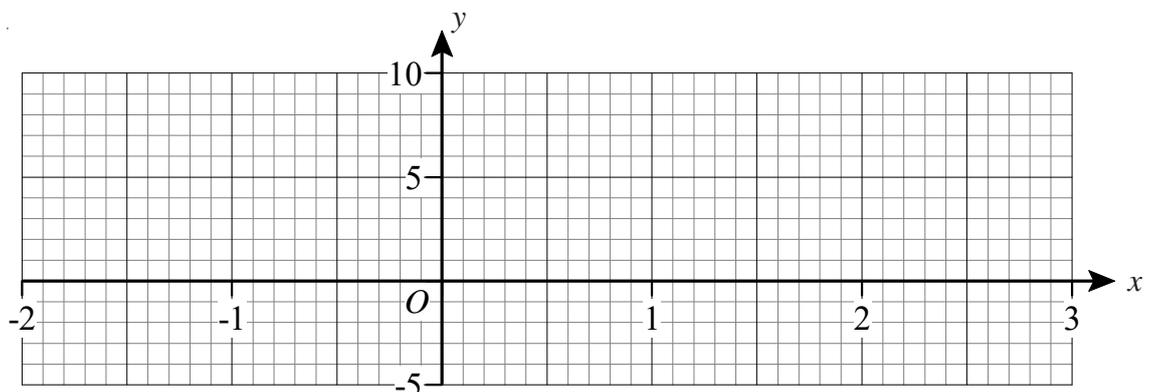
c) (i) On the same axes draw the straight line $y = 2.5$

   (ii) Write down the values of x for which $x^2 - 2x = 2.5$

Quadratic Graphs - Draw and Interpret

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14	5	0	-1	2	9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3
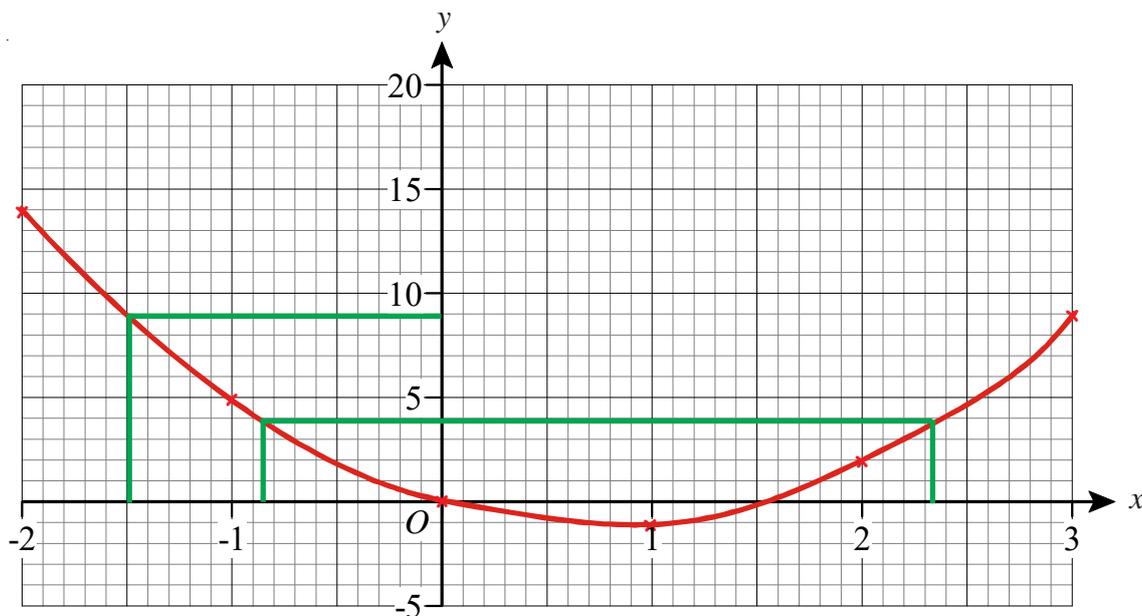
c) Use the graph to find the value of y when $x = -1.5$ $y = 9$

d) Use the graph to find the values of x when $y = 4$ $x = -0.85$ and $x = 2.33$

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8	3	0	-1	0	3

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3

y = 2.5
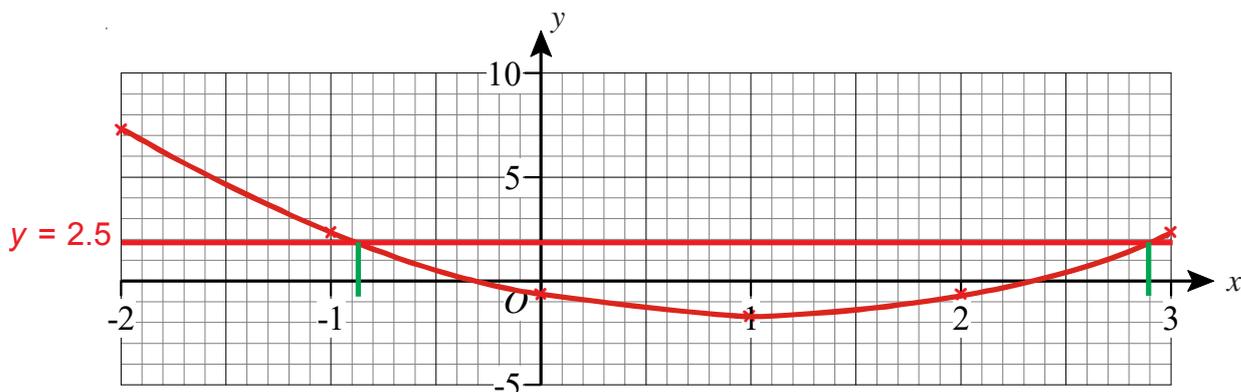
c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$ $x = -0.89$ or $x = 2.9$

Page 117 C

1) The diagram shows the graph of $y = x^2 - 5x - 3$
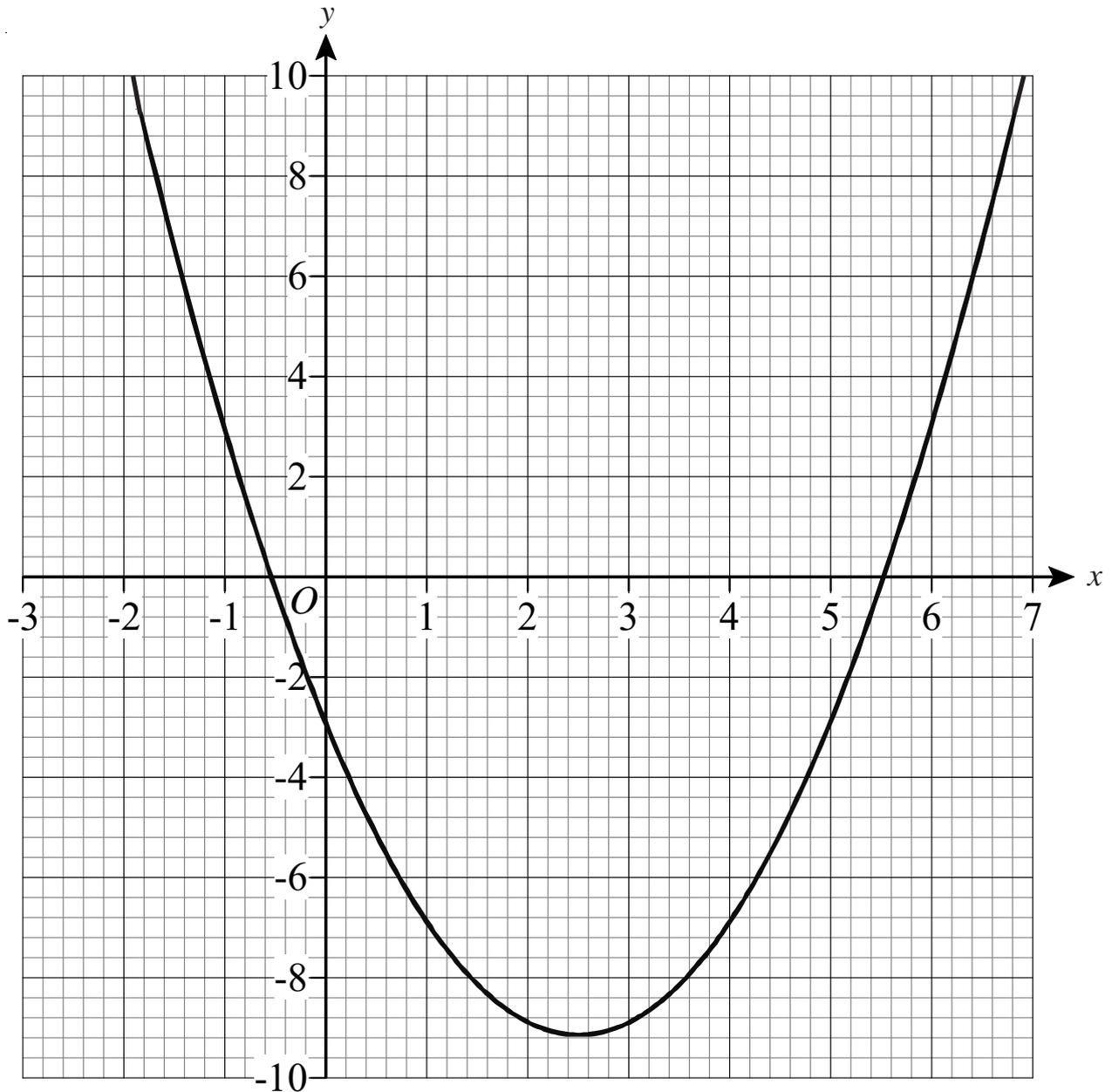
a) Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$

(ii) $x^2 - 5x - 3 = 6$

b) Use the graph to find estimates for the solutions of the simultaneous equations

$$y = x^2 - 5x - 3$$
$$y = x - 4$$

Quadratic Graphs - Draw and Interpret

1)   The diagram shows the graph of $y = x^2 - 5x - 3$
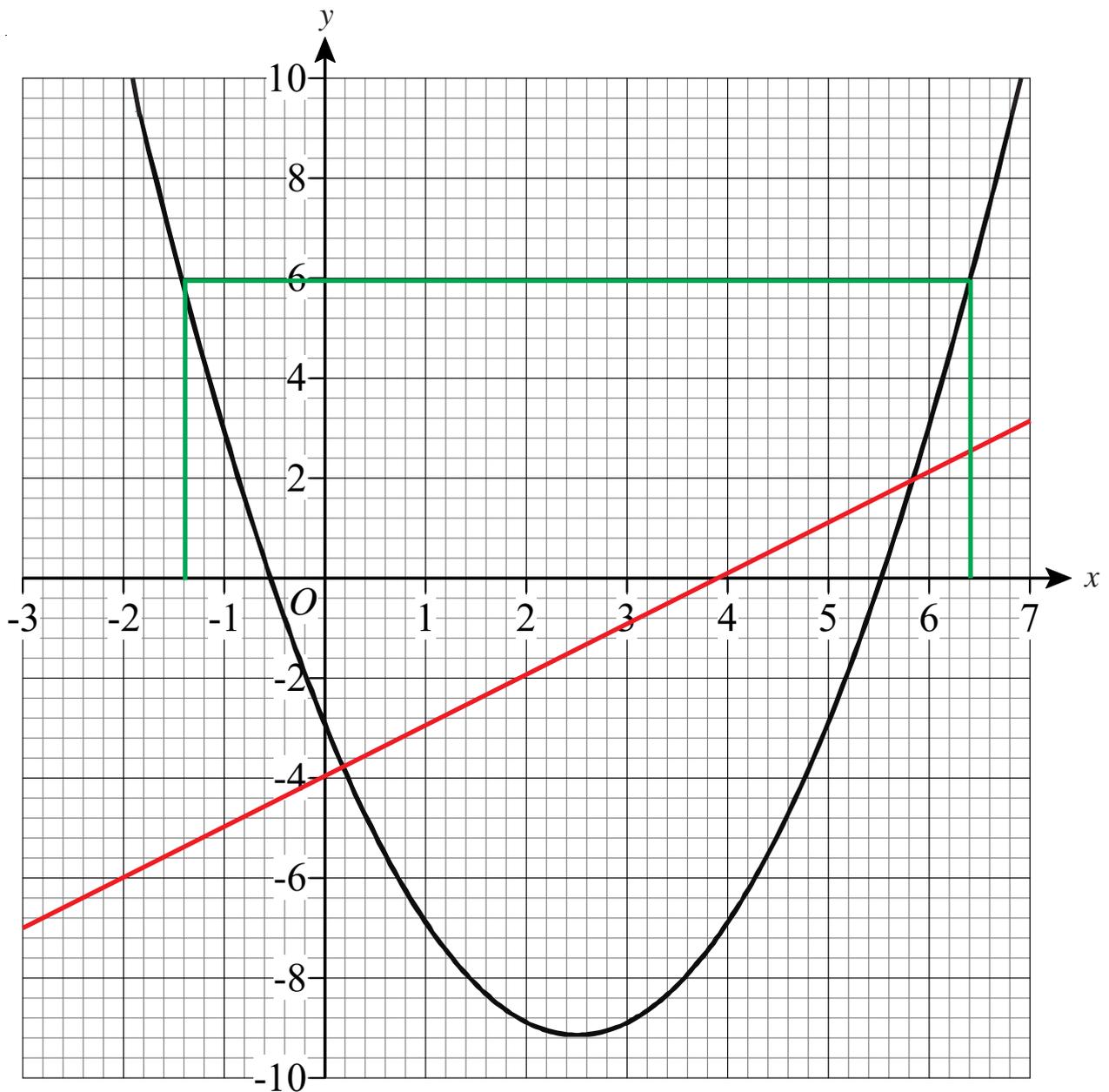
a)   Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$ x = -0.5 and 5.5

(ii) $x^2 - 5x - 3 = 6$ x = -1.4 and 6.4

b)   Use the graph to find estimates for the solutions of the simultaneous equations

$y = x^2 - 5x - 3$ x = 0.2   x = 5.8
$y = x - 4$ y = -3.8   y = 1.8

1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.
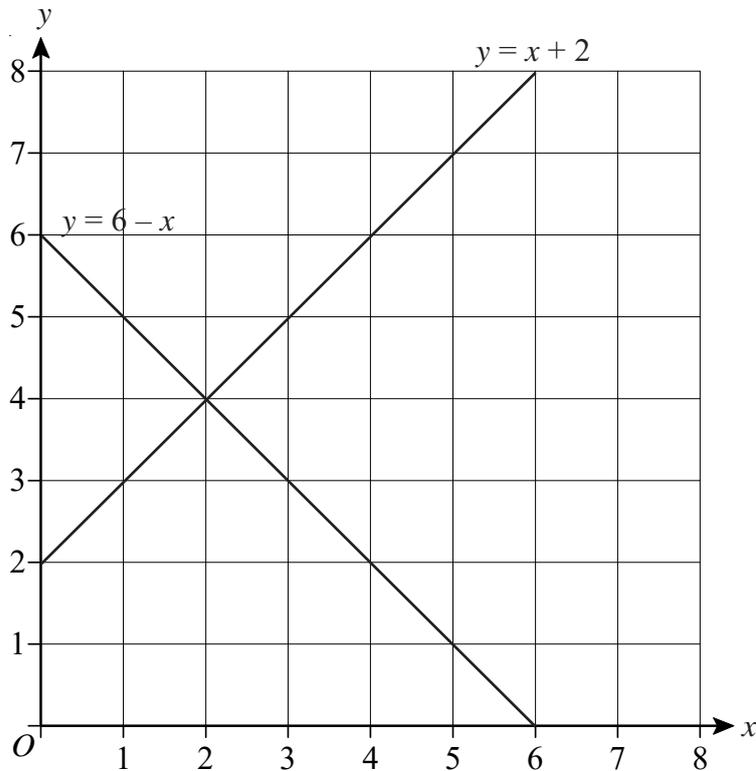
Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$

2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$
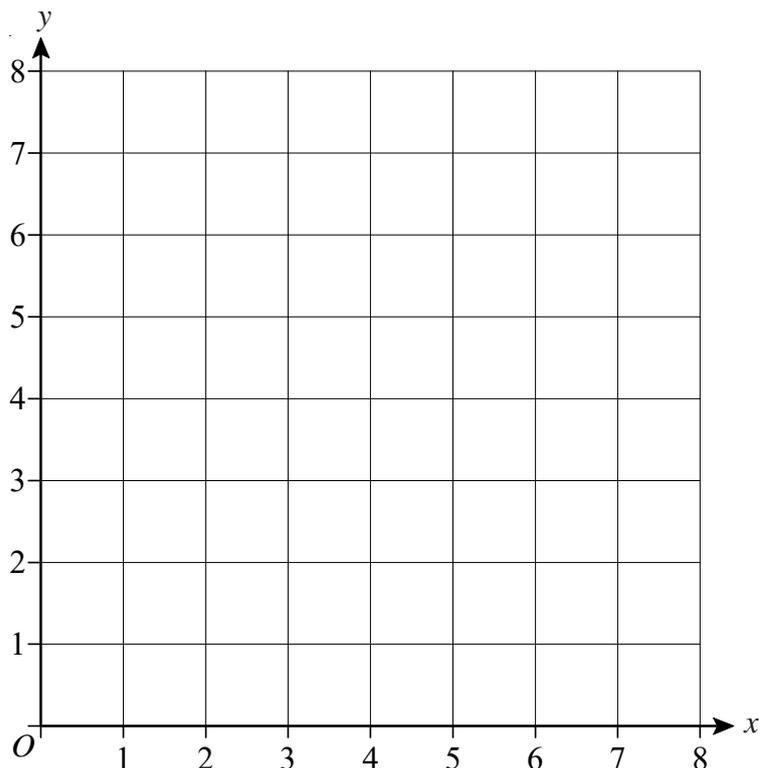
Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

   Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$ *x = 2*
   y = 4

2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

   Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

   x = 2 and y = 5

1) a) Sketch the graph of $y = 3x - 4$ on the axes, showing clearly where it crosses the y-axis.

   b) Sketch the graph of $y = -2x + 3$ on the axes, showing clearly where it crosses the y-axis.

2) a) Sketch the graph of $y = x^2 + 2$ on the axes, showing clearly where it crosses the y-axis.
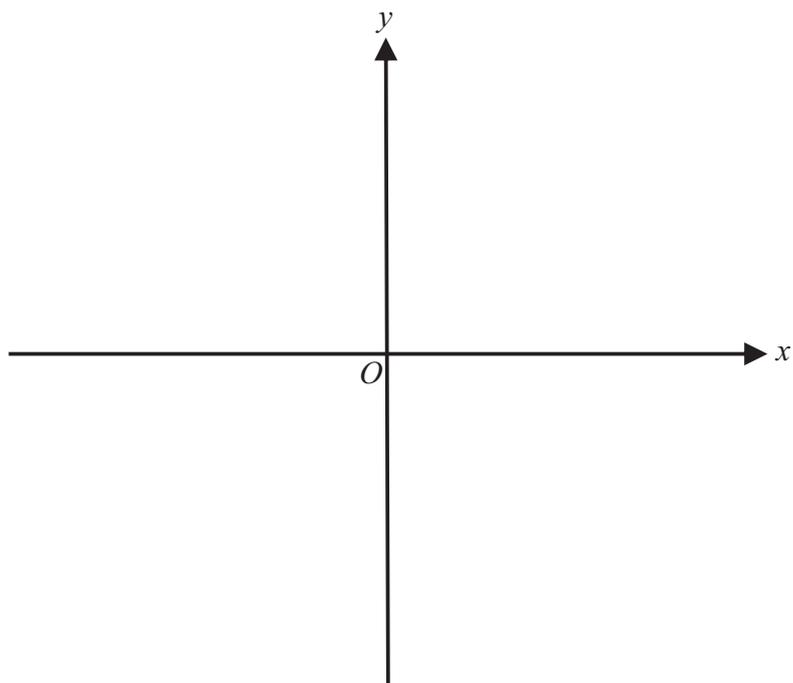
   b) Sketch the graph of $y = -x^2 - 1$ on the axes, showing clearly where it crosses the y-axis.

1)   a) Sketch the graph of $y = 3x - 4$ on the axes, showing clearly where it crosses the y-axis.

     b) Sketch the graph of $y = -2x + 3$ on the axes, showing clearly where it crosses the y-axis.

2)   a) Sketch the graph of $y = x^2 + 2$ on the axes, showing clearly where it crosses the y-axis.

     b) Sketch the graph of $y = -x^2 - 1$ on the axes, showing clearly where it crosses the y-axis.

1) Write as a power of 8
   a) $8^4 \times 8^3$ b) $8^{12} \div 8^7$

2) Write as a power of 3
   a) $3^2 \times 3^9$ b) $3^{10} \div 3^3$

3) Simplify
   a) $k^5 \times k^2$

   b) $x^4 \div x^2$

   c) $\dfrac{k^{11}}{k^6}$

   d) $(k^8)^2$

4) Simplify
   eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

   a) $(2xy^5)^3$

   b) $(2x^2y^2)^3$

   c) $(4xy^4)^2$

   d) $(3xy^2)^4$

5) $2^x \times 2^y = 2^{10}$
        and
     $2^x \div 2^y = 2^2$

   Work out the value of x and the value of y.

6) $5^x \times 5^y = 5^{12}$
        and
     $5^x \div 5^y = 5^6$

   Work out the value of x and the value of y.

7) $a = 2^x$, $b = 2^y$
   Express in terms of a and b
   a) 2^{x+y}

   b) 2^{2x}

   c) 2^{3y}

   d) 2^{x+2y}

1) Write as a power of 8
   a) $8^4 \times 8^3$ **8^7** b) $8^{12} \div 8^7$ **8^5**

2) Write as a power of 3
   a) $3^2 \times 3^9$ **3^{11}** b) $3^{10} \div 3^3$ **3^7**

3) Simplify
   a) $k^5 \times k^2$ **k^7**

   b) $x^4 \div x^2$ **x^2**

   c) $\dfrac{k^{11}}{k^6}$ **k^5**

   d) $(k^8)^2$ **k^{16}**

4) Simplify
   eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

   a) $(2xy^5)^3$ **$8x^3y^{15}$**

   b) $(2x^2y^2)^3$ **$8x^6y^6$**

   c) $(4xy^4)^2$ **$16x^2y^8$**

   d) $(3xy^2)^4$ **$81x^4y^8$**

5) $2^x \times 2^y = 2^{10}$
   and
   $2^x \div 2^y = 2^2$

   Work out the value of x and the value of y. **$x = 6, y = 4$**

6) $5^x \times 5^y = 5^{12}$
   and
   $5^x \div 5^y = 5^6$

   Work out the value of x and the value of y. **$x = 9, y = 3$**

7) $a = 2^x$, $b = 2^y$
   Express in terms of a and b
   a) 2^{x+y} **ab**

   b) 2^{2x} **a^2**

   c) 2^{3y} **b^3**

   d) 2^{x+2y} **ab^2**

Index Notation

1) a) Simplify $d \times d \times d \times d$

   b) Simplify $t \times t^2$

   c) Simplify $m^5 \div m^3$

2) a) Simplify $(2x^2)^3$

   b) Simplify $3x^2 \times 4x^5y^4$

3) a) Simplify $t^4 \times t^5$

   b) Simplify $x^8 \div x^5$

   c) Simplify $(c^4)^3$

4) a) Simplify $x^6 \times x^2$

   b) Simplify $\dfrac{x^8}{x^3}$

   c) Simplify $(2t)^3$

   d) Simplify $3x^2y \times 4x^5y^4$

5) a) Simplify $x^3 \times x^4$

   b) Simplify $t^7 \div t^3$

   c) Simplify $4x^2y^4 \times 3xy^2$

6) a) Simplify $x \times x \times x \times x$

   b) Simplify $2x \times 3y$

1) a) Simplify $d \times d \times d \times d$ d^4

b) Simplify $t \times t^2$ t^3

c) Simplify $m^5 \div m^3$ m^2

2) a) Simplify $(2x^2)^3$ $8x^6$

b) Simplify $3x^2 \times 4x^5y^4$ $12x^7y^4$

3) a) Simplify $t^4 \times t^5$ t^9

b) Simplify $x^8 \div x^5$ x^3

c) Simplify $(c^4)^3$ c^{12}

4) a) Simplify $x^6 \times x^2$ x^8

b) Simplify $\dfrac{x^8}{x^3}$ x^5

c) Simplify $(2t)^3$ $8t^3$

d) Simplify $3x^2y \times 4x^5y^4$ $12x^7y^5$

5) a) Simplify $x^3 \times x^4$ x^7

b) Simplify $t^7 \div t^3$ t^4

c) Simplify $4x^2y^4 \times 3xy^2$ $12x^3y^6$

6) a) Simplify $x \times x \times x \times x$ x^4

b) Simplify $2x \times 3y$ $6xy$

Algebraic Fractions - Introduction

1) Fully simplify each expression

a) $\dfrac{15b^9}{5b^2}$

b) $\dfrac{16x^8}{24x^4}$

c) $\dfrac{3c^7 \times 4c^4}{6c^3}$

d) $\dfrac{10e^8}{5e^3 \times 4e^2}$

e) $\dfrac{3a^4 \times 5a^9}{4a^7 \times 6a^3}$

2) Fully simplify each expression

a) $\dfrac{3x + 30}{3x + 12}$

b) $\dfrac{4x - 20}{8x - 12}$

c) $\dfrac{12x + 30}{18x - 36}$

d) $\dfrac{8x - 10}{14x + 12}$

3) Fully simplify each expression

a) $\dfrac{x}{2} + \dfrac{x}{3}$

b) $\dfrac{5x}{6} - \dfrac{3x}{5}$

c) $\dfrac{2x + 3}{3} + \dfrac{x + 5}{4}$

d) $\dfrac{3x + 4}{4} + \dfrac{2x - 5}{6}$

e) $\dfrac{x - 2}{4} - \dfrac{x + 1}{7}$

f) $\dfrac{3x - 2}{6} - \dfrac{2x - 1}{8}$

1) Fully simplify each expression

a) $\dfrac{15b^9}{5b^2} = 3b^7$

b) $\dfrac{16x^8}{24x^4} = \dfrac{2x^4}{3}$

c) $\dfrac{3c^7 \times 4c^4}{6c^3} = 2c^8$

d) $\dfrac{10e^8}{5e^3 \times 4e^2} = \dfrac{e^3}{2}$

e) $\dfrac{3a^4 \times 5a^9}{4a^7 \times 6a^3} = \dfrac{5a^3}{8}$

2) Fully simplify each expression

a) $\dfrac{3x+30}{3x+12} = \dfrac{x+10}{x+4}$

b) $\dfrac{4x-20}{8x-12} = \dfrac{x-5}{2x-3}$

c) $\dfrac{12x+30}{18x-36} = \dfrac{2x+5}{3x-6}$

d) $\dfrac{8x-10}{14x+12} = \dfrac{4x-5}{7x+6}$

3) Fully simplify each expression

a) $\dfrac{x}{2} + \dfrac{x}{3} = \dfrac{5x}{6}$

b) $\dfrac{5x}{6} - \dfrac{3x}{5} = \dfrac{7x}{30}$

c) $\dfrac{2x+3}{3} + \dfrac{x+5}{4} = \dfrac{11x+27}{12}$

d) $\dfrac{3x+4}{4} + \dfrac{2x-5}{6} = \dfrac{13x+2}{12}$

e) $\dfrac{x-2}{4} - \dfrac{x+1}{7} = \dfrac{3x-18}{28}$

f) $\dfrac{3x-2}{6} - \dfrac{2x-1}{8} = \dfrac{6x-5}{24}$

1)

A _____ B

D _____ C

ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both**
        more than 4 centimetres from the point *D*
and   more than 1 centimetre from the line *AB*.

2)   Two radio transmitters, *A* and *B*, are situated as below.

B ●

A ●

Transmitter *A* broadcasts signals which can be heard up to 3 km from *A*.

Transmitter *B* broadcasts signals which can be heard up to 6 km from *B*.

Shade in the area in which radio signals can be heard from both transmitters.
Use a scale of 1 cm = 1 km.

1)
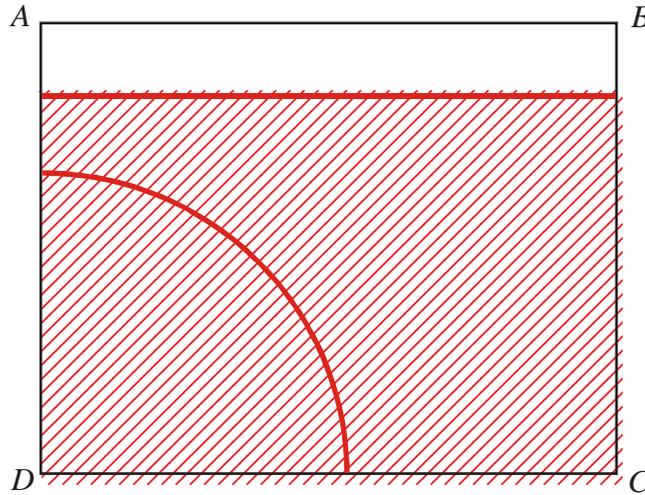
ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both**
   more than 4 centimetres from the point *D*
and more than 1 centimetre from the line *AB*.

2) Two radio transmitters, *A* and *B*, are situated as below.

Transmitter *A* broadcasts signals which can be heard up to 3 km from *A*.

Transmitter *B* broadcasts signals which can be heard up to 6 km from *B*.

Shade in the area in which radio signals can be heard from both transmitters.
Use a scale of 1 cm = 1 km.

Loci

1) Draw the locus of all points which are equidistant from the lines *AB* **and** *AC*.

B

A
― *C*

2) Draw the locus of all points which are equidistant from the points *A* and *B*.

A **x**   **x** *B*
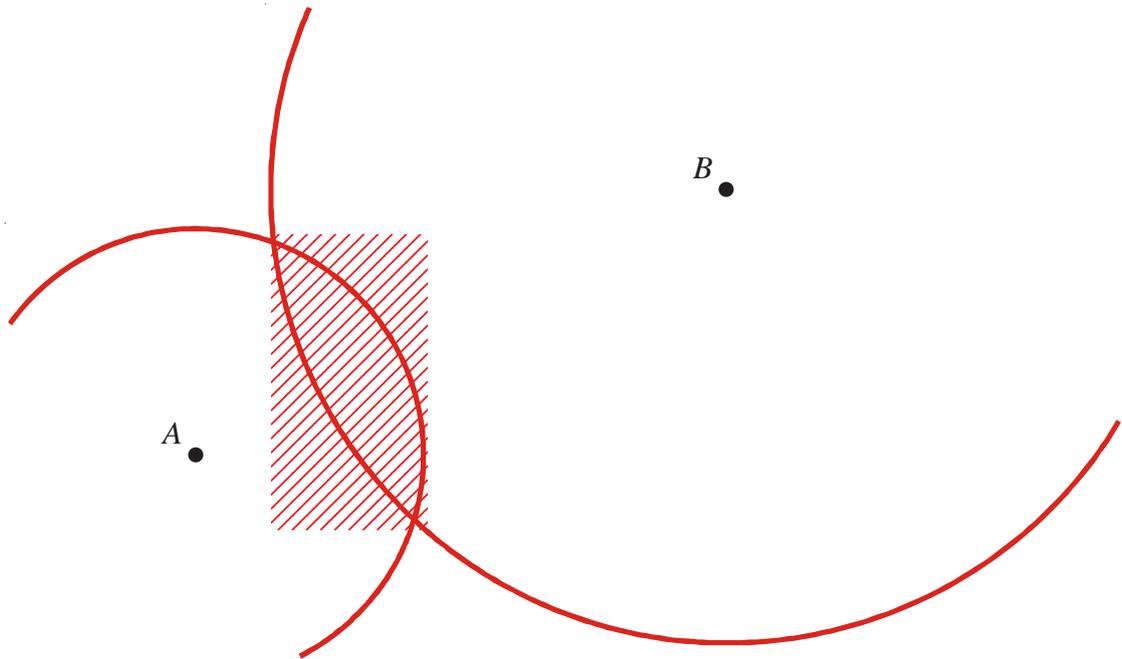
1) Draw the locus of all points which are equidistant from the lines *AB* **and** *AC*.
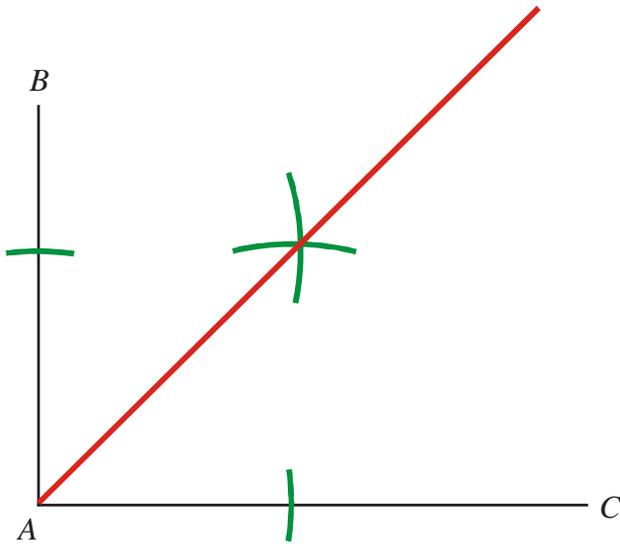
2) Draw the locus of all points which are equidistant from the points *A* and *B*.
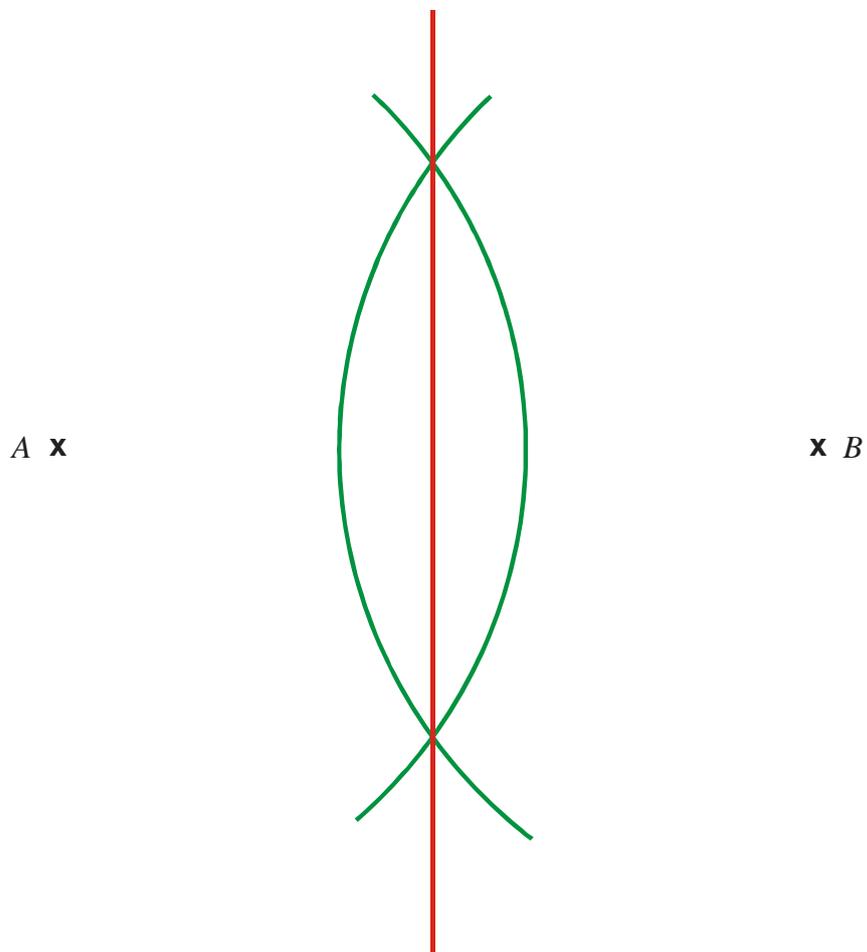
1) Draw the locus of all points that are exactly 3 cm from the line *PQ*.

P ———————————————————— *Q*

2) Draw the locus of all points that are exactly 4 cm from the rectangle *ABCD*

A _____ *B*

D _____ *C*

1) Draw the locus of all points that are exactly 3 cm from the line *PQ*.

P —————————————————————— *Q*

2) Draw the locus of all points that are exactly 4 cm from the rectangle *ABCD*

A   *B*

D   *C*
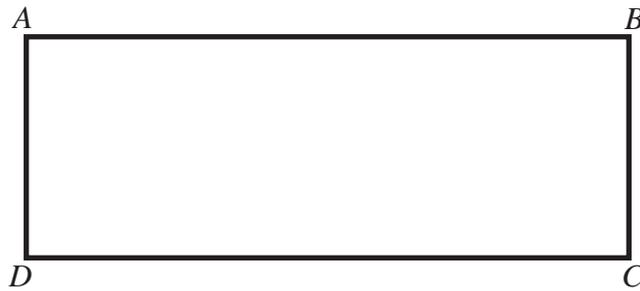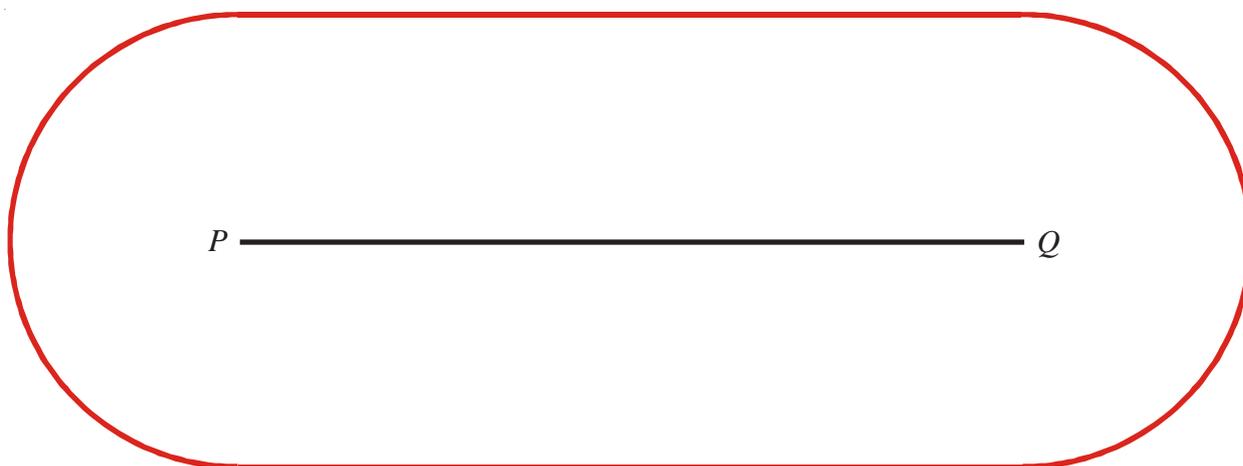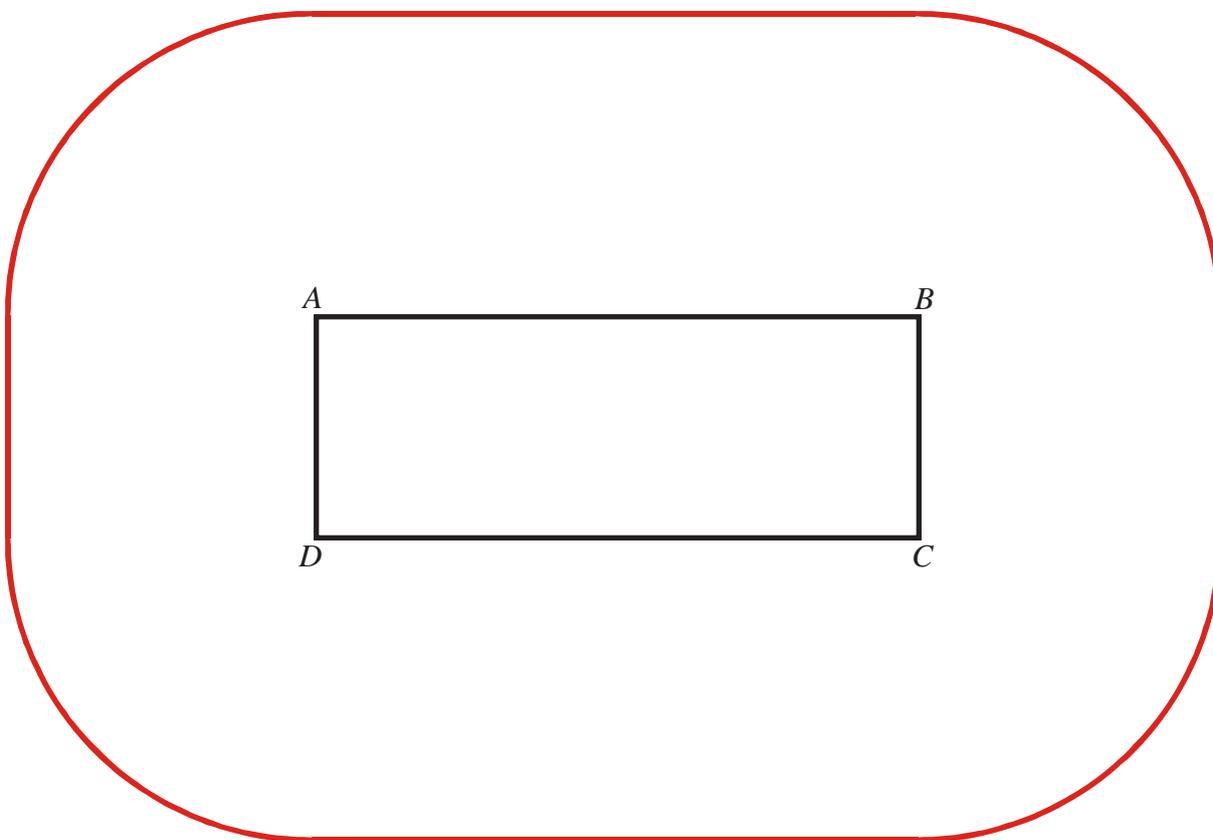
1) The diagram shows a prism drawn on an isometric grid.
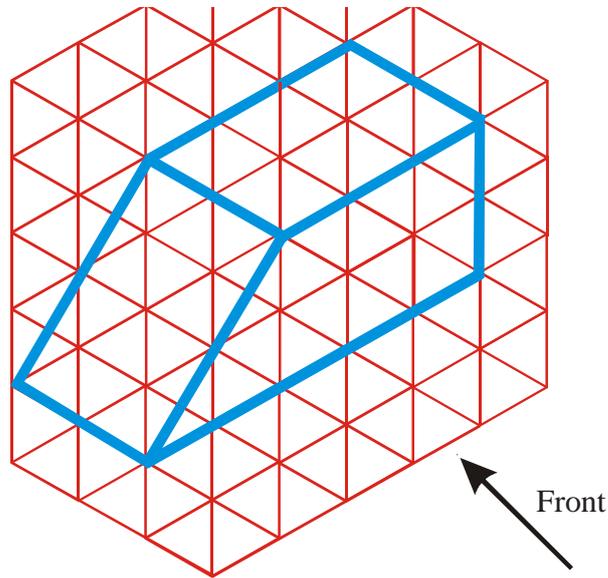
Front

a) On the grid below, draw the front elevation of the prism from
    the direction marked by the arrow.
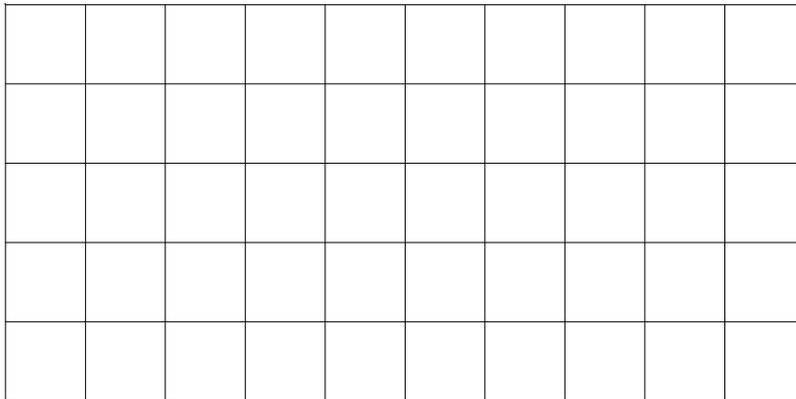
b) On the grid below draw a plan of the prism.

1) The diagram shows a prism drawn on an isometric grid.
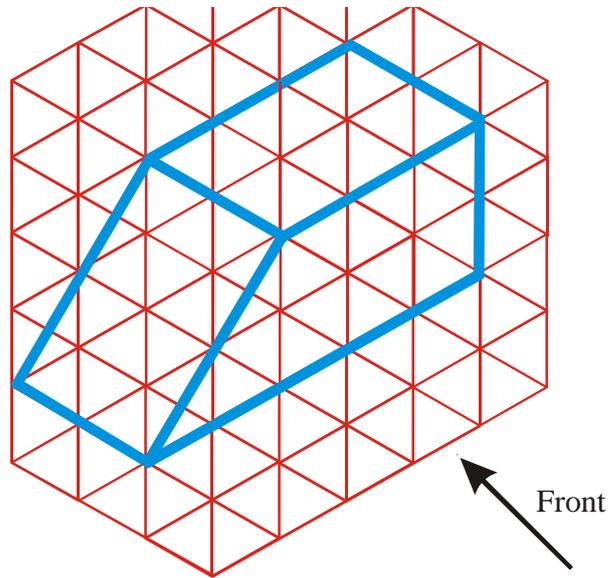
Front

a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.
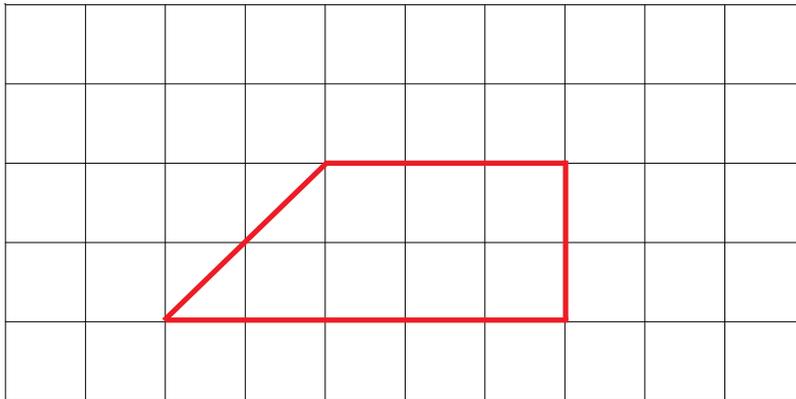
b) On the grid below draw a plan of the prism.

1) Here is the plan and front elevation of a prism.
The front elevation shows the cross section of the prism.

Plan

Front Elevation

On the grid below, draw the side elevation of the prism.

1)   Here is the plan and front elevation of a prism.
     The front elevation shows the cross section of the prism.

Plan

Front Elevation

On the grid below, draw the side elevation of the prism.

OR

seen from the right   seen from the left

1)   The diagram shows a solid prism made from centimetre cubes.

a)   On the centimetre square grid, draw the front elevation of the solid prism from the direction shown by the arrow.

b)   On the centimetre square grid below, draw the plan of the solid prism.

Plans and Elevations

1) The diagram shows a solid prism made from centimetre cubes.

a) On the centimetre square grid, draw the front elevation of the solid prism from the direction shown by the arrow.

b) On the centimetre square grid below, draw the plan of the solid prism.

Plans and Elevations

1) The diagram shows a solid prism.

2 cm

1 cm

3 cm

4 cm

a) On the grid below, draw the front elevation of the prism from the direction of the arrow.

b) On the grid below, draw the plan of the prism.

Plans and Elevations

1)   The diagram shows a solid prism.

2 cm

1 cm

3 cm

4 cm

a)   On the grid below, draw the front elevation of the prism from the direction of the arrow.

b)   On the grid below, draw the plan of the prism.

1) Copy the shape below onto the isometric grid.

4 cm

3 cm

5 cm

2) The shape below is made out of 2 cm by 2 cm by 2 cm cubes.

Copy the shape onto the isometric grid.

4 cm

6 cm

2 cm

1) Copy the shape below onto the isometric grid.

4 cm

3 cm

5 cm
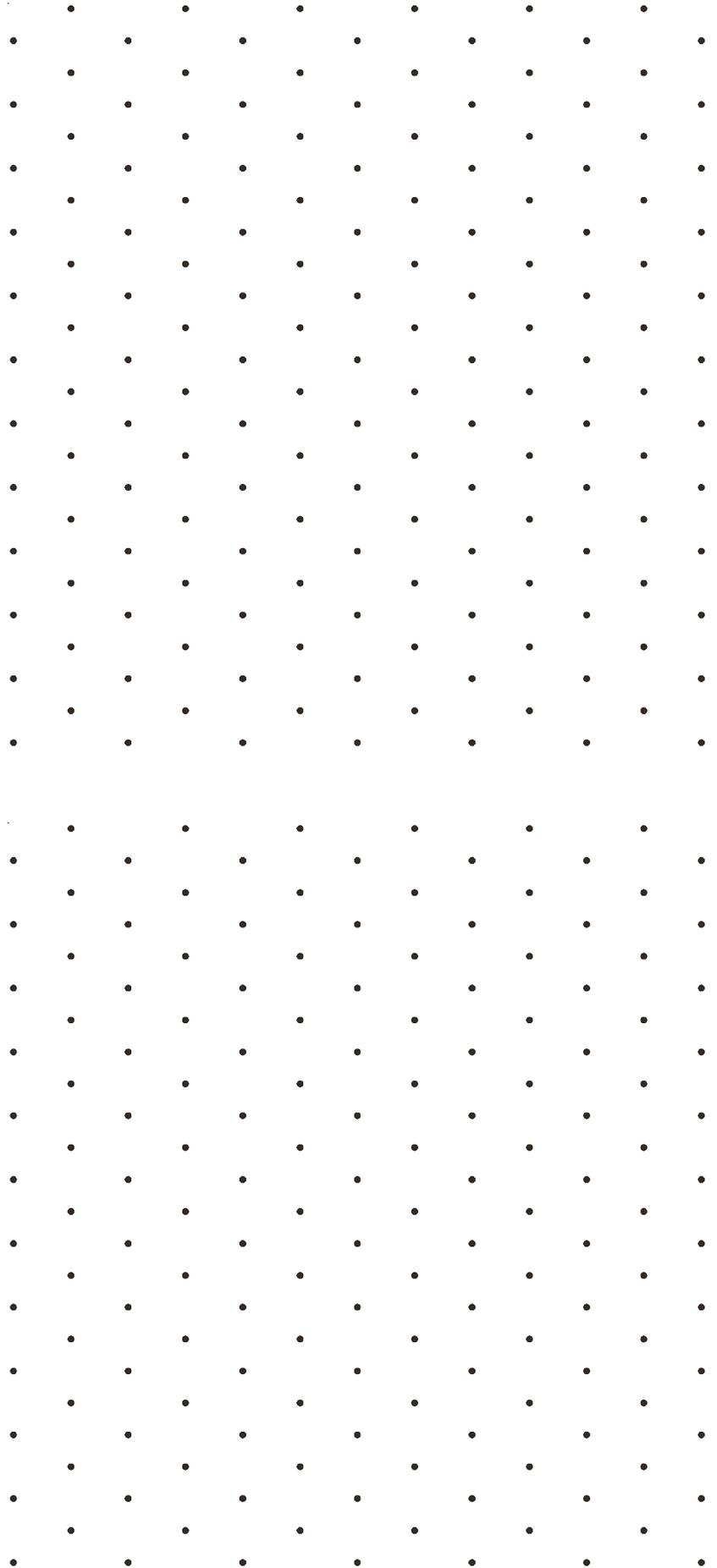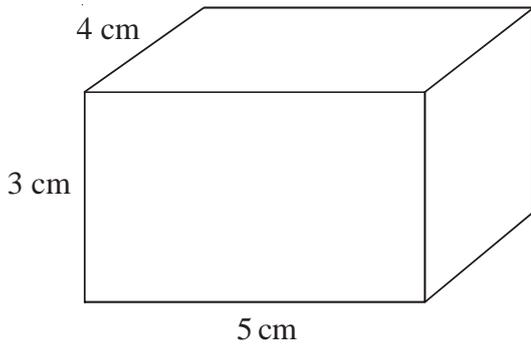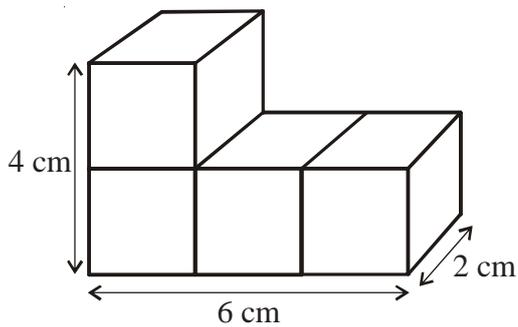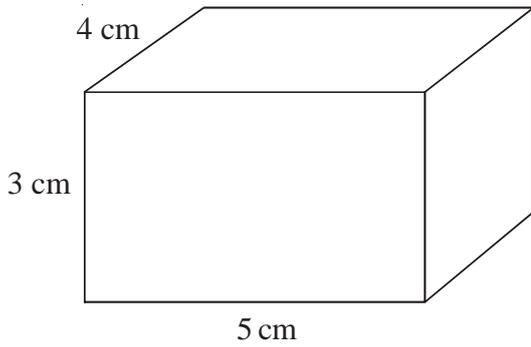
Other correct diagrams are possible.

2) The shape below is made out of 2 cm by 2 cm by 2 cm cubes.

Copy the shape onto the isometric grid.

4 cm

6 cm

2 cm
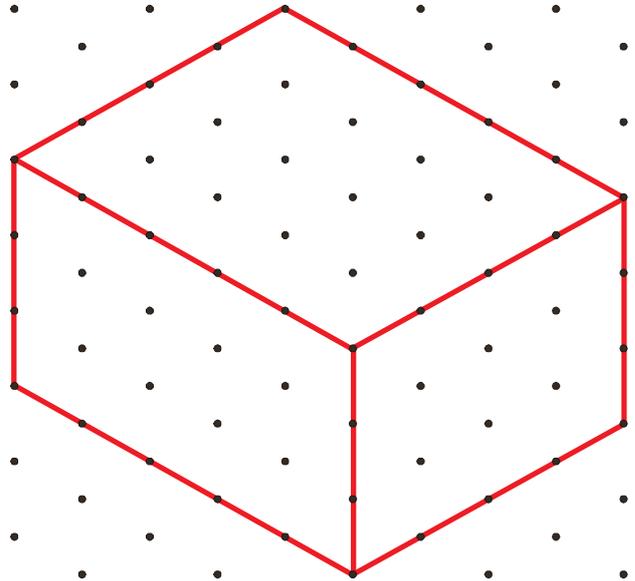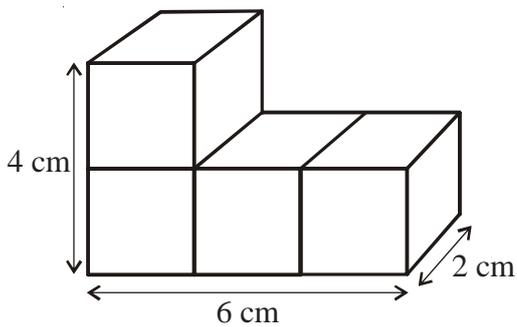
Other correct diagrams are possible.
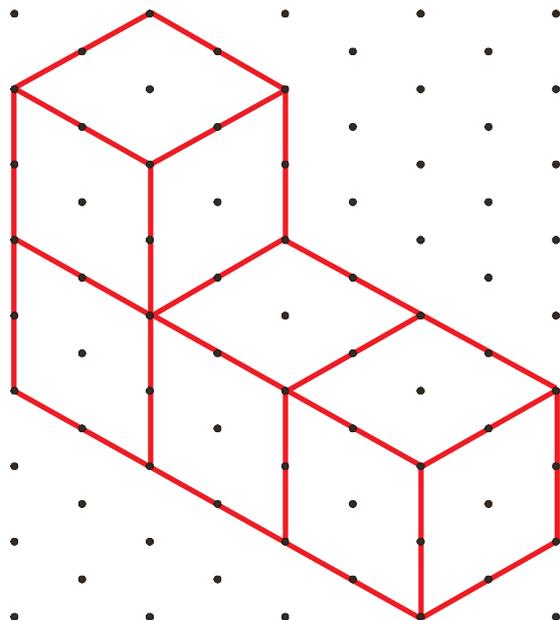
Geometric Properties of Quadrilaterals

1)   Here are four quadrilaterals.
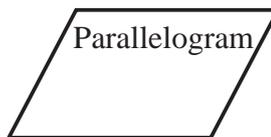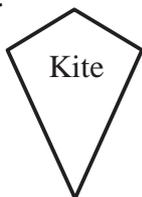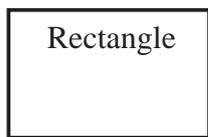
   Rectangle   Kite   Parallelogram   Rhombus

   a) Which quadrilateral has all its sides equal?

   b) Which quadrilateral has all its angles equal?

   c) Which quadrilateral has two pairs of adjacent sides equal?

2)   Here are four quadrilaterals.

   Square   Rectangle   Rhombus   Trapezium

   We can sort out these shapes using the following chart.

   Are all sides equal?

   Yes   *No*

   Are all angles equal?   Are both pairs of opposite sides equal?

   Yes   *No*   *Yes*   *No*

   ....

   Write the name of the quadrilateral that should appear on each of the four lines above.

3)   Complete the shape sorter below.

   **I think about
   a quadrilateral** ⟹ **Are all the
   sides equal?** — *Yes* ⟹ **Are the
   diagonals equal?** — *Yes* ⟹ Name the shape

   ....

   No ⟱   *No* ⟱

   Name three different
   possible shapes   Name the shape

   ....

   ....

   ....

1) Here are four quadrilaterals.

Rectangle   Kite   Parallelogram   Rhombus

a) Which quadrilateral has all its sides equal?   Rhombus

b) Which quadrilateral has all its angles equal?   Rectangle

c) Which quadrilateral has two pairs of adjacent sides equal?   Kite

2) Here are four quadrilaterals.

Square   Rectangle   Rhombus   Trapezium

We can sort out these shapes using the following chart.

Are all sides equal?

Yes / No

Are all angles equal?   Are both pairs of opposite sides equal?

Yes / No   Yes / No

Square   Rhombus   Rectangle   Trapezium

Write the name of the quadrilateral that should appear on each of the four lines above.

3) Complete the shape sorter below.

I think about a quadrilateral → **Are all the sides equal?** — Yes → **Are the diagonals equal?** — Yes → Name the shape

Square

No ↓   No ↓

Name three different possible shapes   Name the shape

any three from   Rectangle   Rhombus
Kite
Parallelogram
Trapezium
Arrowhead

1)

     a) Work out the size of an **exterior** angle of a regular hexagon.

     b) Work out the size of an **interior** angle of a regular hexagon.

2)

     a) Name the regular polygon, above.
     b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

3)   The size of each **exterior** angle of a regular polygon is 40°.
      Work out the number of sides of the regular polygon.

4)   The size of each **interior** angle of a regular polygon is 120°.
      Work out the number of sides of the regular polygon.

Angle Sum of Polygons

1)

   a) Work out the size of an **exterior** angle of a regular hexagon. 60°

   b) Work out the size of an **interior** angle of a regular hexagon. 120°

2)
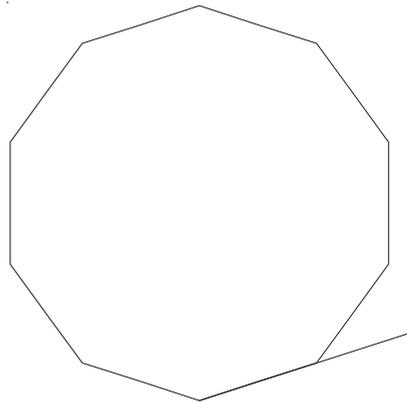
   a) Name the regular polygon, above. Decagon

   b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

   Exterior angle = 36°
   Interior angle = 144°

3) The size of each **exterior** angle of a regular polygon is 40°.
    Work out the number of sides of the regular polygon. 9

4) The size of each **interior** angle of a regular polygon is 120°.
    Work out the number of sides of the regular polygon. 6

1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.

2)
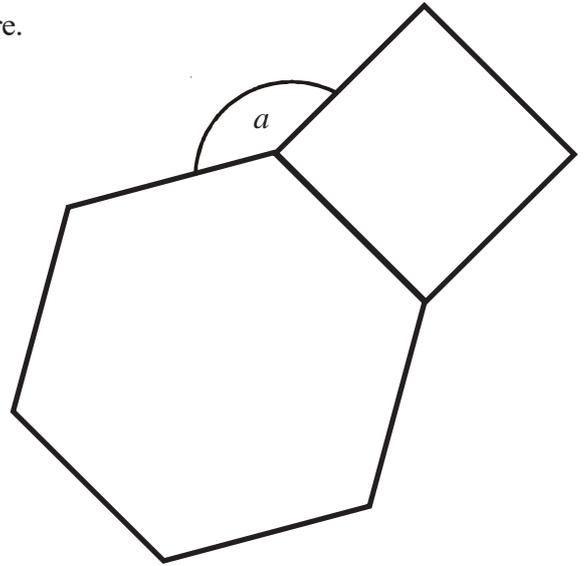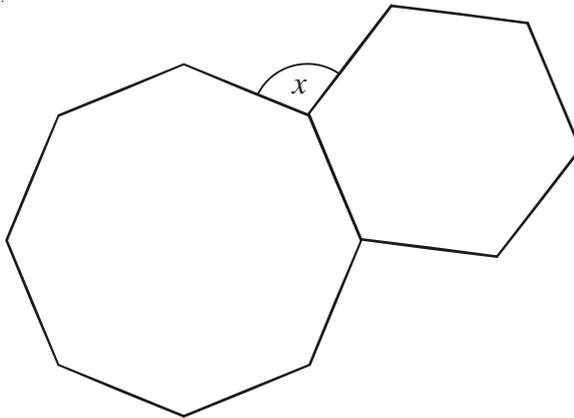
The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*.

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*.

Page 125 B
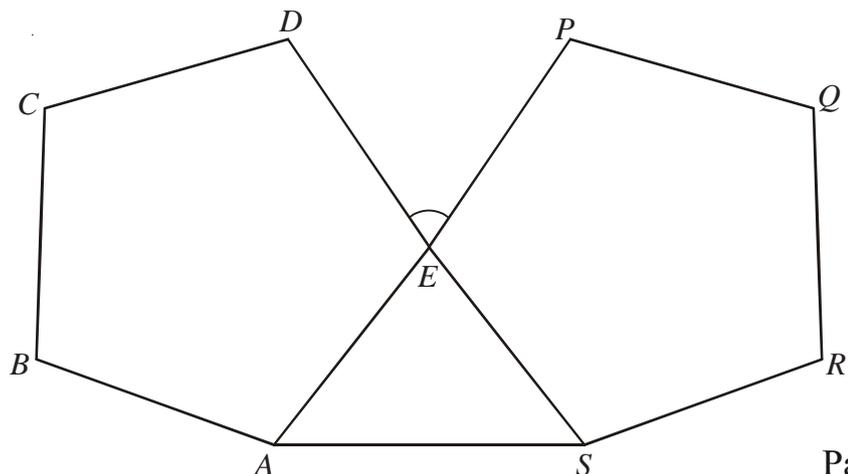
1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.

150°

2)
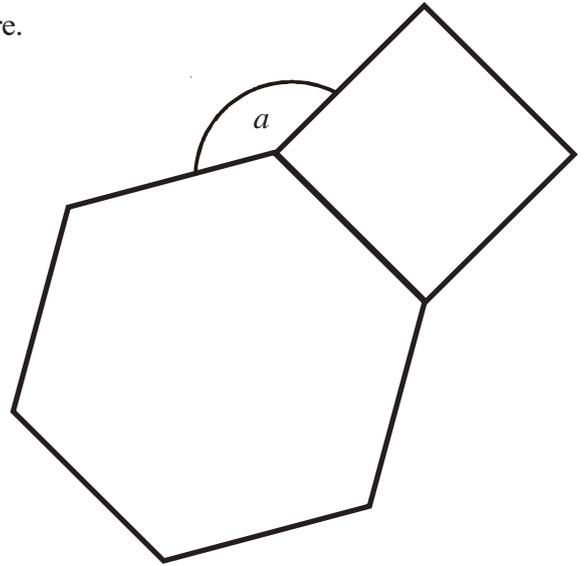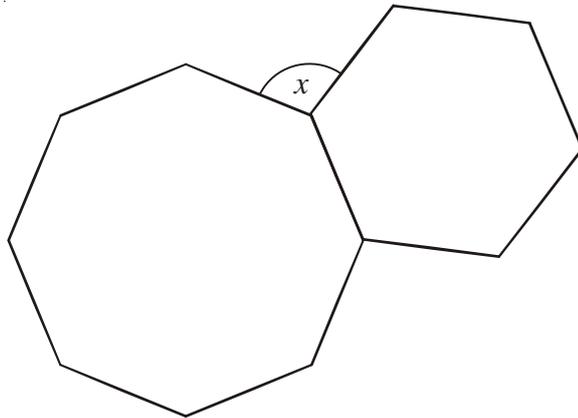
The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*. 105°

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*. 84°
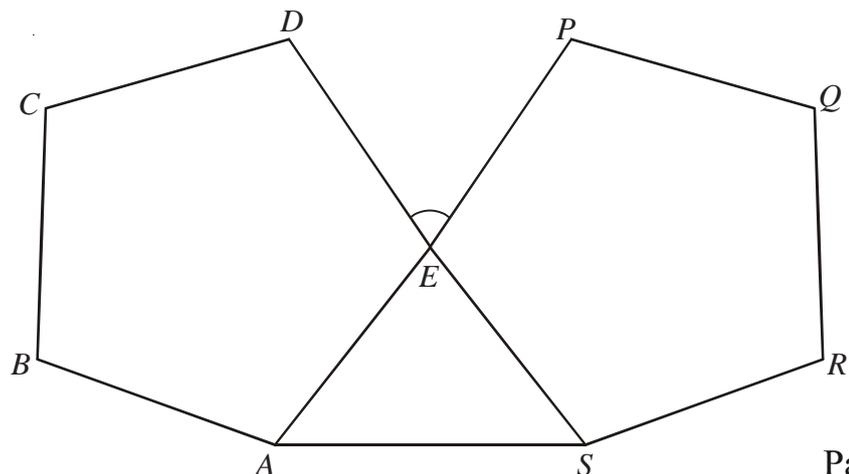
1) Jane runs 200 metres in 21.4 seconds.

   Work out Jane's average speed in metres per second.
   Give your answer correct to 1 decimal place.

2) A car travels at a steady speed and takes five hours to travel 310 miles.

   Work out the average speed of the car in miles per hour.

3) A plane flies 1440 miles at a speed of 240 mph.

   How long does it take?

4) A marathon runner runs at 7.6 mph for three and a half hours.

   How many miles has he run?

5) A car takes 15 minutes to travel 24 miles.

   Find its speed in **mph**.

6) A cyclist takes 10 minutes to travel 2.4 miles.

   Calculate the average speed in mph.

7) Tony went on holiday to Miami.
   He travelled from London by plane.

   The distance from London to Miami is 7120 km.
   The plane journey took 8 hours.

   Calculate the average speed of the plane.

1) Jane runs 200 metres in 21.4 seconds.

   Work out Jane's average speed in metres per second.
   Give your answer correct to 1 decimal place.

   S = 9.3 m/s

2) A car travels at a steady speed and takes five hours to travel 310 miles.

   Work out the average speed of the car in miles per hour.

   S = 62 mph

3) A plane flies 1440 miles at a speed of 240 mph.

   How long does it take?

   T = 6 hours

4) A marathon runner runs at 7.6 mph for three and a half hours.

   How many miles has he run?

   D = 26.6 miles

5) A car takes 15 minutes to travel 24 miles.

   Find its speed in **mph**.

   S = 96 mph

6) A cyclist takes 10 minutes to travel 2.4 miles.

   Calculate the average speed in mph.

   S = 14.4 mph

7) Tony went on holiday to Miami.
   He travelled from London by plane.

   The distance from London to Miami is 7120 km.
   The plane journey took 8 hours.

   Calculate the average speed of the plane.

   890 km/h

1) An ice hockey puck has a volume of 113 cm³.

   It is made out of rubber with a density of 1.5 grams per cm³.

   Work out the mass of the ice hockey puck.

2) An apple has a mass of 160 g and a volume of 100 cm³.

   Find its density in g/cm³.

3) A steel ball has a volume of 1500 cm³.

   The density of the ball is 95 g/cm³.

   Find the mass of the ball **in kg**.

4) The mass of a bar of chocolate is 1800 g.

   The density of the chocolate is 9 g/cm³.

   What is the volume of the bar of chocolate?

5) A solid cylinder has a radius of 4 cm and a height of 10 cm.

10 cm

← 4 cm →
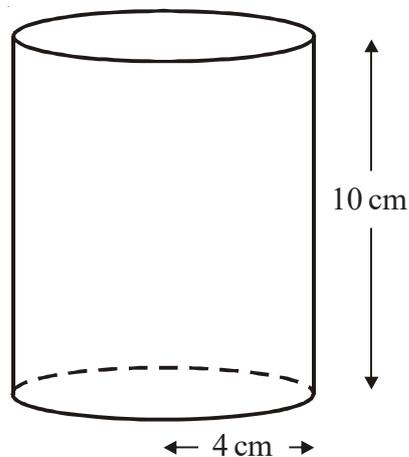
   a) Work out the volume of the cylinder.
      Give your answer correct to 3 significant figures.

   The cylinder is made of wood.
   The density of the wood is 0.7 grams per cm³

   b) Work out the mass of the cylinder.
      Give your answer correct to 3 significant figures.

Compound Measures - Density

1) An ice hockey puck has a volume of 113 cm³.

   It is made out of rubber with a density of 1.5 grams per cm³.

   Work out the mass of the ice hockey puck.   *M* = 169.5 g

2) An apple has a mass of 160 g and a volume of 100 cm³.

   Find its density in g/cm³.   *D* = 1.6 g/cm³

3) A steel ball has a volume of 1500 cm³.

   The density of the ball is 95 g/cm³.

   Find the mass of the ball **in kg**.   *M* = 142.5 kg

4) The mass of a bar of chocolate is 1800 g.

   The density of the chocolate is 9 g/cm³.

   What is the volume of the bar of chocolate?   *V* = 200 cm³

5) A solid cylinder has a radius of 4 cm and a height of 10 cm.

10 cm

← 4 cm →
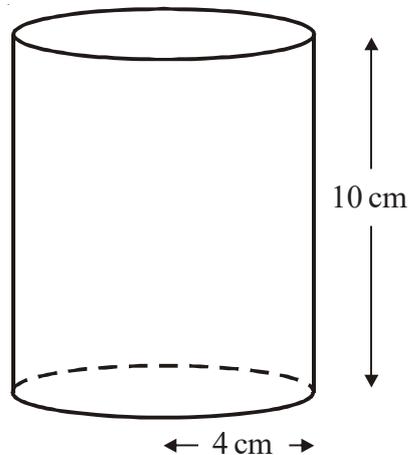
   a) Work out the volume of the cylinder.
      Give your answer correct to 3 significant figures.   503 cm³

   The cylinder is made of wood.
   The density of the wood is 0.7 grams per cm³

   b) Work out the mass of the cylinder.
      Give your answer correct to 3 significant figures.   352 g

1)   Calculate the:

      a) flow rate when a 240 L tank is filled in 15 minutes.

      b) volume of a container that takes 4 minutes to fill at a flow rate of 12 litres per minute.

      c) time taken to fill a 5 L bucket with a flow rate of 0.2 litres per second.

      d) volume of a vessel that takes 3 minutes to fill at a flow rate of 0.4 litres per second.

      e) time taken to fill a $75\,000\,cm^3$ box with a flow rate of 0.5 litres per second.

2)   A tap is used to fill a container which measures 120 cm by 80 cm by 50 cm
      The tap releases water at a flow rate of 0.8 litres per second.
      Find the time taken for the container to fill.

3)   Tank A is a cuboid with dimensions 6 m by 4 m by 3 m
      Tank B is a cube with dimensions 3 m
   Both tanks are initially empty and are filled with water.
      The flow rate of water into tank A is $0.5\,m^3/sec$
      The flow rate of water into tank B is $0.2\,m^3/sec$
      Which tank is filled quicker and by how many seconds?

4)   Two containers take the same amount of time to fill with water.
      Container A measures 1.5 m by 1.2 m by 0.5 m and is filled using a hose with a flow rate of
      0.8 litres per second.
      Container B measures 2 m by 1 m by 0.5 m and is filled using a tap.
      Calculate the flow rate of the tap used by Container B in litres per second.
      Give your answer to 1 decimal place.

5)   A swimming pool measures 50 m by 10 m.
      The pool takes 32 hours to fill at a rate of 1562.5 litres per minute.
      Calculate the depth of the pool.

6)   The diagram shows a full water tank.
      When a bottle is filled from the tank, it takes 20 seconds and the water level in the tank drops
      by 1 cm.
      Assume the rate of flow stays the same.
      How long would it take to completely empty the tank?

20 cm   30 cm   30 cm   50 cm
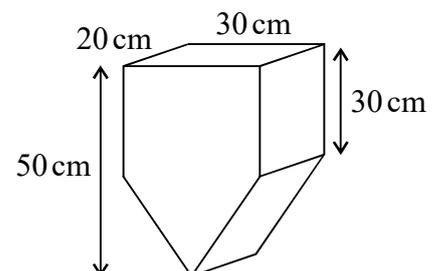
1) Calculate the:

a) flow rate when a 240 L tank is filled in 15 minutes.   *itres per minute*

b) volume of a container that takes 4 minutes to fill at a flow rate of 12 litres per minute.   *L*

c) time taken to fill a 5 L bucket with a flow rate of 0.2 litres per second.   *25   econds*

d) volume of a vessel that takes 3 minutes to fill at a flow rate of 0.4 litres per second.   *L*

e) time taken to fill a 75 000 cm^3 box with a flow rate of 0.5 litres per second.   *econds or*
   2 minutes 30 seconds

2) A tap is used to fill a container which measures 120 cm by 80 cm by 50 cm
   The tap releases water at a flow rate of 0.8 litres per second.
   Find the time taken for the container to fill.
   Time taken = 600 seconds = 10 minutes

3) Tank A is a cuboid with dimensions 6 m by 4 m by 3 m
   Tank B is a cube with dimensions 3 m
   Both tanks are initially empty and are filled with water.
   The flow rate of water into tank A is 0.5 m^3/sec
   The flow rate of water into tank B is 0.2 m^3/sec
   Which tank is filled quicker and by how many seconds?
   Tank A: 144 seconds
   Tank B: 135 seconds
   Tank B is quicker by 6 seconds

4) Two containers take the same amount of time to fill with water.
   Container A measures 1.5 m by 1.2 m by 0.5 m and is filled using a hose with a flow rate of
   0.8 litres per second.
   Container B measures 2 m by 1 m by 0.5 m and is filled using a tap.
   Calculate the flow rate of the tap used by Container B in litres per second.
   Give your answer to 1 decimal place.
   Time taken = 1125 seconds
   Flow rate = 0.9 litres per second

5) A swimming pool measures 50 m by 10 m.
   The pool takes 32 hours to fill at a rate of 1562.5 litres per minute.
   Calculate the depth of the pool.
   Depth = 6 m

6) The diagram shows a full water tank.
   When a bottle is filled from the tank, it takes 20 seconds and the water level in the tank drops
   by 1 cm.
   Assume the rate of flow stays the same.
   How long would it take to completely empty the tank?
   Flow rate = 30 cm^3 per second
   Total volume = 24000 cm^3
   Time taken = 800 seconds or 13 minutes 20 seconds
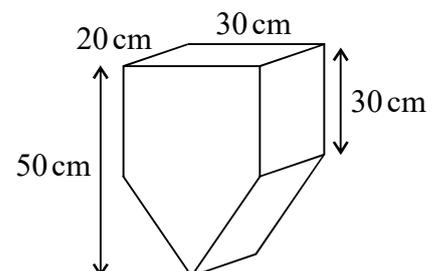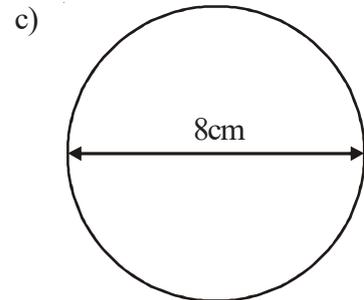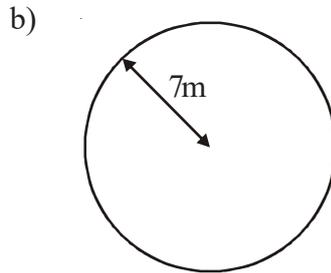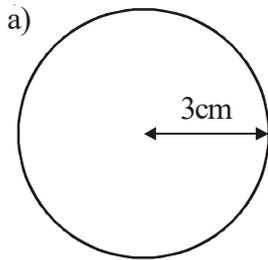
20 cm   30 cm

30 cm

50 cm

1) Find the areas of the following shapes.

a)

3cm

b)

7m

c)

8cm

2) Work out the areas of the following shapes.

a)

12 mm

b)

10cm
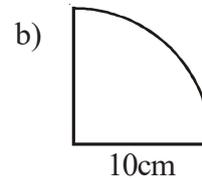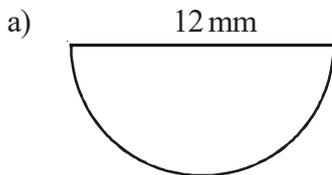
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table.

b) Work out the area of the base of the table.

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

Calculate the area of the shape.
Give your answer correct to
3 significant figures.

13 cm

17 cm

Area of a Circle

1) Find the areas of the following shapes.

a)

3cm

28.278 cm²

b)

7m

153.958 m²

c)

8cm
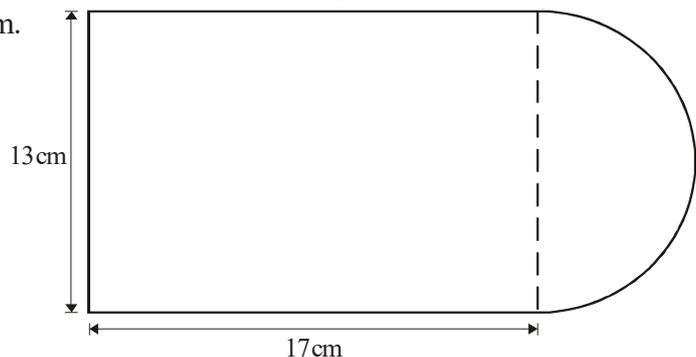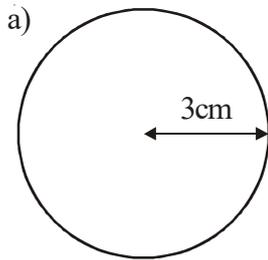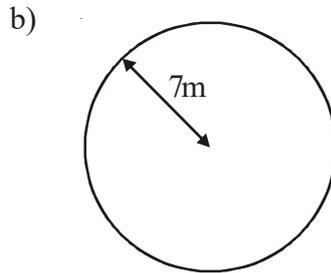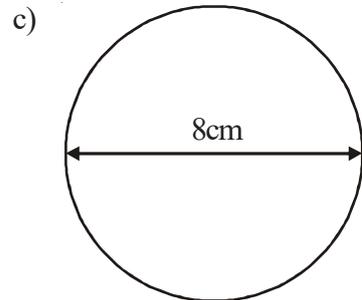
50.272 cm²

2) Work out the areas of the following shapes.

a)

12 mm

56.556 mm²

b)
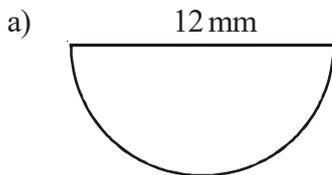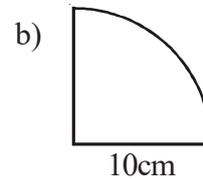
10cm   **78.55 cm²**

3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table. **11311.2 cm²**

b) Work out the area of the base of the table. **706.95 cm²**

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

Calculate the area of the shape.
Give your answer correct to
3 significant figures. **287 cm²**
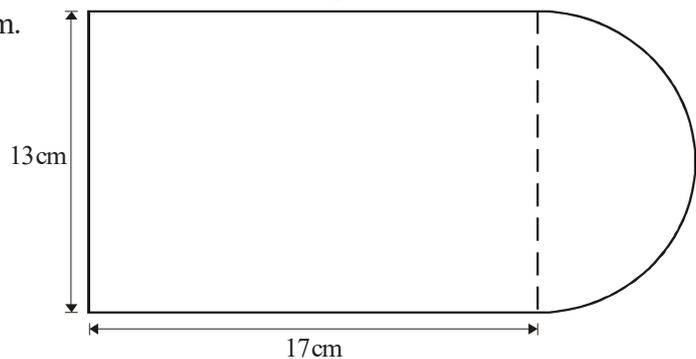
13 cm
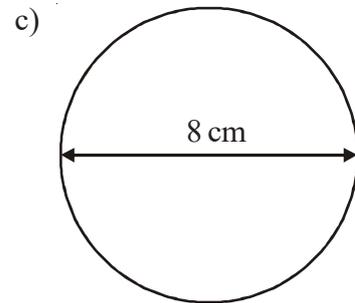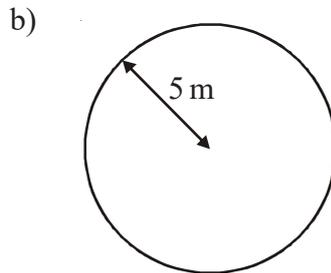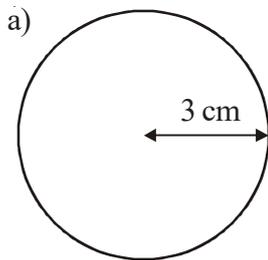
17 cm

Circumference of a Circle

1) Find the circumference of the following shapes.

a)

3 cm

b)

5 m

c)

8 cm

2) Work out the perimeter of the following shapes.

a)

12 mm

b)

10 cm
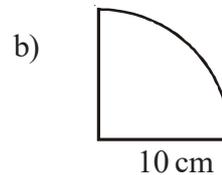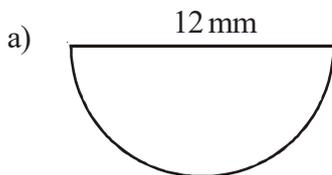
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.
   Let π be 3.14

b) Work out the circumference of the base of the table.
   Let π be 3.14

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.

12 cm

15 cm

Circumference of a Circle

1) Find the circumference of the following shapes.

a)

3 cm

18.852 cm

b)

5 m

31.42 m

c)
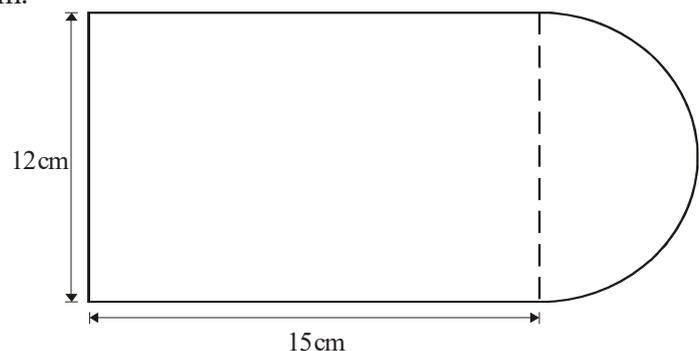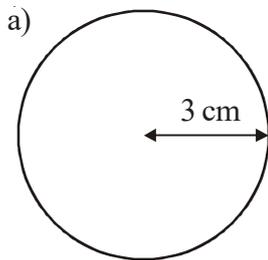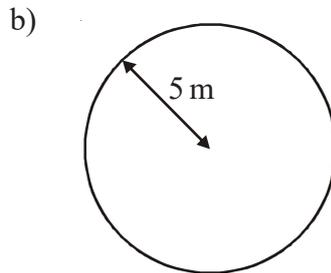
8 cm
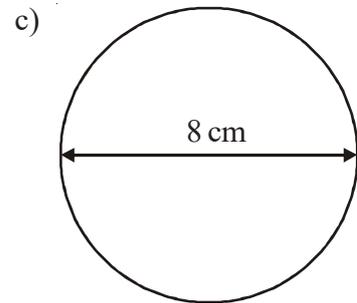
25.136 cm

2) Work out the perimeter of the following shapes.

a)

12 mm

30.852 mm

b)
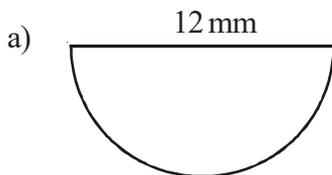
10 cm
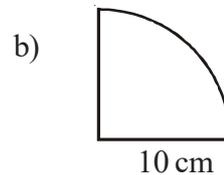
35.71 cm

3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.
    Let π be 3.14   376.8 cm

b) Work out the circumference of the base of the table.
    Let π be 3.14   94.2 cm

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.   60.9 cm
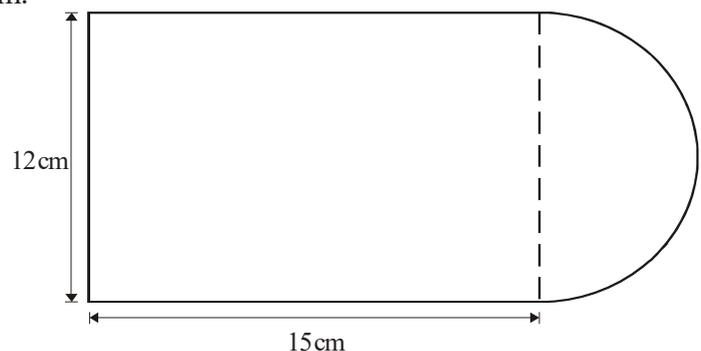
12 cm

15 cm

1) A circle has a radius of 5 cm.
   A square has sides of length 12 cm.
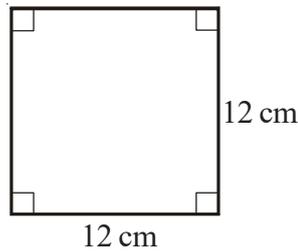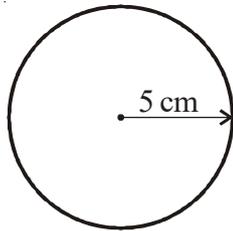
5 cm

12 cm

12 cm

   Work out the difference between the area of the circle and the area
   of the square if you take π to be 3.

2) Here is a tile in the shape of a semi-circle.
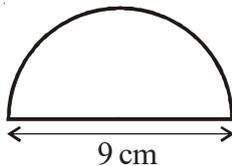
9 cm

   The diameter of the semi-circle is 9 cm.
   Work out the perimeter of the tile.
   Give your answer correct to two decimal places.

3) A circle has a radius of 7 cm.

7 cm
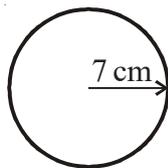
   Work out the area of the circle.
   Give your answer correct to three significant figures.

4) A circle has a diameter of 14 cm.
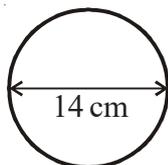
14 cm

   Work out the circumference of the circle.
   Give your answer correct to three significant figures.

1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.
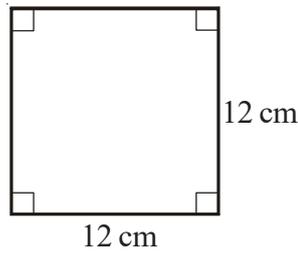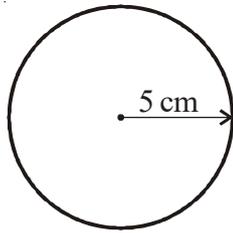
5 cm

12 cm

12 cm

Work out the difference between the area of the circle and the area
of the square if you take π to be 3.

69 cm²

2) Here is a tile in the shape of a semi-circle.
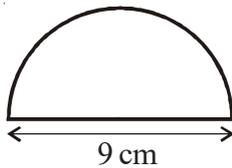
9 cm

The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places. 23.14 cm

3) A circle has a radius of 7 cm.

7 cm
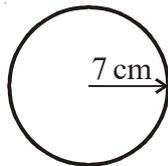
Work out the area of the circle.
Give your answer correct to three significant figures. 154 cm²

4) A circle has a diameter of 14 cm.
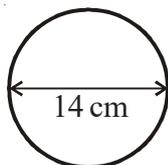
14 cm

Work out the circumference of the circle.
Give your answer correct to three significant figures. 44.0 cm

Area and Circumference of a Circle

1) The radius of a circle is 10 cm.

10 cm
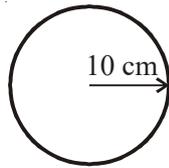
Work out the area of this circle.

2) The diagram shows a circular pond with a path around it.
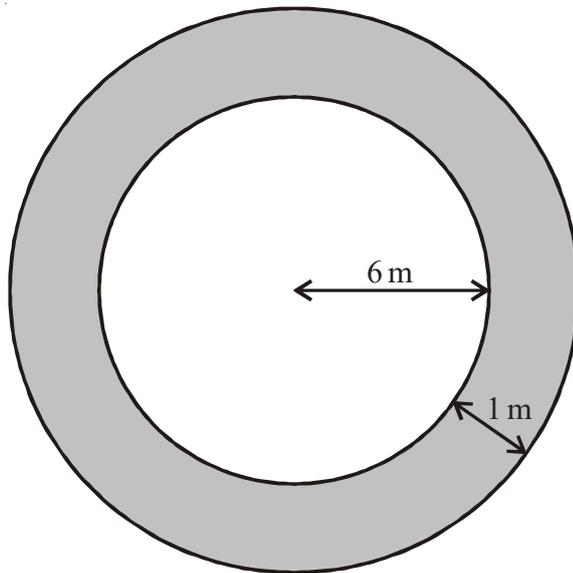
6 m

1 m

The pond has a radius of 6 m.
The path has a width of 1 m.

Work out the area of the path.
Give your answer correct to 3 significant figures.

3) The diagram shows a CD which has a radius of 6 cm.
   a) Work out the circumference of the CD.
      Give your answer correct to 3 significant figures.

6 cm

CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.

   b) Work out the greatest number of CDs which can be cut from one
      rectangular sheet.

Area and Circumference of a Circle
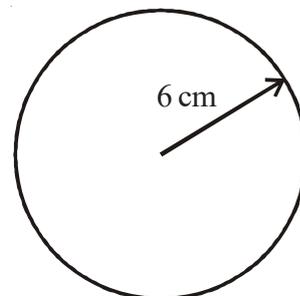
1) The radius of a circle is 10 cm.

10 cm
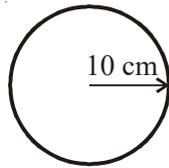
Work out the area of this circle.   314.2 cm²

2) The diagram shows a circular pond with a path around it.
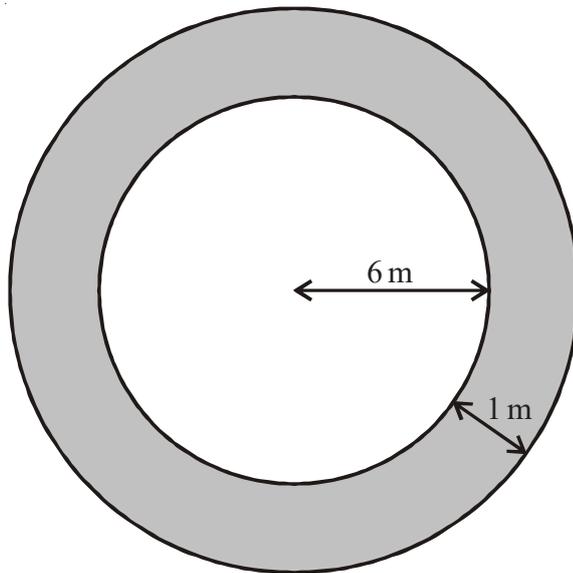
6 m

1 m

The pond has a radius of 6 m.
The path has a width of 1 m.

Work out the area of the path.
Give your answer correct to 3 significant figures.   40.8 m²

3) The diagram shows a CD which has a radius of 6 cm.
   a) Work out the circumference of the CD.
      Give your answer correct to 3 significant figures.

   37.7 cm

6 cm

CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.
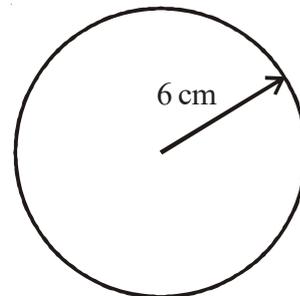
   b) Work out the greatest number of CDs which can be cut from one
      rectangular sheet.   32

1)   Find the surface area of this triangular prism.

5 cm

3 cm

6 cm

4 cm

2)   Find the surface area of this triangular prism.

12 cm

13 cm   13 cm

15 cm

10 cm

3)   With the aid of Pythagoras' Theorem, find the surface area of this
     triangular prism.
     Give your answer correct to 2 significant figures.

4.6 cm

9.3 cm

2.3 cm
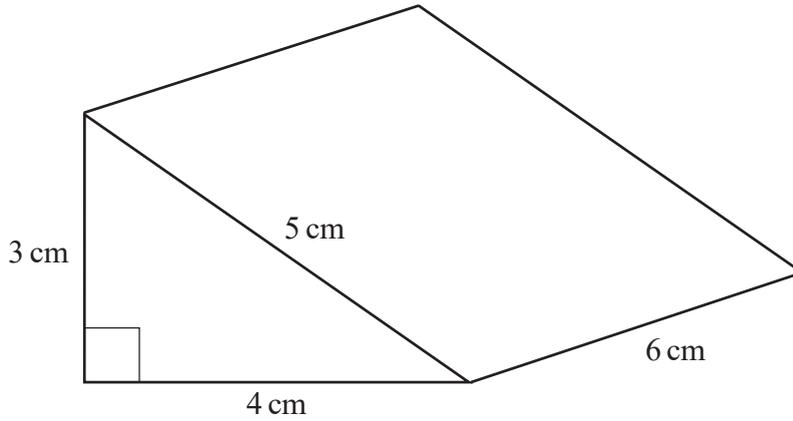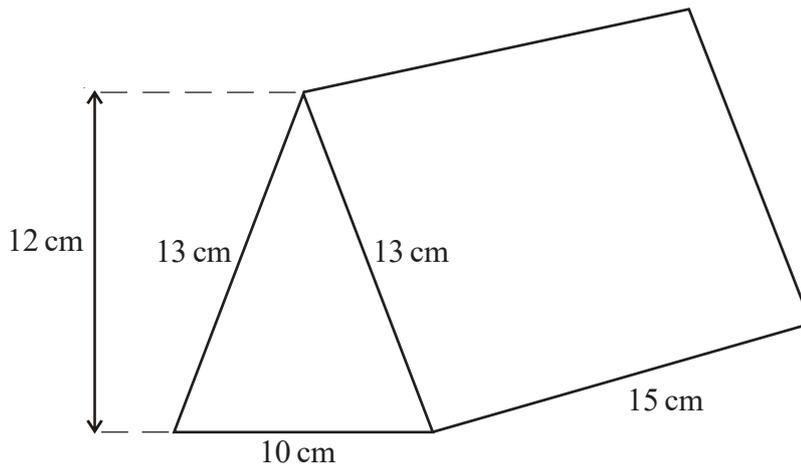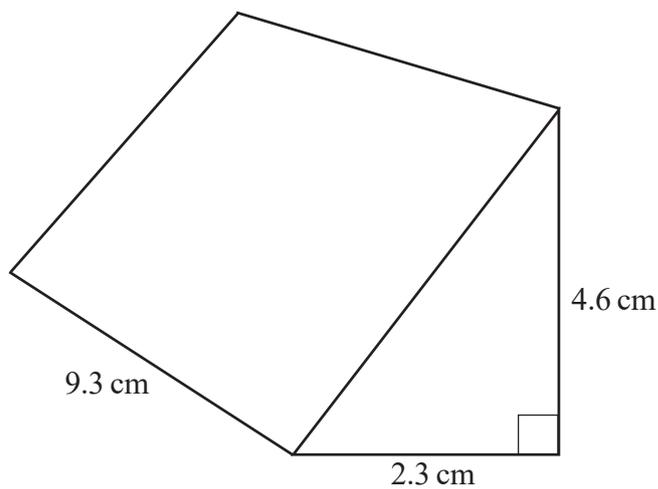
1)   Find the surface area of this triangular prism.   **84 cm²**

3 cm
5 cm
4 cm
6 cm
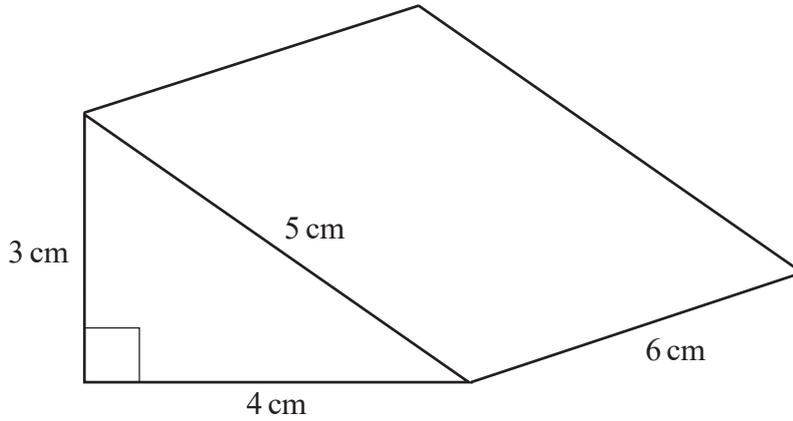
2)   Find the surface area of this triangular prism.   **660 cm²**
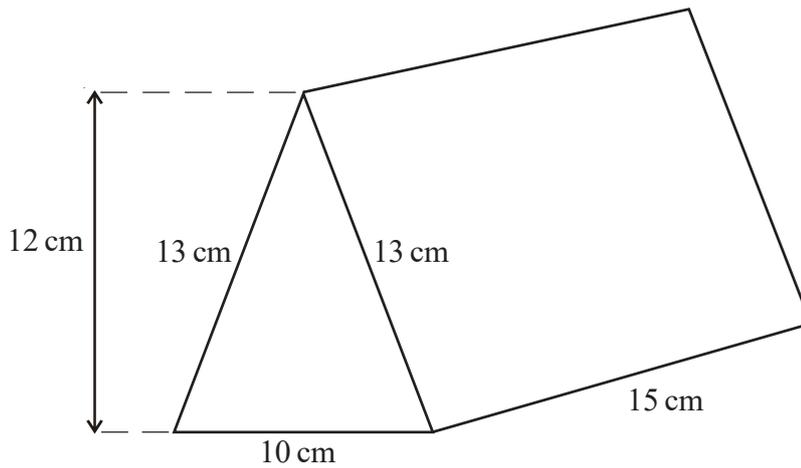
12 cm
13 cm   13 cm
10 cm
15 cm

3)   With the aid of Pythagoras' Theorem, find the surface area of this
      triangular prism.
      Give your answer correct to 2 significant figures.   **120 cm²**
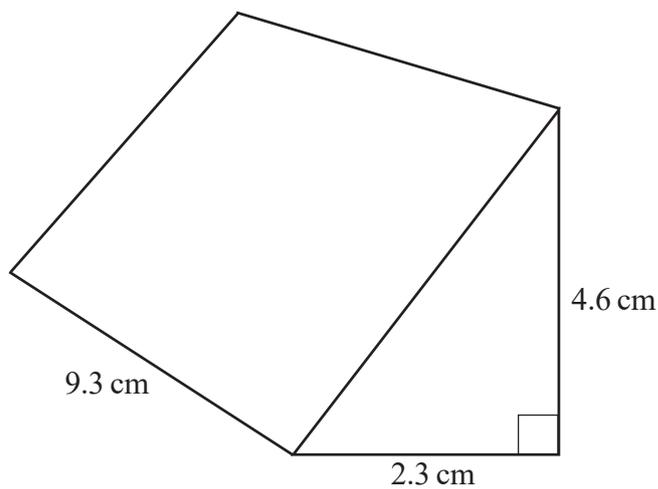
4.6 cm
9.3 cm
2.3 cm

1) Work out the surface area of this cylinder.

6 cm

10 cm

2) Work out the surface area of this cylinder.

8.5 cm

15 cm

3) Work out the surface area of this cylinder.

50 cm

17 cm

4) Work out the surface area of a cylinder with radius 10 cm and height 11 cm.

1)   Work out the surface area of this cylinder.

6 cm
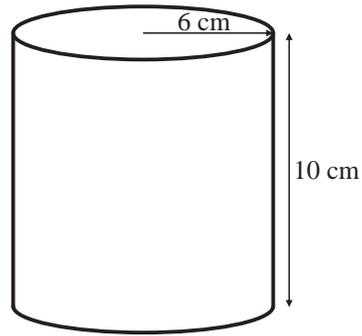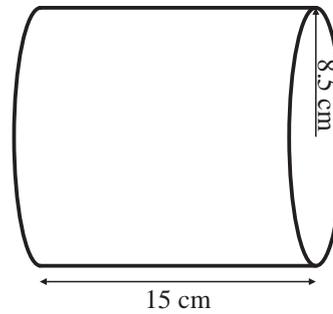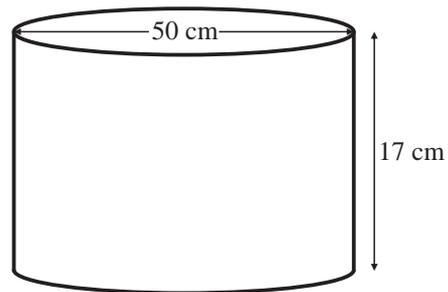
10 cm

603.2 cm²

2)   Work out the surface area of this cylinder.

8.5 cm

15 cm
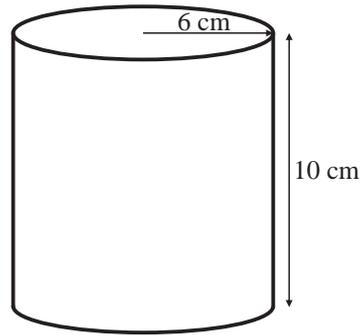
1255.1 cm²

3)   Work out the surface area of this cylinder.

50 cm

17 cm
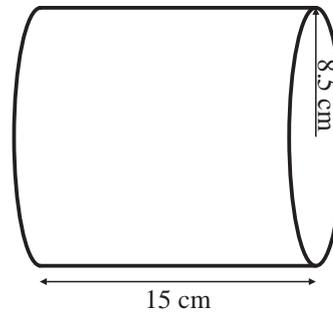
6597.3 cm²
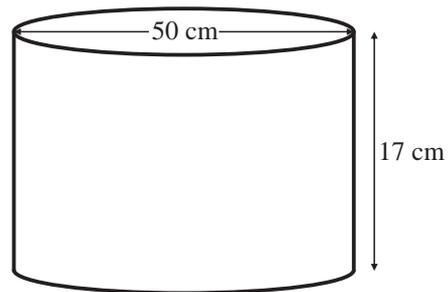
4)   Work out the surface area of a cylinder with radius 10 cm and height 11 cm.   1319.5 cm²

Volume of a Prism

1) The diagram shows a cuboid.
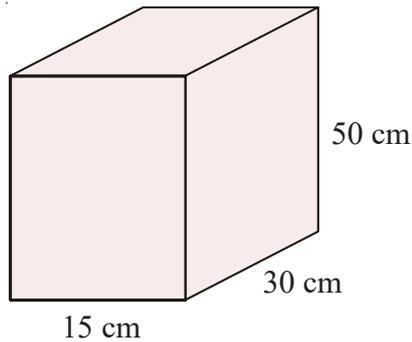
   Work out the volume of the cuboid.

   50 cm

   30 cm

   15 cm

2) Calculate the volume of this triangular prism.

   4 cm

   5 cm

   3 cm

   9 cm
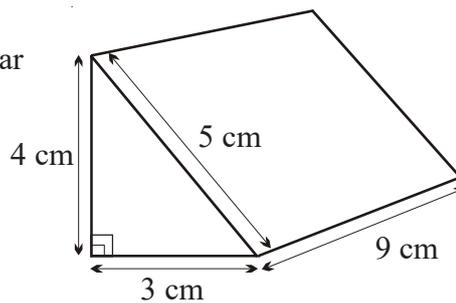
3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

   2.5 cm

   3.8 cm
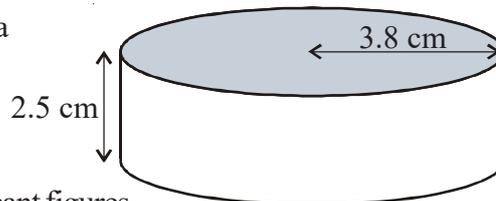
   Work out the volume of the puck.
   Give your answer correct to 3 significant figures.

4) A cuboid has: a volume of 80cm³
                    a length of 5 cm
                    a width of 2 cm

   Work out the height of the cuboid.

5) Work out the maximum number of boxes which can fit in the carton.

   200 cm

   Carton

   100 cm

   80 cm

   50 cm

   Box

   20 cm

   10 cm

1) The diagram shows a cuboid.

Work out the volume of the cuboid.

22500 cm³

50 cm

30 cm

15 cm
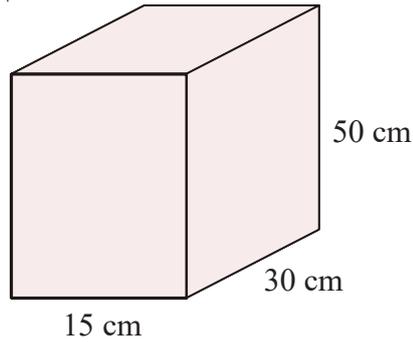
2) Calculate the volume of this triangular prism.

54 cm³
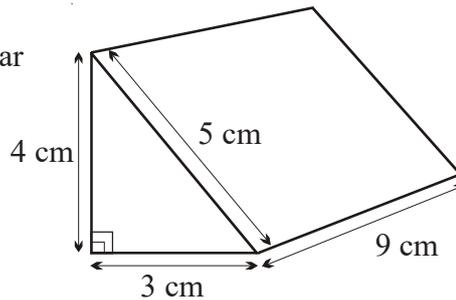
4 cm

5 cm

9 cm

3 cm

3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

2.5 cm

3.8 cm

Work out the volume of the puck.
Give your answer correct to 3 significant figures.

113 cm³
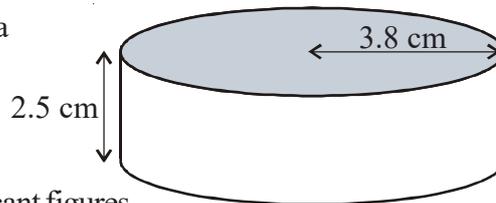
4) A cuboid has: a volume of 80cm³
a length of 5 cm
a width of 2 cm

Work out the height of the cuboid.   8 cm

5) Work out the maximum number of boxes which can fit in the carton.

160
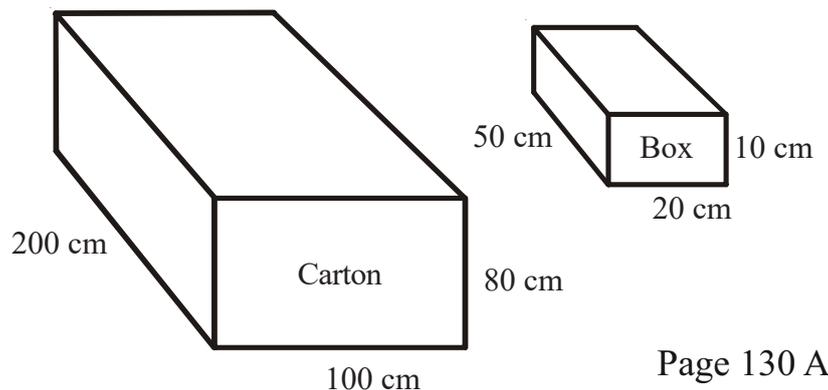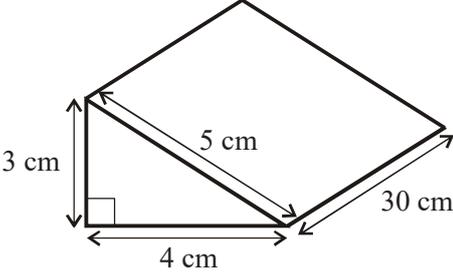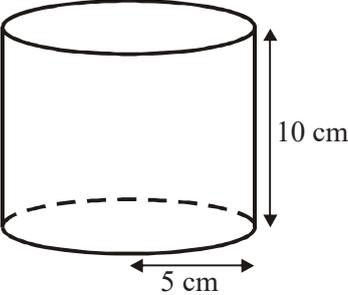
200 cm

Carton

100 cm

80 cm

50 cm

Box

20 cm

10 cm

1) Work out the volume of the prism.

5 cm

3 cm

30 cm

4 cm

2)

10 cm

5 cm

A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

3)

8 cm

6 cm

20 cm

12 cm
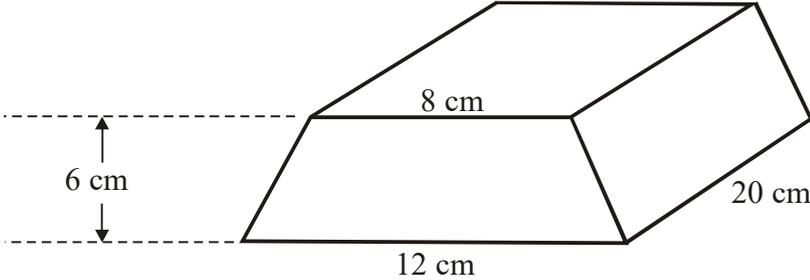
The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

Find the volume of the prism.
You must state your units.

1) Work out the volume of the prism. **180 cm³**
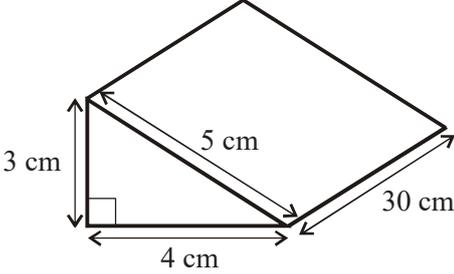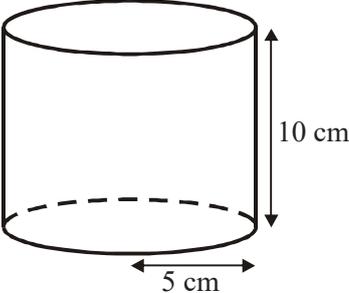
3 cm
5 cm
30 cm
4 cm

2) A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

786 cm³
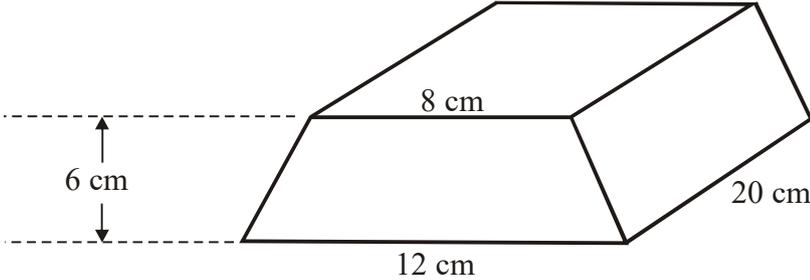
10 cm

5 cm

3)

6 cm
8 cm
20 cm
12 cm

The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

Find the volume of the prism.
You must state your units. **1200 cm³**

Pythagoras' Theorem - Introduction

1) Find the length of side *a*.
   Give your answer to 1 decimal place.

12 cm

a

14 cm

2) Find the length of side *b*.
   Give your answer to 1 decimal place.

b

5 cm

8 cm

3) Find the length of side *c*.
   Give your answer to 1 decimal place.

10 cm

13 cm

c

4) Find the length of side *d*.
   Give your answer to 1 decimal place.

d

8 cm

5 cm

5) Find the length of the diagonal of this rectangle.
   Give your answer to 1 decimal place.

9 cm

16 cm

Pythagoras' Theorem - Introduction

1) Find the length of side *a*.
   Give your answer to 1 decimal place.

   18.4 cm

12 cm

a

14 cm
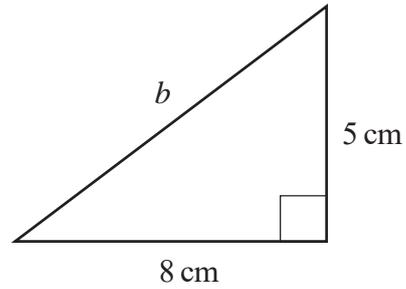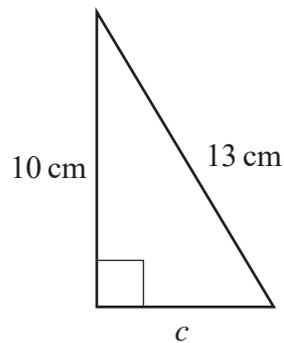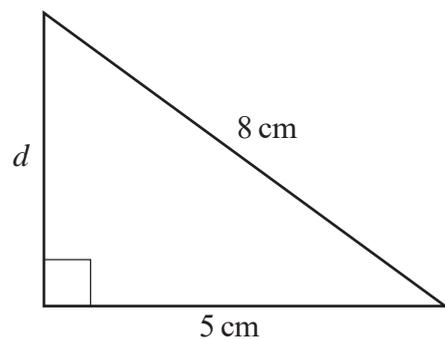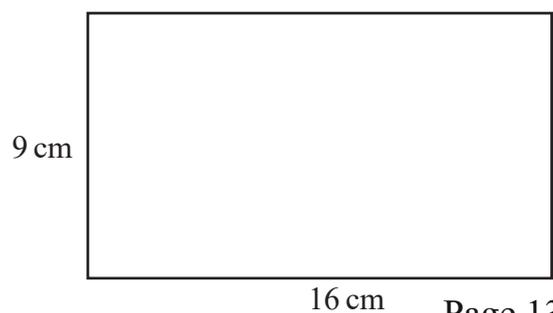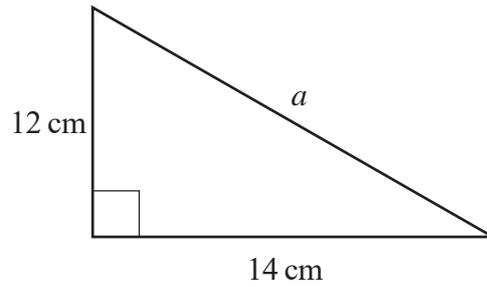
2) Find the length of side *b*.
   Give your answer to 1 decimal place.

   9.4 cm

b

5 cm

8 cm
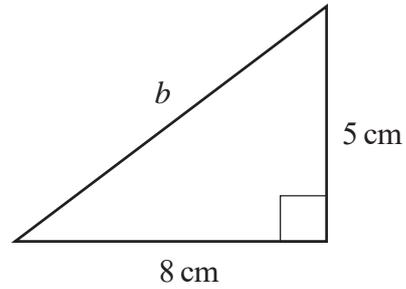
3) Find the length of side *c*.
   Give your answer to 1 decimal place.

   8.3 cm
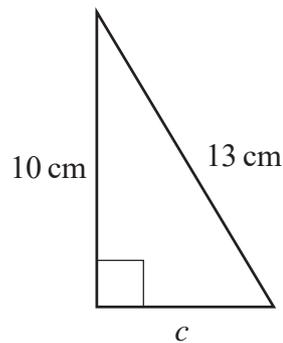
10 cm

13 cm

c

4) Find the length of side *d*.
   Give your answer to 1 decimal place.

   6.2 cm
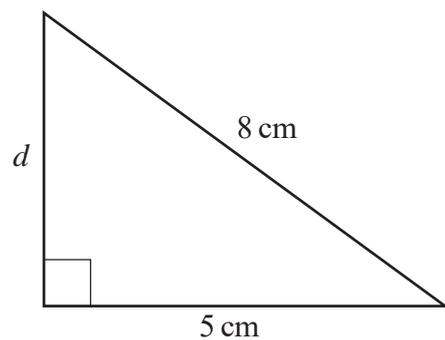
8 cm

d

5 cm

5) Find the length of the diagonal of this rectangle.
   Give your answer to 1 decimal place.

   18.4 cm

9 cm

16 cm

Pythagoras' Theorem - Introduction

1) Find the length of side *AC*.
Give your answer to 1 decimal place.

A

12cm

B   7cm   C
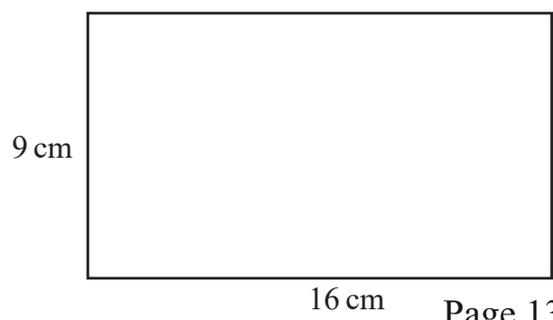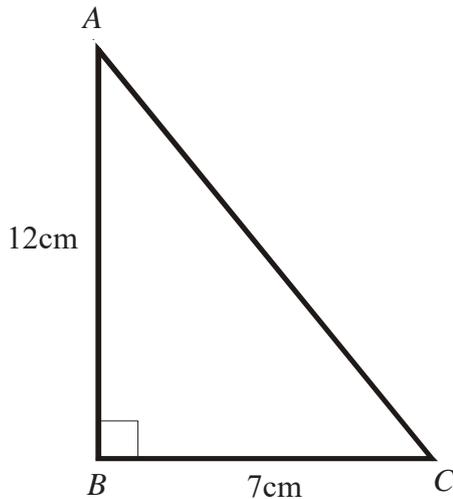
2) Find the length of side *QR*
Give your answer to 1 decimal place.
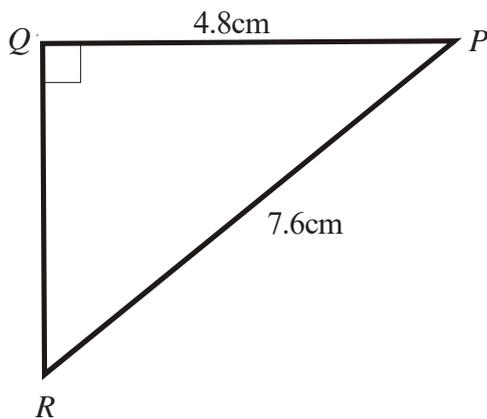
Q   4.8cm   P

7.6cm

R

3) Find the length of side *SU*
Give your answer to 1 decimal place.

T   23cm   S

14cm

U

4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

2.1m

0.8m

5) In the sketch of the rectangular field, below,
James wants to walk from *B* to *D*.

A   B

60m

D   50m   C
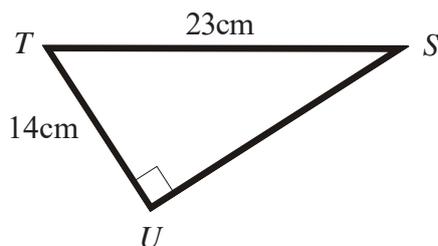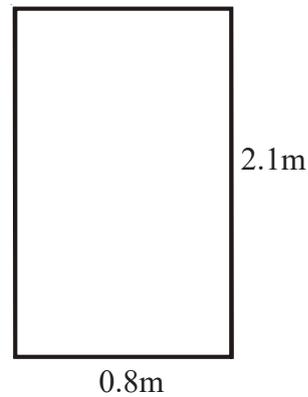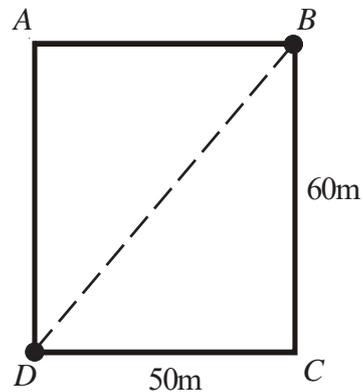
Which of the following routes is shorter and
by how much?
From *B* to *C* to *D* or straight across the field
from *B* to *D*.
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical
beaker as shown below.
The beaker has a diameter of 8cm and
a height of 17cm.
Will a pencil of length 19cm fit in the beaker
without poking out of the top?
All workings must be shown.
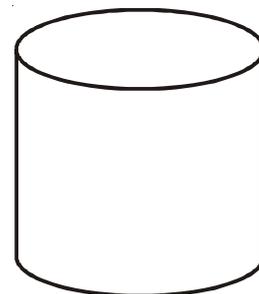
Pythagoras' Theorem - Introduction

1) Find the length of side *AC*.
Give your answer to 1 decimal place.

13.9 cm

A

12cm

B 7cm C
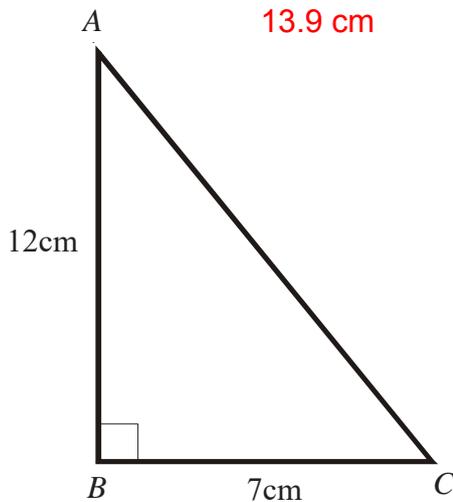
2) Find the length of side *QR* **5.9 cm**
Give your answer to 1 decimal place.
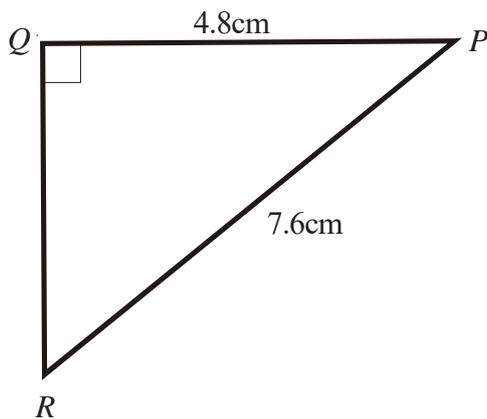
4.8cm
Q P

7.6cm

R

3) Find the length of side *SU*
Give your answer to 1 decimal place.

18.2 cm

23cm
T S

14cm

U

4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

2.2 m

2.1m

0.8m

5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.

A B

60m

D 50m C
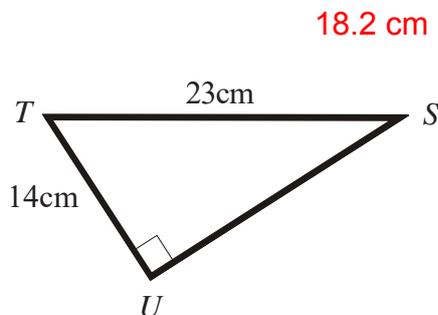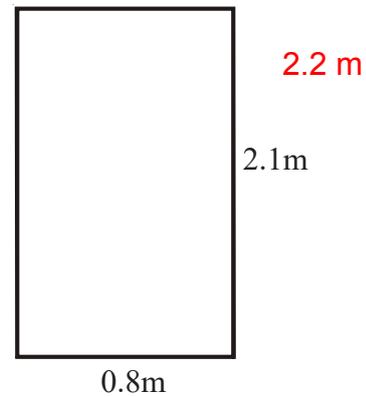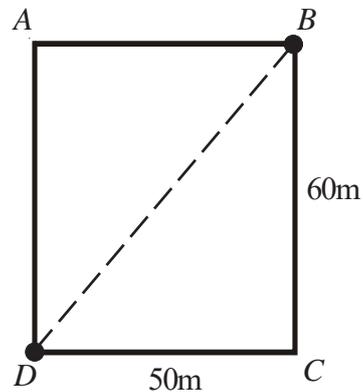
Which of the following routes is shorter and by how much?
From *B* to *C* to *D* or straight across the field from *B* to *D*. **B to D is shorter, by 32 m**
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top? **No. The diagonal is only 18.8cm.**
All workings must be shown.

Longest side
$17^2 = 289$
$8^2 = \underline{64}$
353
$\sqrt{353} = 18.79$
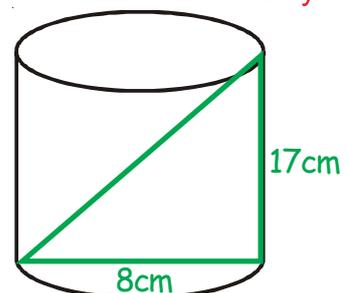
17cm

8cm

Page 131 B

Pythagoras' Theorem - Line on a Graph

1) Points *P* and *Q* have coordinates (1, 4) and (5, 2).
   Calculate the shortest distance between *P* and *Q*.
   Give your answer correct to 1 decimal place.
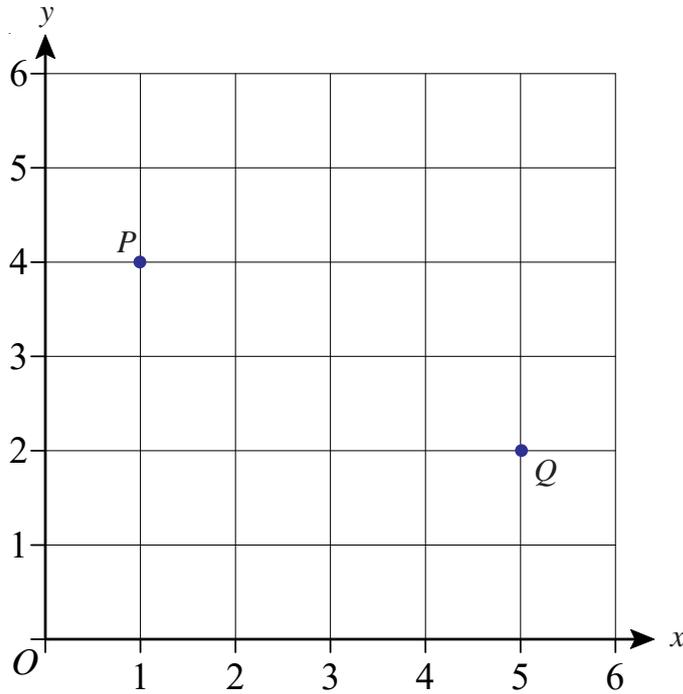
2) Points *A* and *B* have coordinates (-4, 3) and (3, -2).
   Calculate the shortest distance between *A* and *B*.
   Give your answer correct to 1 decimal place.
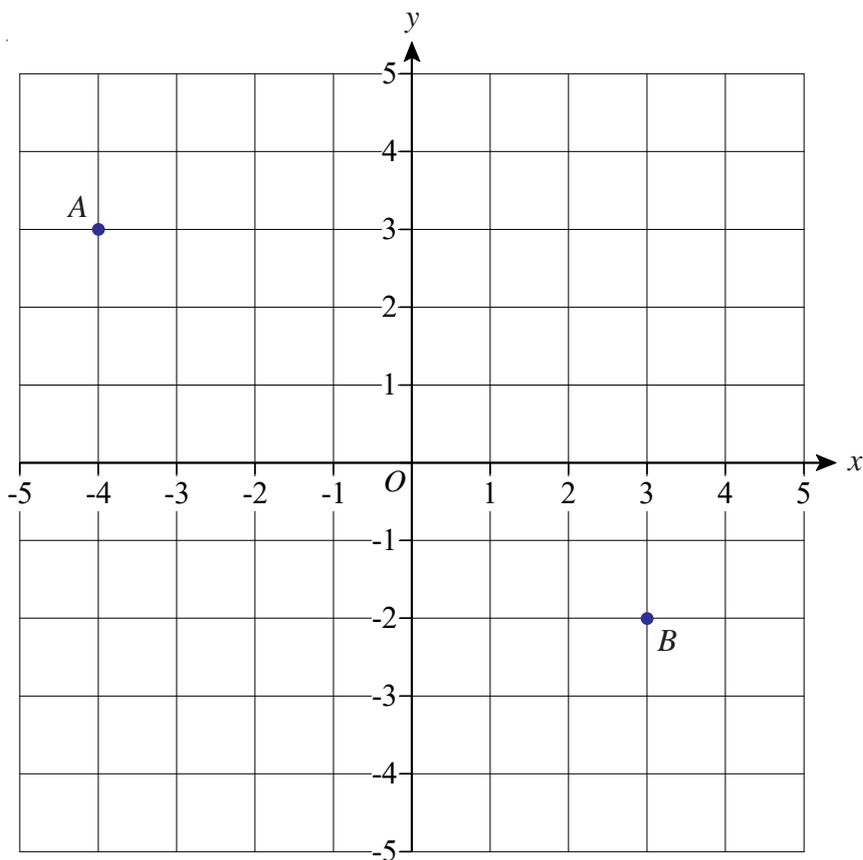
1) Points P and Q have coordinates $(1, 4)$ and $(5, 2)$.
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place.   4.5
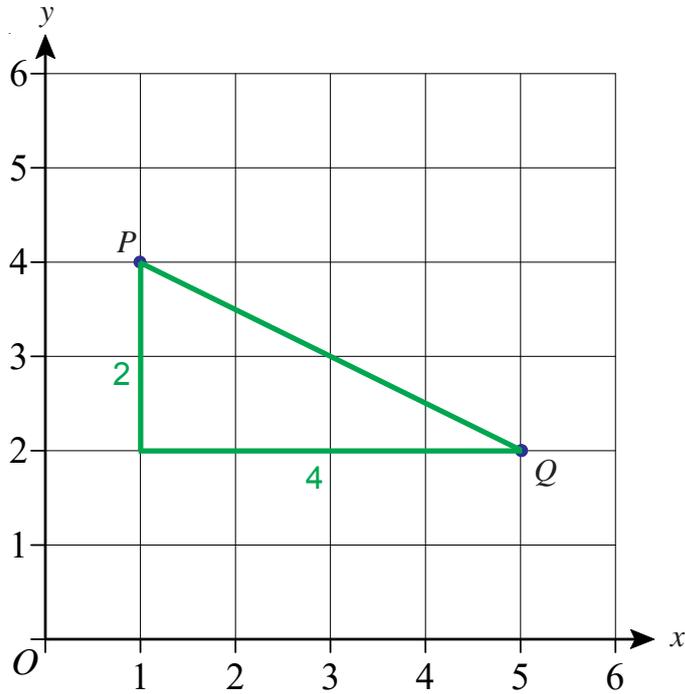
2) Points A and B have coordinates $(-4, 3)$ and $(3, -2)$.
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.   8.6
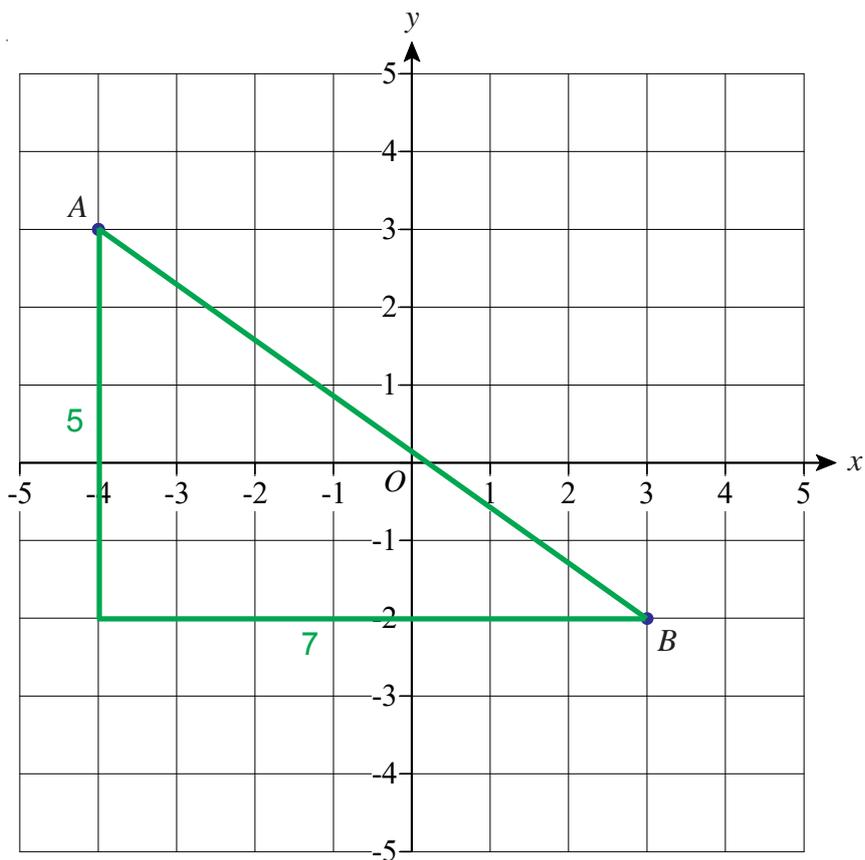
1)   The points *A* (3, 0), *B* (2, 4) and *C* (-3, 1) are three corners of a parallelogram.

     What are the coordinates of the 4th corner?
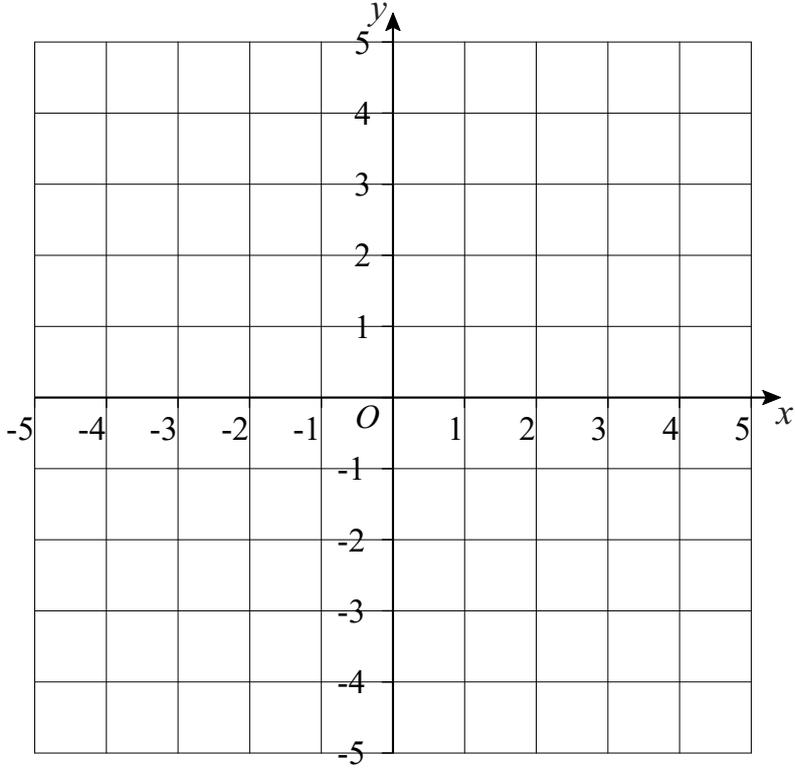
2)   The diagram shows 3 vertices of a parallelogram.

     Write down the coordinates of all the possibilities for the 4th vertex.
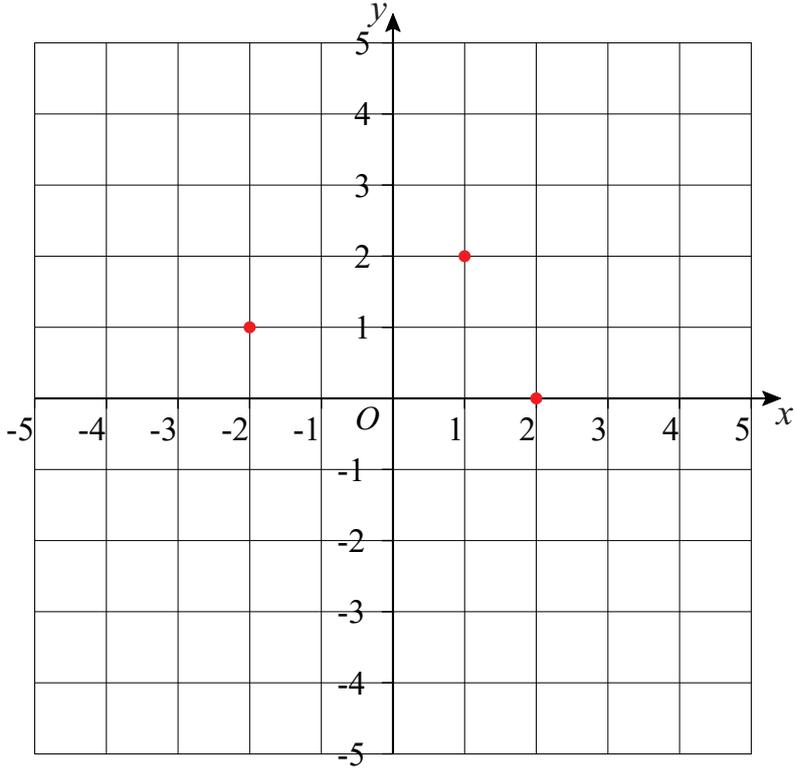
1) The points *A* (3, 0), *B* (2, 4) and *C* (-3, 1) are three corners of a parallelogram.

    What are the coordinates of the 4th corner? (-2, -3)
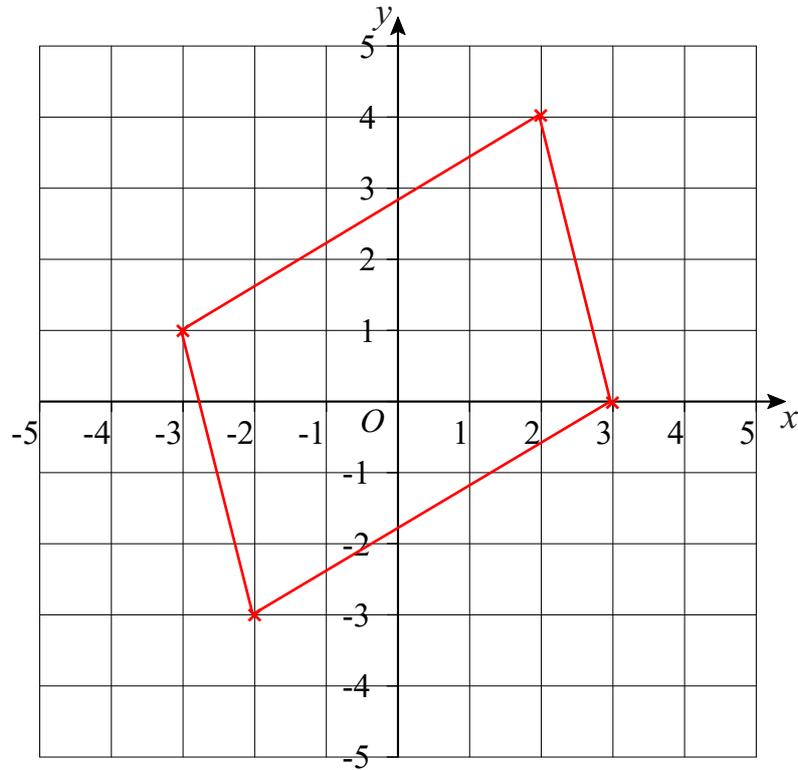
2) The diagram shows 3 vertices of a parallelogram.

    Write down the coordinates of all the possibilities for the 4th vertex. (-1, -1) or (-3, 3) or (5, 1)
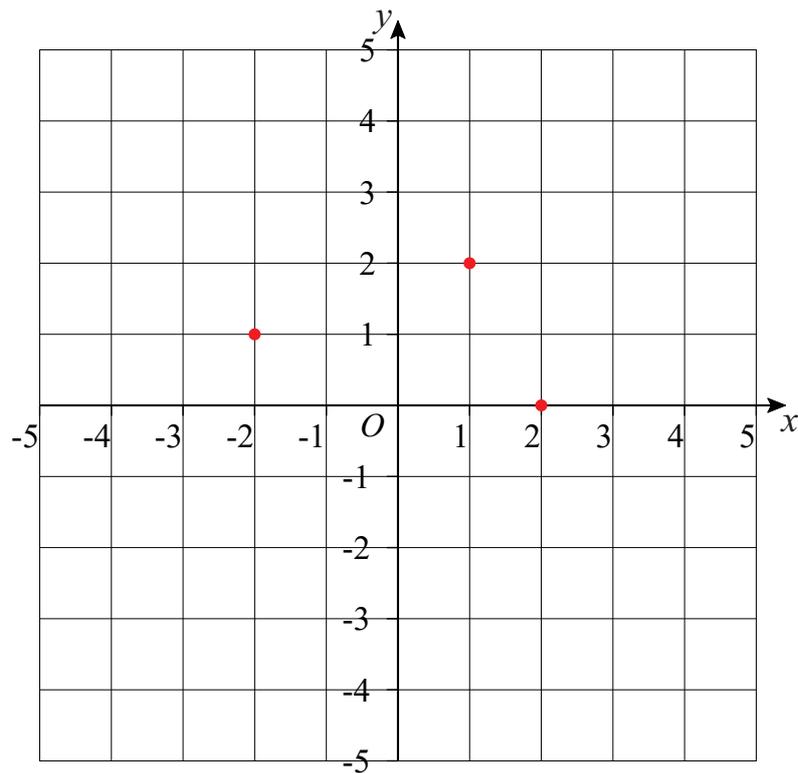
Enlargements - Fractional Scale Factor

1) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.

Label your new triangle W.
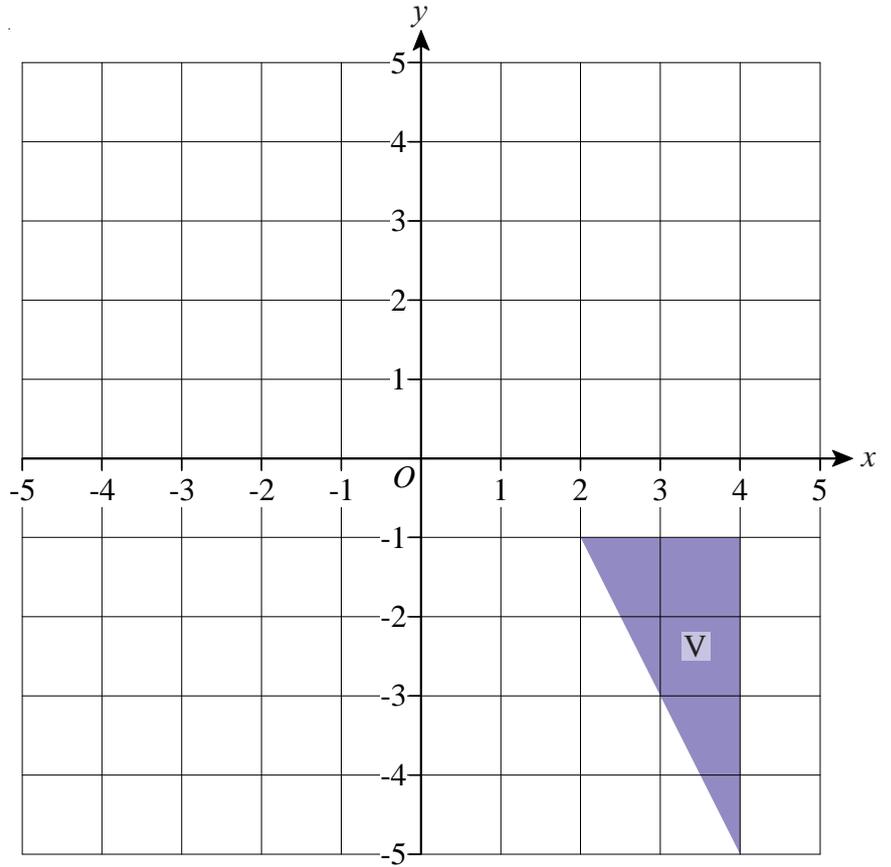
2) Describe fully the single transformation which maps triangle T to triangle S.
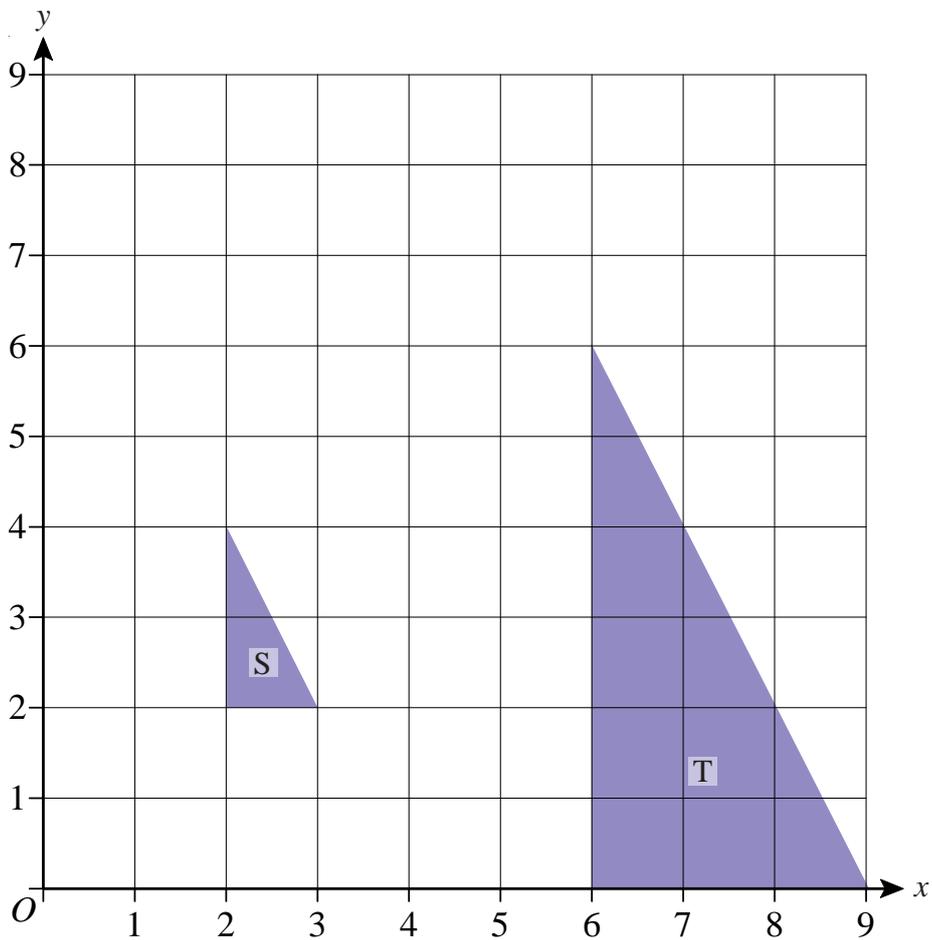
Enlargements - Fractional Scale Factor

1) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.

Label your new triangle W.
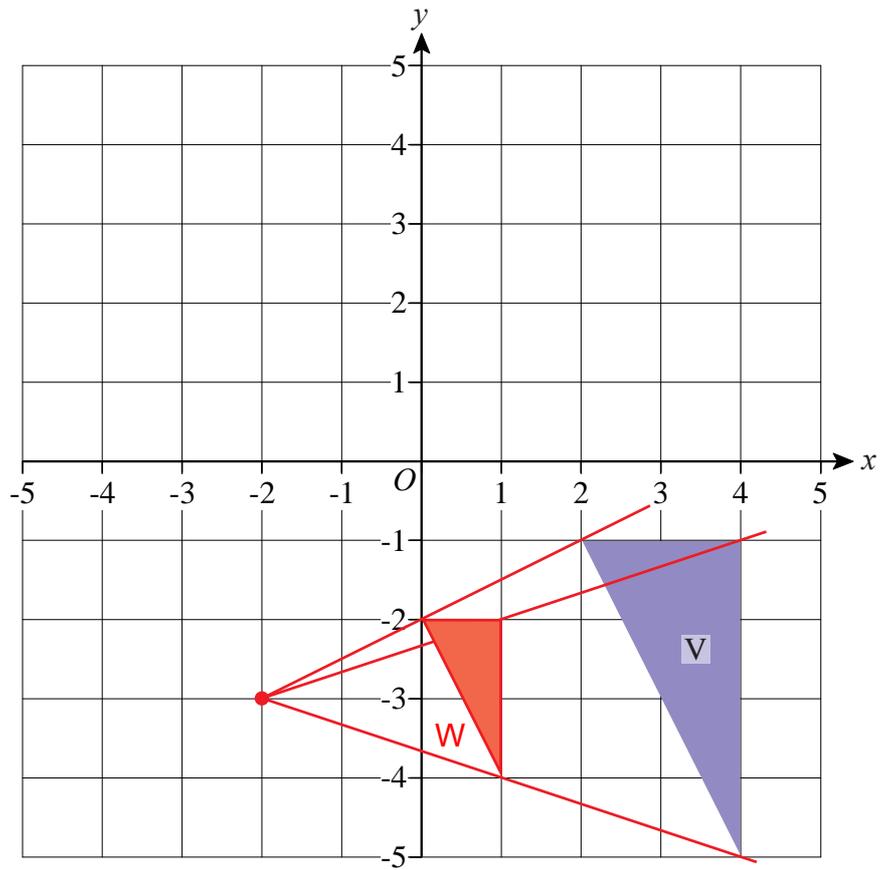
2) Describe fully the single transformation which maps triangle T to triangle S.

Enlargement, scale factor $\frac{1}{3}$, centre of enlargement (0, 3).
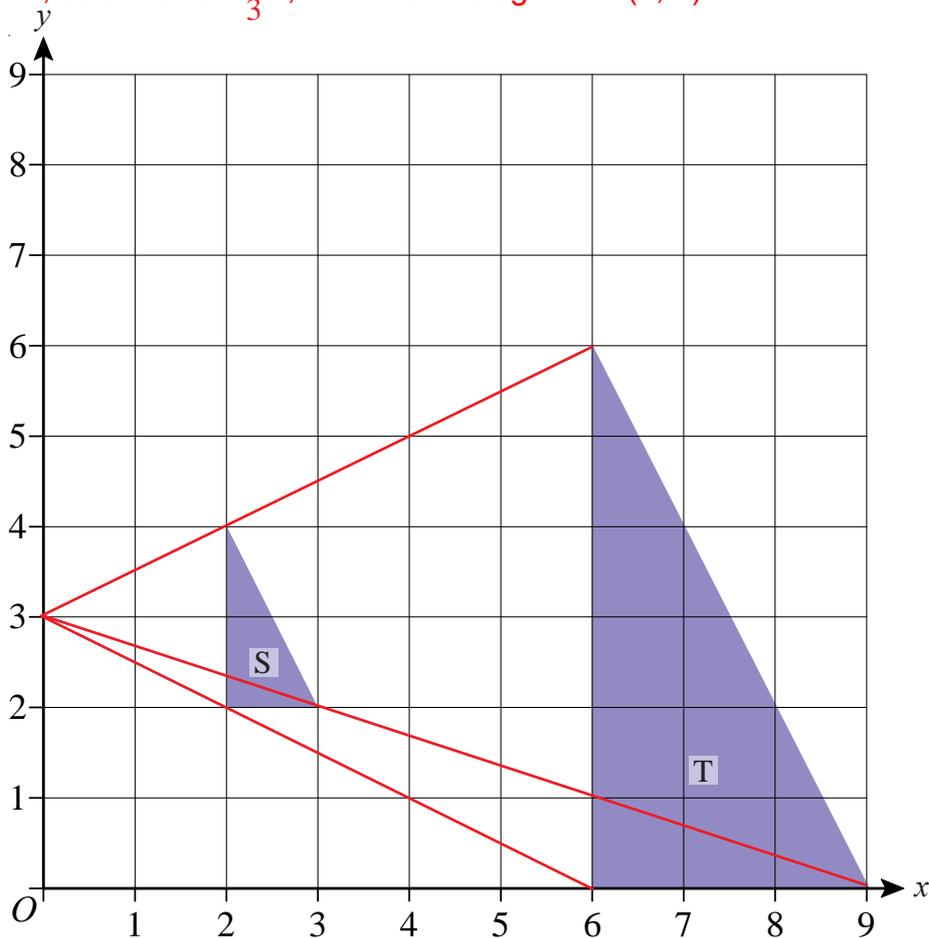
Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.

N
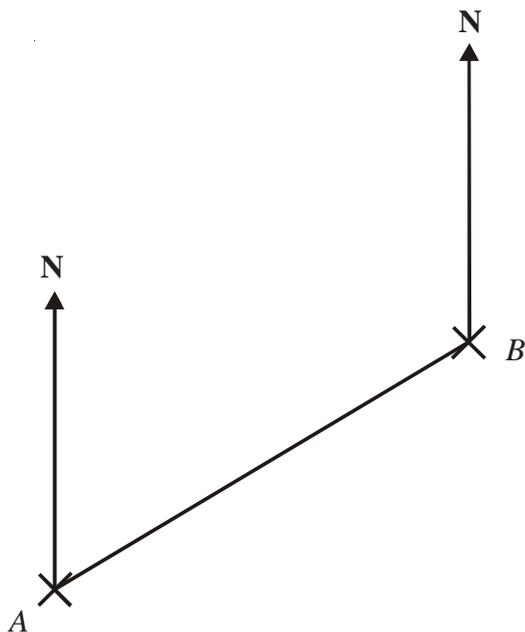
a) Measure the bearing of *B* from *A*.

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

N

b) Mark the position of *C* with a cross and label it *C*.

× *B*

×
A

2) The diagram shows the positions of two boats, *P* and *Q*.

N

N

×
Q

×
P
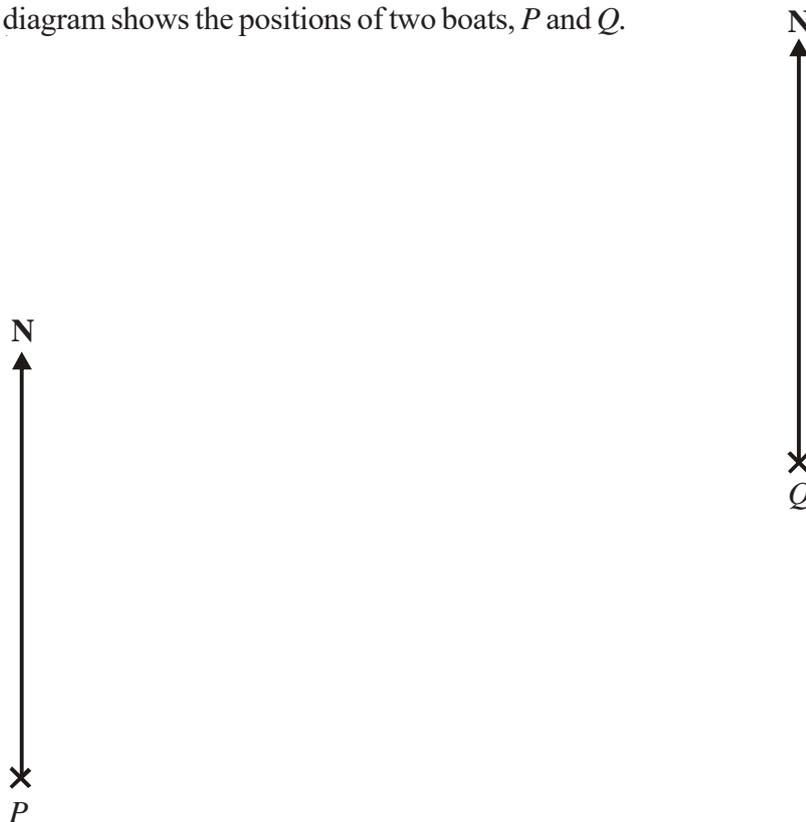
The bearing of a boat *R* from boat *P* is 050°
The bearing of boat *R* from boat *Q* is 320°

In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.

N
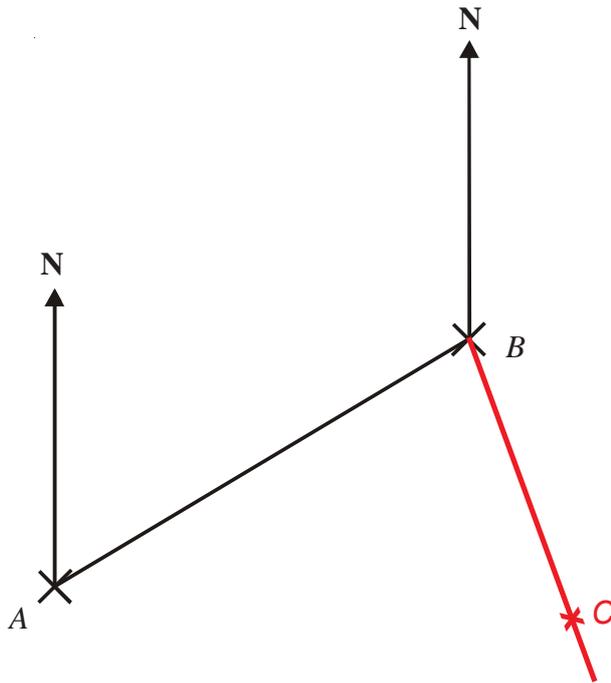
a) Measure the bearing of *B* from *A*.   059°

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

N

b) Mark the position of *C* with a cross and label it *C*.

B

A

C

2) The diagram shows the positions of two boats, *P* and *Q*.
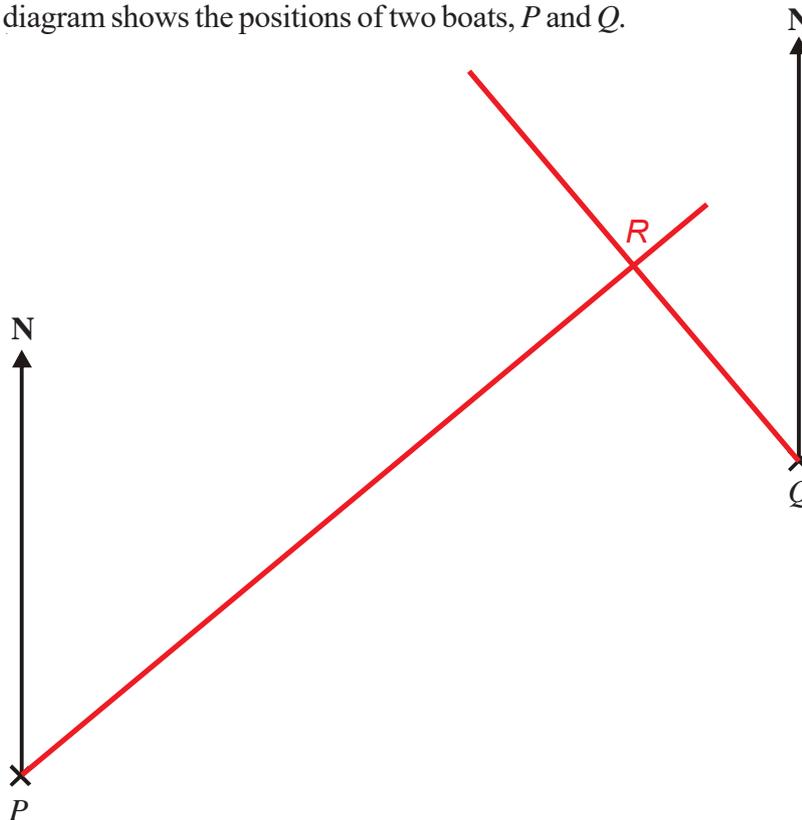
N

N

R

N

Q

P

The bearing of a boat *R* from boat *P* is 050°
The bearing of boat *R* from boat *Q* is 320°

In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

1) School *B* is due east of school *A*.
   C is another school.
   The bearing of *C* from *A* is 065°.
   The bearing of *C* from *B* is 313°.

   Complete the scale drawing below.
   Mark with a cross the position of *C*.

N

A ●————————————————————————————● B

2) In the diagram, point *A* marks the position of Middlewitch.
   The position of Middlemarch is to be marked on the diagram as point *B*
   On the diagram, mark with a cross the position of *B* given that:

   B is on a bearing of 320° from *A* and
   B is 5 cm from *A*

N
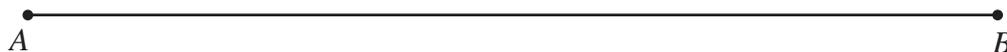
● A

3) **Work out** the bearing of
   a) *B* from *P*
   b) *P* from *A*
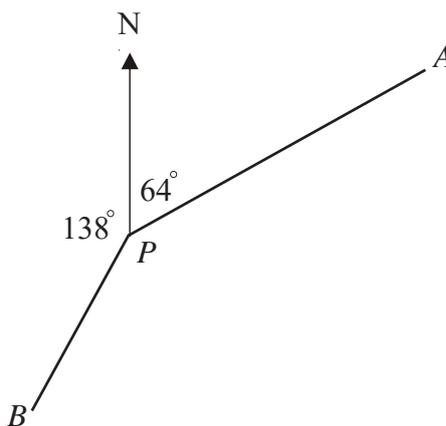
N

64°

138°

P

A

B

*Diagram **NOT**
accurately drawn.*

Bearings

1) School *B* is due east of school *A*.
C is another school.
The bearing of *C* from *A* is 065°.
The bearing of *C* from *B* is 313°.

Complete the scale drawing below.
Mark with a cross the position of *C*.

N

65°

C

47°

A

B

313°

2) In the diagram, point *A* marks the position of Middlewitch.

The position of Middlemarch is to be marked on the diagram as point *B*

On the diagram, mark with a cross the position of *B* given that:

B is on a bearing of 320° from *A* and
B is 5 cm from *A*

B

N

40°

A

320°
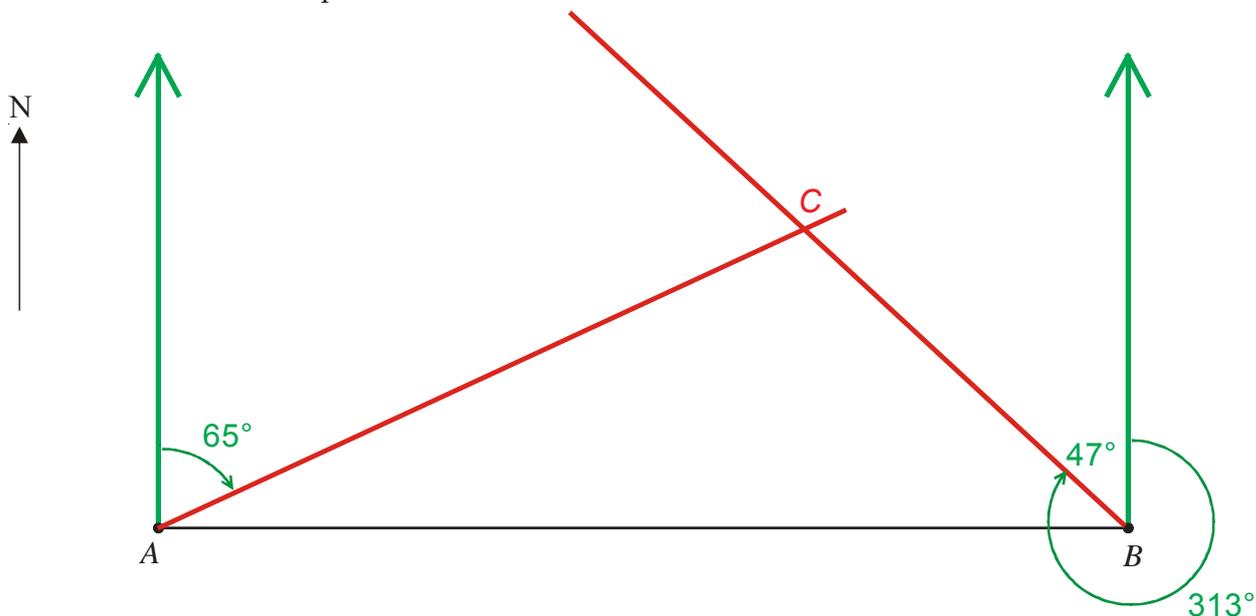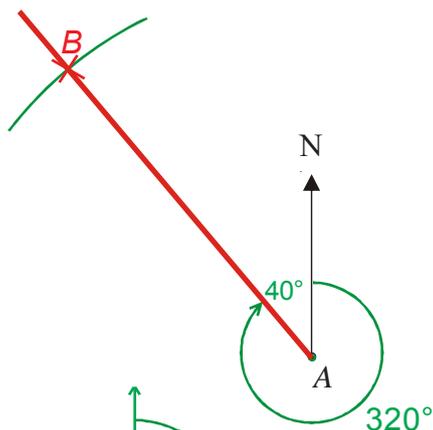
3) **Work out** the bearing of

a) *B* from *P*   222°
b) *P* from *A*   244°
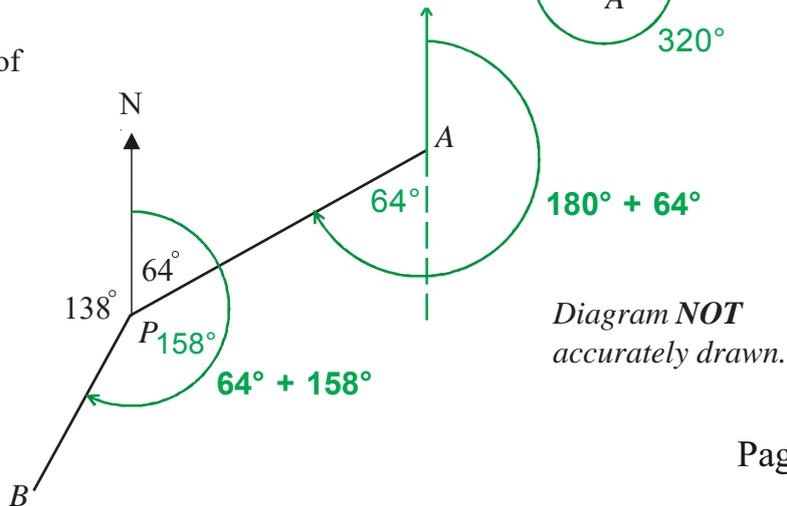
N

A

64°

180° + 64°

64°

138°

P 158°

64° + 158°

*Diagram NOT
accurately drawn.*

B

1)   The Venn diagram shows the number of students studying one or more of the
      sciences Chemistry, Biology and Physics.
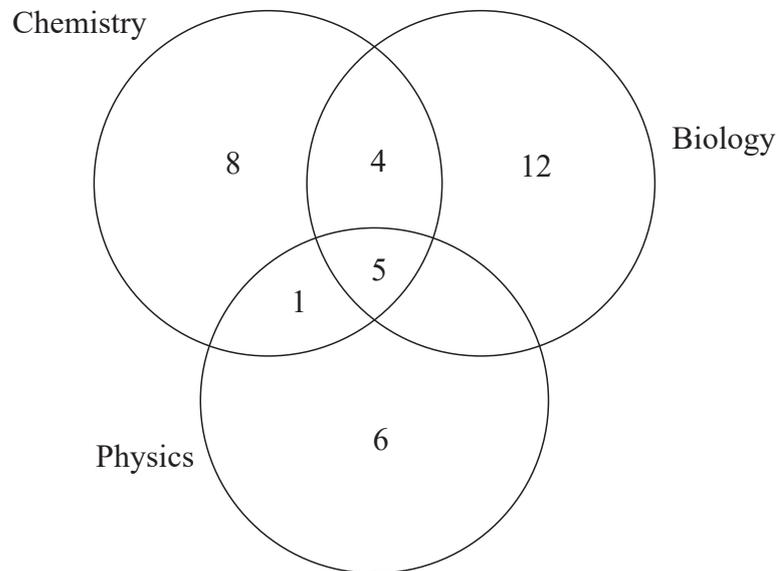
      a) How many students are represented in this Venn diagram?

      b) How many students are studying exactly two sciences?

      c) What is the probability that a student chosen at random is not studying Physics?

2)   There are 31 student who study languages.
      All 31 study at least one of Spanish, French or German.
      4 study all three languages.
      9 study Spanish and French.
      7 study French and German.
      6 study Spanish and German.
      7 study only French and 5 study only German.
      Complete the Venn diagram to show this information.
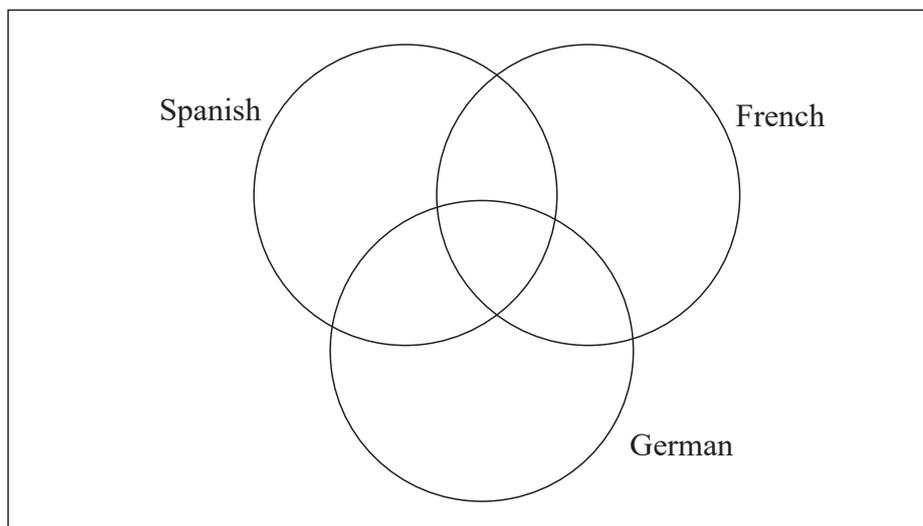
1) The Venn diagram shows the number of students studying one or more of the sciences Chemistry, Biology and Physics.
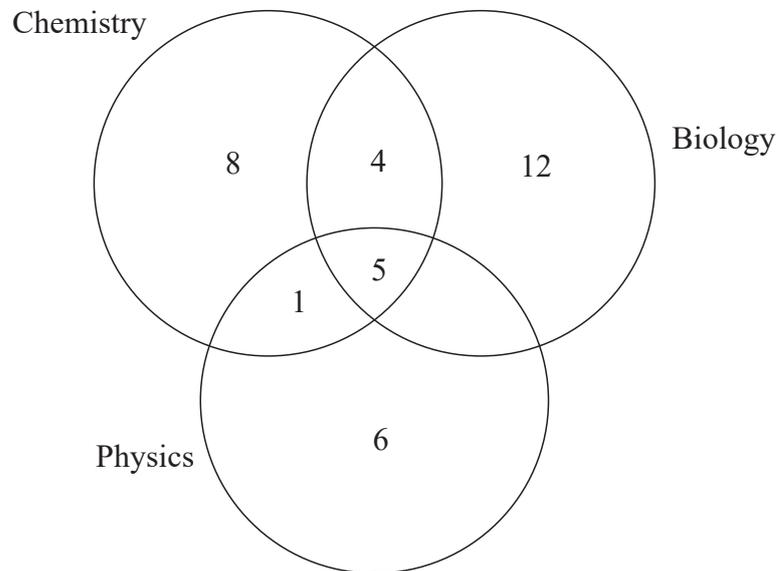
a) How many students are represented in this Venn diagram? **36**

b) How many students are studying exactly two sciences? **5**

c) What is the probability that a student chosen at random is not studying Physics? **$\frac{24}{36}$**

2) There are 31 student who study languages.
   All 31 study at least one of Spanish, French or German.
   4 study all three languages.
   9 study Spanish and French.
   7 study French and German.
   6 study Spanish and German.
   7 study only French and 5 study only German.
   Complete the Venn diagram to show this information.
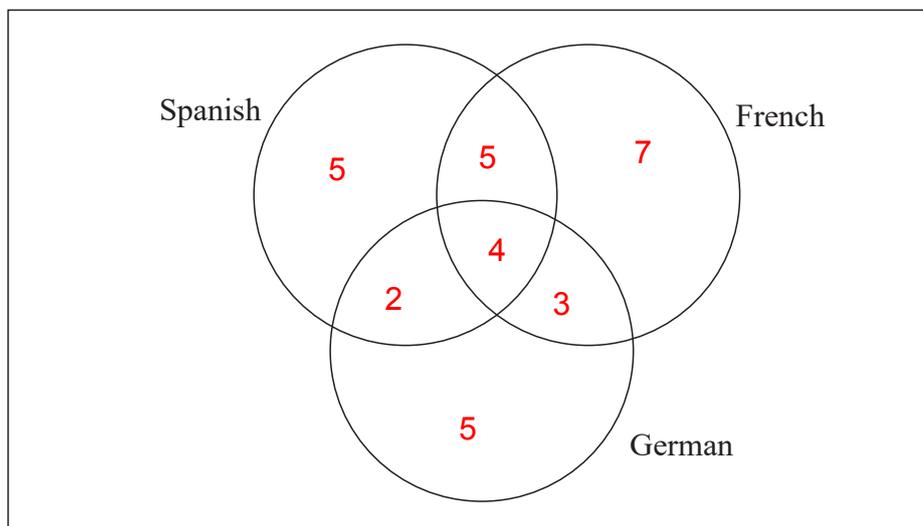
1) A village has 240 houses.
The council want to look at how many houses have electric cars.
They take a sample of 20 houses, and find that 7 have electric cars.
Use this information to estimate how many houses in the village have electric cars.

2) A local corner shop is looking to upgrade their self-checkout machines.
On average, they have 3600 customers a month.
They conduct a survey to find out how many customers use the current machines by asking a random sample of 40 customers.
The results of the survey show that 11 customers use the current machines.

a) Use this information to estimate how many customers use the machines each month.

b) State any assumptions you have made.

3) Park Lane School is creating a new lunch menu.
The head teacher takes a sample of 20 students from year 11 to see if they liked the menu.
16 of the 20 students said they would eat from the menu.
There are 650 students in the school.

a) Use this information to estimate how many students would agree to the new menu.

b) How could the head teacher make their estimate more reliable?

4) A group of conservationists planted 840 new trees in a woodland.
After a year, they return to see how many of the trees are still healthy and growing.

a) Lucy takes a random sample of 60 trees, and finds 46 are still healthy.
Use this information to estimate the total number of healthy trees in the woodland.

.

b) Jack takes a sample of 35 trees, and finds 28 are still healthy.
Use this information to estimate the total number of healthy trees in the woodland.

c) Whose estimate is more reliable? Give a reason with your answer.

1) A village has 240 houses.
   The council want to look at how many houses have electric cars.
   They take a sample of 20 houses, and find that 7 have electric cars.
   Use this information to estimate how many houses in the village have electric cars.

   $240 \div 20 = 12$ $12 \times 7 = 84$

2) A local corner shop is looking to upgrade their self-checkout machines.
   On average, they have 3600 customers a month.
   They conduct a survey to find out how many customers use the current machines by asking a random sample of 40 customers.
   The results of the survey show that 11 customers use the current machines.

   a) Use this information to estimate how many customers use the machines each month.

   $3600 \div 40 = 90$ 9 $11 = 990$

   b) State any assumptions you have made.

   All customers are likely to have the same opinion as the sample.

3) Park Lane School is creating a new lunch menu.
   The head teacher takes a sample of 20 students from year 11 to see if they liked the menu.
   16 of the 20 students said they would eat from the menu.
   There are 650 students in the school.

   a) Use this information to estimate how many students would agree to the new menu.

   $650 \div 20 = 32.5$ 3 $16 = 520$

   b) How could the head teacher make their estimate more reliable?

   Ask students from every year group.

4) A group of conservationists planted 840 new trees in a woodland.
   After a year, they return to see how many of the trees are still healthy and growing.

   a) Lucy takes a random sample of 60 trees, and finds 46 are still healthy.
      Use this information to estimate the total number of healthy trees in the woodland.

. $840 \div 60 = 14$ 1 $46 = 644$

   b) Jack takes a sample of 35 trees, and finds 28 are still healthy.
      Use this information to estimate the total number of healthy trees in the woodland.

   $840 \div 35 = 24$ $24 \times 28 = 672$

   c) Whose estimate is more reliable? Give a reason with your answer.

   Lucy as she took a larger sample.

Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency
Alicante	8
Paris	7
Ibiza	15
St Lucia	1
Biarritz	9

Draw a pie chart to illustrate the information.
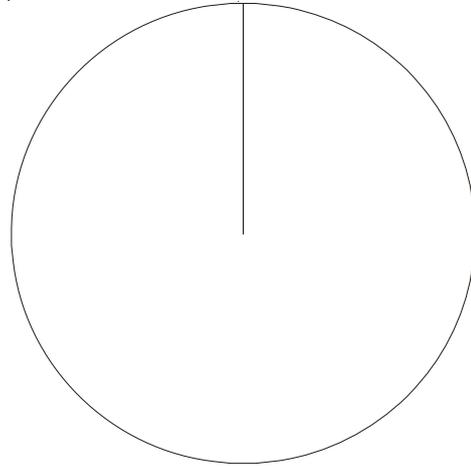
2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

Region	Frequency
Southern England	9
London	23
Midlands	16
Northern England	12
Total	60

Draw a pie chart to illustrate the information.
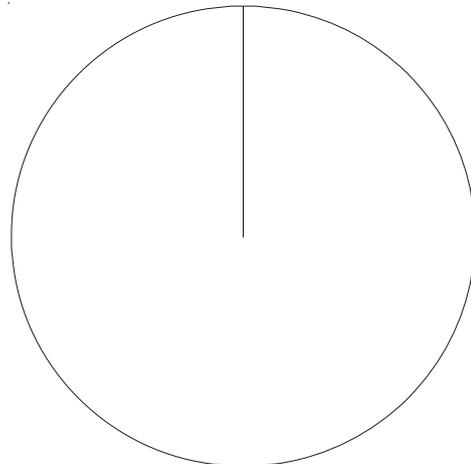
3) Sophie represents her monthly expenses using a pie char

Diagram accurately drawn
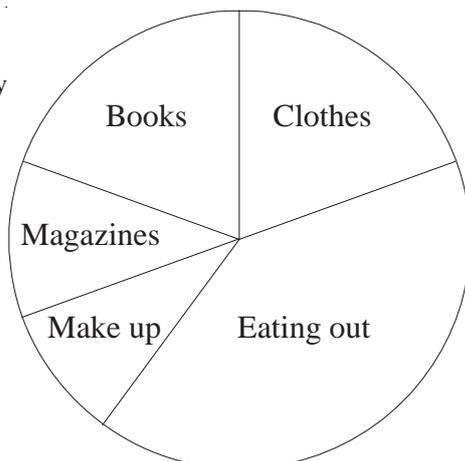
Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

		Angle
Clothes	£35	
Eating out		
Make up	£17	34°
Magazines		
Books		
Total	£180	

Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency	Angle
Alicante	8	72°
Paris	7	63°
Ibiza	15	135°
St Lucia	1	9°
Biarritz	9	81°

Draw a pie chart to illustrate the information.
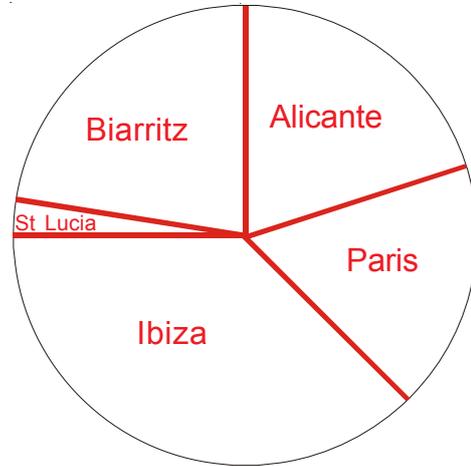
2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

Region	Frequency	Angle
Southern England	9	54°
London	23	138°
Midlands	16	96°
Northern England	12	72°
Total	60	

Draw a pie chart to illustrate the information.

3) Sophie represents her monthly expenses using a pie char

Diagram accurately drawn
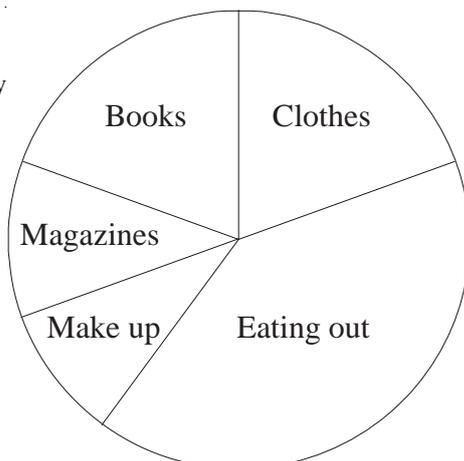
Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

		Angle
Clothes	£35	70°
Eating out	£73	146°
Make up	£17	34°
Magazines	£20	40°
Books	£35	70°
Total	£180	360°

Page 137

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners.
Give your answer to 1 decimal place.

2) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

a) Work out the total number of pens in the classroom.

b) Write down the modal number of pens in a pencil case.

c) Work out the mean number of pens in a pencil case.

d) Work out the range of the number of pens in a pencil case.

3) Thomas is analysing the local football team.
He records the number of goals scored in each
football match in the past twelve months.

Thomas said that the mode is 7
Thomas is wrong.
a) Explain why.

b) Calculate the mean number of goals scored.

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners.   2.4
Give your answer to 1 decimal place.

2) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

a) Work out the total number of pens in the classroom.   52

b) Write down the modal number of pens in a pencil case.   2

c) Work out the mean number of pens in a pencil case.   2

d) Work out the range of the number of pens in a pencil case.   5

3) Thomas is analysing the local football team.
He records the number of goals scored in each
football match in the past twelve months.

Thomas said that the mode is 7
Thomas is wrong.
a) Explain why.   Thomas gave the highest
frequency instead of giving
the number of 'goals scored'
associated with it.

b) Calculate the mean number of goals scored.
   1.92

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

1) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (*t* minutes)	Frequency		
$0 < t < 6$	15		
$6 < t < 12$	23		
$12 < t < 18$	28		
$18 < t < 24$	19		
$24 < t < 30$	15		

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place.

2) The table shows some information about the heights (*h* cm) of 100 plants.

Height (*h* cm)	Frequency		
$120 < h < 130$	9		
$130 < h < 140$	18		
$140 < h < 150$	27		
$150 < h < 160$	31		
$160 < h < 170$	15		

a) Find the class interval in which the median lies.

b) Work out an estimate for the mean height of the plants.

3) The table gives information about the number of books sold in a shop during each
of the last 30 weeks.

Number of books (*n*)	Frequency		
$0 < n < 40$	2		
$40 < n < 80$	6		
$80 < n < 120$	13		
$120 < n < 160$	6		
$160 < n < 200$	3		

Calculate an estimate for the mean number of books sold each week.

Give your answer correct to 1 decimal place.

Averages From a Table - Estimate for the Mean

1) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (t minutes)	Frequency	Midpoint	MP × Frequency
$0 < t < 6$	15	3	45
$6 < t < 12$	23	9	207
$12 < t < 18$	28	15	420
$18 < t < 24$	19	21	399
$24 < t < 30$	15	27	405
	100		**1476**

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place.   14.8 minutes

2) The table shows some information about the heights (h cm) of 100 plants.

Height (h cm)	Frequency	Midpoint	MP × Frequency
$120 < h < 130$	9	125	1125
$130 < h < 140$	18	135	2430
$140 < h < 150$	27	145	3915
$150 < h < 160$	31	155	4805
$160 < h < 170$	15	165	2475
	100		**14750**

a) Find the class interval in which the median lies. $140 < h < 150$

b) Work out an estimate for the mean height of the plants.   147.5 cm

3) The table gives information about the number of books sold in a shop during each
of the last 30 weeks.

Number of books (n)	Frequency	Midpoint	MP × Frequency
$0 < n < 40$	2	20	40
$40 < n < 80$	6	60	360
$80 < n < 120$	13	100	1300
$120 < n < 160$	6	140	840
$160 < n < 200$	3	180	540
	30		**3080**

Calculate an estimate for the mean number of books sold each week.

Give your answer correct to 1 decimal place.   102.7 books

Page 138 B

1)   Find the median, quartiles and interquartile range for each data set.

    a) 2 5 5 6 6 7 7 9 10 10 10   M: LQ: UQ: IQR:

    b) 7 8 8 8 9 9 11 14 15 16 18   M: LQ: UQ: IQR:

    c) 11 11 15 18 19 23 24   M: LQ: UQ: IQR:

    d) 1.1 1.2 1.3 1.5 1.5 1.6 1.9   M: LQ: UQ: IQR:

2)   Find the median, quartiles and interquartile range for each data set.

    a) 3 5 1 4 5 3 3 4 3 1 5

    b) 4 13 8 8 5 8 7

    c) 6 7 14 17 19 16 5 20 21 20 16 6 17 8 18

    d) 4.1 1.4 6.1 3.3 1.5 5.2 4.5 7.2 5.8 3.9 4.8

3)   Find the median, quartiles and interquartile range for each data set.

    a) 2 5 5 6 8 10

    b) 13 11 9 12 13 14 9 15 10

    c) 15 12 21 15 14 19 19 17

    d) 2.6 1.9 2.2 2.7 2.4 2.3 2.1 1.8 2.7 2.1 2.4 2.1

4)   The time, in minutes, taken by a group of students to complete a puzzle are shown.

Andy	Ella	Ty	Luke	Ollie	Chloe	Emma	Karen	Scott	Gareth
16	9	12	17	13	11	8	17	11	14

    Find the interquartile range of the times.

5)   The data in the table shows the tries scored by a rugby team at each game in a season.

Game	1	2	3	4	5	6	7	8
Tries	3	0	2	5	5	0	1	3

    Calculate the interquartile range of the number of tries scored.

1)   Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 6 7 7 9 10 10 10   M: 7   LQ: 5   UQ: 10   IQR: 5

b) 7 8 8 8 9 9 11 14 15 16 18   M: 9   LQ: 8   UQ: 15   IQR: 7

c) 11 11 15 18 19 23 24   M: 18   LQ: 11   UQ: 23   IQR: 12

d) 1.1 1.2 1.3 1.5 1.5 1.6 1.9   M: 1.5   LQ: 1.2   UQ: 1.6   IQR: 0.4

2)   Find the median, quartiles and interquartile range for each data set.

a) 3 5 1 4 5 3 3 4 3 1 5   M = 3   LQ = 3   UQ = 5   IQR = 2

b) 4 13 8 8 5 8 7   M = 8   LQ = 5   UQ = 8   IQR = 3

c) 6 7 14 17 19 16 5 20 21 20 16 6 17 8 18
          M = 16   LQ = 7   UQ = 19   IQR = 12

d) 4.1 1.4 6.1 3.3 1.5 5.2 4.5 7.2 5.8 3.9 4.8
          M = 4.5   LQ = 3.3   UQ = 5.8   IQR = 2.5

3)   Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 8 10   M = 5.5   LQ = 5   UQ = 8   IQR = 3

b) 13 11 9 12 13 14 9 15 10   M = 12   LQ = 9.5   UQ = 13.5   IQR = 4

c) 15 12 21 15 14 19 19 17   M = 16   LQ = 14.5   UQ = 19   IQR = 4.5

d) 2.6 1.9 2.2 2.7 2.4 2.3 2.1 1.8 2.7 2.1 2.4 2.1
          M = 2.25   LQ = 2.1   UQ = 2.5   IQR = 0.4

4)   The time, in minutes, taken by a group of students to complete a puzzle are shown.

Andy	Ella	Ty	Luke	Ollie	Chloe	Emma	Karen	Scott	Gareth
16	9	12	17	13	11	8	17	11	14

Find the interquartile range of the times.   IQR = 16 – 11 = 5

5)   The data in the table shows the tries scored by a rugby team at each game in a season.

Game	1	2	3	4	5	6	7	8
Tries	3	0	2	5	5	0	1	3

Calculate the interquartile range of the number of tries scored.   IQR = 4 – 0.5 = 3.5

1) Find the median and interquartile range of the following lists of data

   a) 8, 8, 9, 10, 11, 11, 12, 12, 13, 13, 13

   b) 8, 4, 6, 7, 2, 9, 3, 7, 10, 5, 4

   c) 22, 29, 25, 19, 33, 22, 24, 19, 32, 28

   d) 4, 9, –1, 14, 0, 7, –3, 8

2) Below are the lengths of fish, in cm, caught by 2 groups of fishermen.

   Group A: 22, 24, 25, 28, 28, 29, 29
   Group B: 25, 27, 23, 28, 25, 26, 28

   Compare the lengths of fish caught between the two groups.

3) Shown is the daily screen time, in hours, of 10 students from years 8 and 10

   Year 8: 5, 9, 6, 8, 7, 2, 6, 4, 7, 9
   Year 10: 4, 9, 8, 3, 6, 10, 4, 9, 2, 3

   Compare the daily screen time of the two year groups.

4) Shown are the test scores from two classes.

   Class A: 51, 42, 59, 32, 39, 48, 37, 28, 56, 48, 36, 54
   Class B: 54, 29, 51, 54, 27, 58, 57, 35, 44, 57, 41, 47

   Compare the test scores of the two classes.

5) Data is collected about the annual salaries of staff working at different accountancy firms.

	Lowest	Median	Highest
Company A	£24,000	£38,500	£86,000
Company B	£21,000	£34,000	£112,000
Company C	£23,500	£36,000	£92,000

   a) Calculate the range for Company C

   b) Which company has the highest average wage?

   c) Which company is the least consistent in wages?

1) Find the median and interquartile range of the following lists of data

a) 8, 8, 9, 10, 11, 11, 12, 12, 13, 13, 13
Median: 11   IQR: 4
b) 8, 4, 6, 7, 2, 9, 3, 7, 10, 5, 4
Median: 6   IQR: 4
c) 22, 29, 25, 19, 33, 22, 24, 19, 32, 28
Median: 24.5   IQR: 7
d) 4, 9, –1, 14, 0, 7, –3, 8
Median: 5.5   IQR: 9

2) Below are the lengths of fish, in cm, caught by 2 groups of fishermen.

Group A: 22, 24, 25, 28, 28, 29, 29
Group B: 25, 27, 23, 28, 25, 26, 28

Compare the lengths of fish caught between the two groups.
On average, the fish caught by group A were longer.
Group B were also more consistent in their fish lengths.

3) Shown is the daily screen time, in hours, of 10 students from years 8 and 10

Year 8: 5, 9, 6, 8, 7, 2, 6, 4, 7, 9
Year 10: 4, 9, 8, 3, 6, 10, 4, 9, 2, 3

Compare the daily screen time of the two year groups.
On average, Year 8 spent longer looking at screens than Year 10
Year 8 were also more consistent in their screen time.

4) Shown are the test scores from two classes.

Class A: 51, 42, 59, 32, 39, 48, 37, 28, 56, 48, 36, 54
Class B: 54, 29, 51, 54, 27, 58, 57, 35, 44, 57, 41, 47

Compare the test scores of the two classes.
On average, class B scored higher in their test.
Class A were more consistent in their test scores.

5) Data is collected about the annual salaries of staff working at different accountancy firms.

	Lowest	Median	Highest
Company A	£24,000	£38,500	£86,000
Company B	£21,000	£34,000	£112,000
Company C	£23,500	£36,000	£92,000

a) Calculate the range for Company C
£92000 – £23500 = £68500
b) Which company has the highest average wage?
Company A
c) Which company is the least consistent in wages?
Company B as they have the largest range (£91000)

1) Jim and Sue each take a driving test.

The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.

Jim   **Sue**

0.7 ——— Pass

0.6 ——— Pass

— — — ——— Fail

— — — ——— Fail

0.6 ——— Pass

Fail

— — — ——— Fail
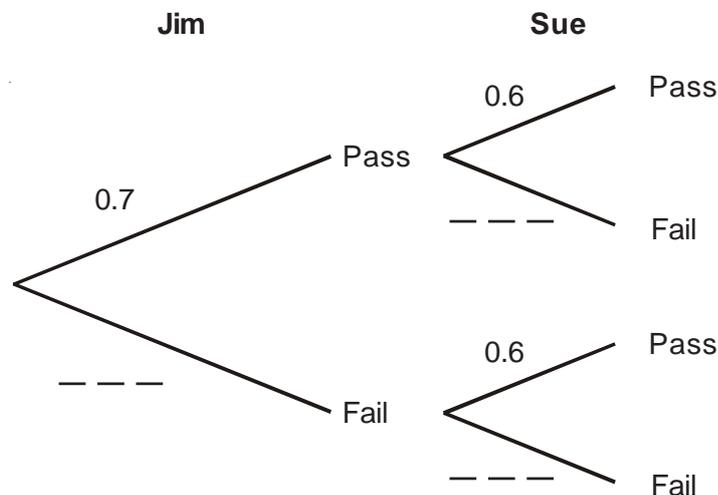
b) Work out the probability that both Jim and Sue will pass the driving test.

c) Work out the probability that only one of them will pass the driving test.

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.

1st pen   **2nd pen**

. . . . . ——— Blue

Blue

. . . . . ——— Red

. . . . .

. . . . . ——— Blue

Red

. . . . . ——— Red

b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Tree Diagrams - Introduction

1) Jim and Sue each take a driving test.

The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.

Jim   **Sue**

Pass

0.6 — Pass

0.7

0.4 — Fail

0.3 — Fail

0.6 — Pass

0.4 — Fail
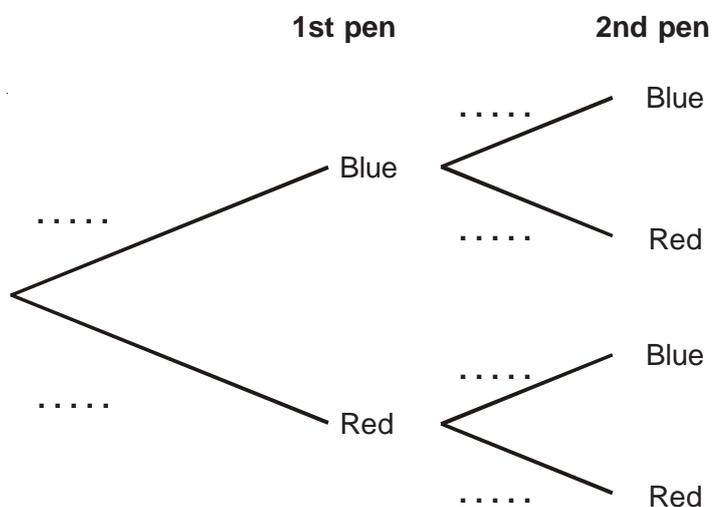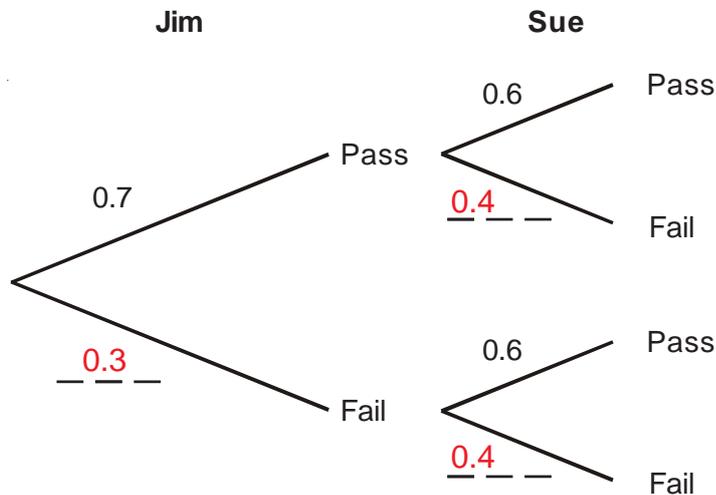
b) Work out the probability that both Jim and Sue will pass the driving test.   0.42

c) Work out the probability that only one of them will pass the driving test.   0.28 + 0.18 = 0.46

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.

1st pen   **2nd pen**

$\frac{2}{7}$ — Blue

$\frac{2}{7}$ — Blue

$\frac{5}{7}$ — Red

$\frac{5}{7}$ — Red

$\frac{2}{7}$ — Blue

$\frac{5}{7}$ — Red

$\frac{10}{49} + \frac{10}{49} = \frac{20}{49}$

b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Tree Diagrams - Introduction

1) Tim puts 3 red counters and 4 blue counters in a bag.
   He takes at random a counter from the bag.
   He writes down the colour of the counter.
   He puts the counter in the bag again.
   He then takes at random a second counter from the bag.

   a) Complete the probability tree diagram.

   1st counter   **2nd counter**

$\frac{3}{7}$ — Red

$\frac{3}{7}$ Red

− − − Blue

− − − Red

− − − Blue

− − − Blue

   b) Work out the probability that Tim takes two red counters.

2) In a game of chess, a player can either win, lose or draw.
   The probability that Jane wins any game of chess is 0.2
   The probability that Jane draws any game of chess is 0.3
   Jane plays 2 games of chess.

   1st game   **2nd game**

   a) Complete the probability tree diagram.

   . . . . . Win
   . . . . . Draw
   0.2 Win
   . . . . . Lose
   . . . . . Win
   0.3 Draw . . . . . Draw
   . . . . . Lose
   . . . . . Win
   . . . . . Draw
   . . . . . Lose
   Lose

   b) Work out the probability that Jane will
      win both games.

Tree Diagrams - Introduction

1) Tim puts 3 red counters and 4 blue counters in a bag.
   He takes at random a counter from the bag.
   He writes down the colour of the counter.
   He puts the counter in the bag again.
   He then takes at random a second counter from the bag.

   a) Complete the probability tree diagram.

   1st counter   **2nd counter**
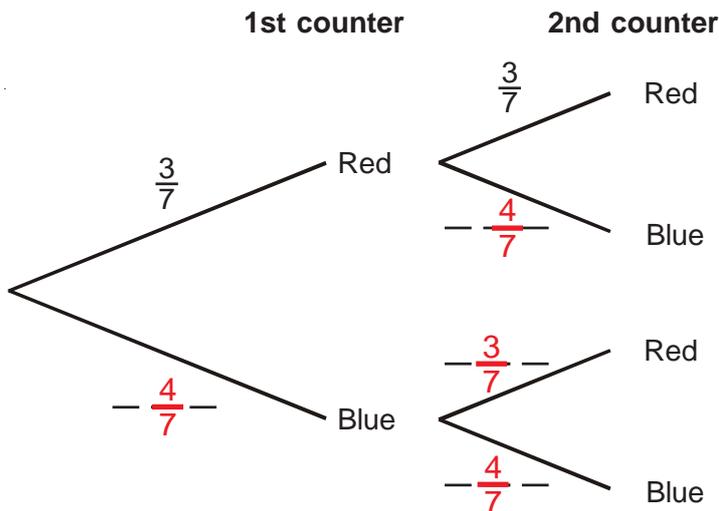
   b) Work out the probability that Tim takes two red counters. $\frac{9}{49}$

2) In a game of chess, a player can either win, lose or draw.
   The probability that Jane wins any game of chess is 0.2
   The probability that Jane draws any game of chess is 0.3
   Jane plays 2 games of chess.

   a) Complete the probability tree diagram.

   1st game   **2nd game**
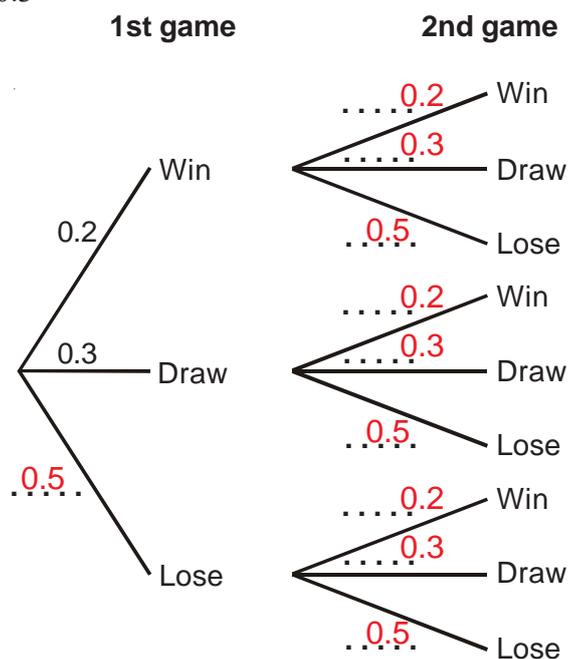
   b) Work out the probability that Jane will
       win both games. 0.04

1) Lucy throws a biased dice twice.
   Complete the probability tree diagram to show the outcomes.
   Label clearly the branches of the tree diagram.

1st Throw   **2nd Throw**

$\frac{2}{6}$ *Six*

                  Not Six

2) A bag contains 10 coloured balls.
   7 of the balls are blue and 3 of the balls are green.
   Nathan is going to take a ball, replace it, and then take a second ball.

   a) Complete the tree diagram.

1st Ball   **2nd Ball**
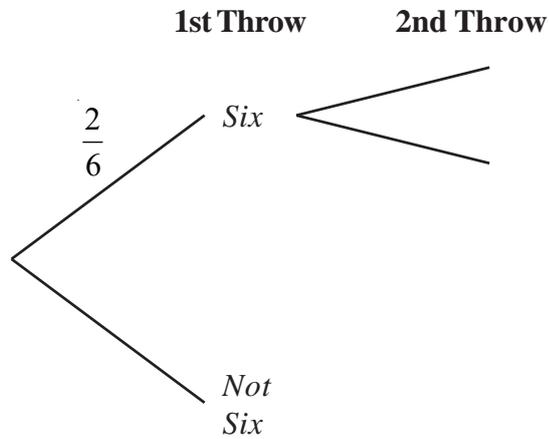
                  Blue
   Blue
                  Green
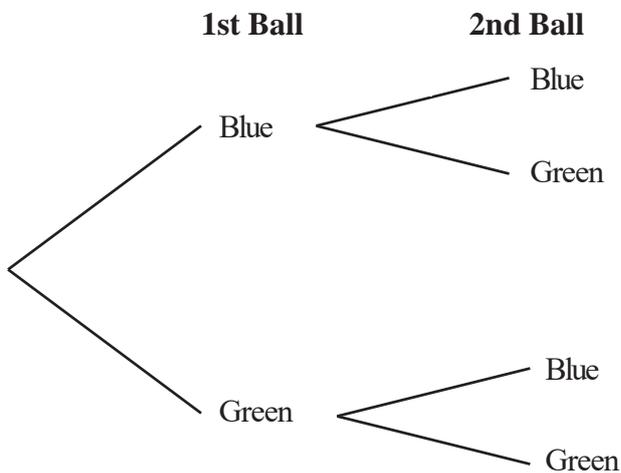
                  Blue
   Green
                  Green

   b) Work out the probability that Nathan will take two blue balls.

   c) Work out the probability that Nathan will take one of each coloured balls.

   d) Work out the probability that Nathan will take two balls of the same colour.

1) Lucy throws a biased dice twice.
   Complete the probability tree diagram to show the outcomes.
   Label clearly the branches of the tree diagram.

1st Throw   **2nd Throw**

$\frac{2}{6}$ — six

$\frac{2}{6}$ — *Six* <

$\frac{4}{6}$ — not six

$\frac{4}{6}$ — *Not Six* <

$\frac{2}{6}$ — six

$\frac{4}{6}$ — not six

2) A bag contains 10 coloured balls.
   7 of the balls are blue and 3 of the balls are green.
   Nathan is going to take a ball, replace it, and then take a second ball.

   a) Complete the tree diagram.

1st Ball

$\frac{7}{10}$ — Blue

$\frac{7}{10}$ — Blue <

$\frac{3}{10}$ — Green

$\frac{3}{10}$ — Green <

$\frac{7}{10}$ — Blue

$\frac{3}{10}$ — Green
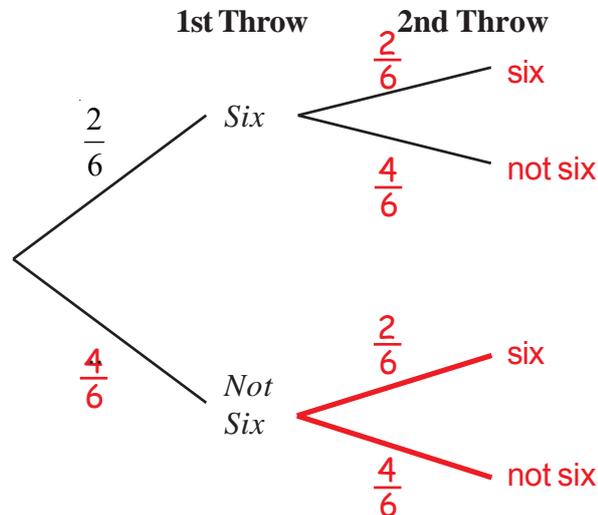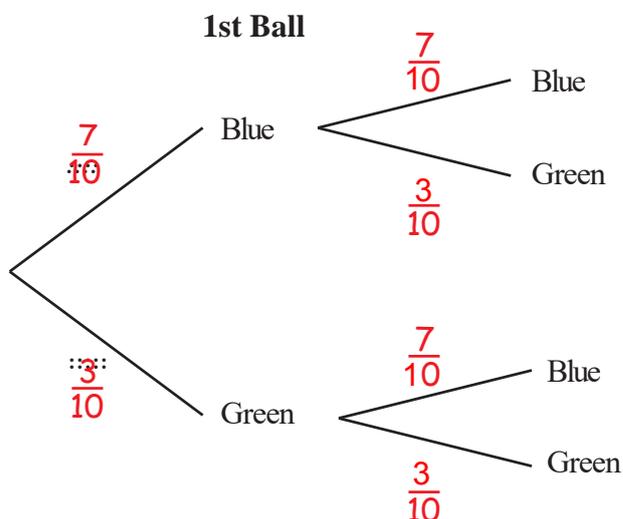
b) Work out the probability that Nathan will take two blue balls. $\frac{49}{100}$

c) Work out the probability that Nathan will take one of each coloured balls. $\frac{42}{100}$

d) Work out the probability that Nathan will take two balls of the same colour. $\frac{58}{100}$

1) Find the value of:

   a) 2^{-3}

   b) 3^{-2}

   c) 5^{-1}

   d) 10^{-4}

2) Find the value of:

   a) $2^{-3} \times 4^{-1}$

   b) $10^{-2} \times 2^{-4}$

   c) 5×5^{-3}

   d) 8×2^{-3}

3) Write these numbers in order of size.

   Start with the smallest.

   3^2 3^{-1} 0.3 3^0 3^{-2} -3

4) If $2^x = \dfrac{1}{64}$, find the value of x.

1) Find the value of:

   a) 2^{-3} $\dfrac{1}{8}$

   b) 3^{-2} $\dfrac{1}{9}$

   c) 5^{-1} $\dfrac{1}{5}$

   d) 10^{-4} $\dfrac{1}{10000}$

2) Find the value of:

   a) $2^{-3} \times 4^{-1}$ $\dfrac{1}{32}$

   b) $10^{-2} \times 2^{-4}$ $\dfrac{1}{1600}$

   c) 5×5^{-3} $\dfrac{1}{25}$

   d) 8×2^{-3} 1

3) Write these numbers in order of size.

   Start with the smallest.

   3^2 3^{-1} 0.3 3^0 3^{-2} -3

   $-3, 3^{-2}, 0.3, 3^{-1}, 3^0, 3^2$

4) If $2^x = \dfrac{1}{64}$, find the value of x.

   $x = -6$

Standard Form

1) Change the following to normal (or ordinary) numbers.

   a) 4.3×10^4

   b) 6.79×10^6

   c) 7.03×10^3

   d) 9.2×10^2

   e) 1.01×10^4

   f) 4×10^5

2) Change the following to normal (or ordinary) numbers.

   a) 4.3×10^{-4}

   b) 6.79×10^{-6}

   c) 7.03×10^{-3}

   d) 9.2×10^{-2}

   e) 1.01×10^{-4}

   f) 4×10^{-5}

3) Change the following to standard form.

   a) 360

   b) 8 900

   c) 520 000

   d) 60000

   e) 1 003

   f) 6 450 000

4) Change the following to standard form.

   a) 0.071

   b) 0.0008

   c) 0.00076

   d) 0.0928

   e) 0.00009

   f) 0.00000173

5) Work out the following, giving your answer in standard form.

   a) $3\,000 \times 5\,000$

   b) 240×0.0002

   c) $9 \times 1.1 \times 10^7$

   d) $5 \times 4 \times 10^3$

   e) $\dfrac{8 \times 10^4}{4 \times 10^2}$

   f) $9 \times 10^2 \times 2 \times 10^{-5}$

   g) $7 \times 10^2 \times 3 \times 10^{-4}$

   h) $2 \times 3.6 \times 10^{-5}$

   i) $6 \times 4.1 \times 10^3$

Standard Form

1) Change the following to normal (or ordinary) numbers.

   a) 4.3×10^4
      43 000

   b) 6.79×10^6
      6 790 000

   c) 7.03×10^3
      7 030

   d) 9.2×10^2
      920

   e) 1.01×10^4
      10 100

   f) 4×10^5
      400 000

2) Change the following to normal (or ordinary) numbers.

   a) 4.3×10^{-4}
      0.00043

   b) 6.79×10^{-6}
      0.00000679

   c) 7.03×10^{-3}
      0.00703

   d) 9.2×10^{-2}
      0.092

   e) 1.01×10^{-4}
      0.000101

   f) 4×10^{-5}
      0.00004

3) Change the following to standard form.

   a) 360
      3.6×10^2

   b) 8 900
      8.9×10^3

   c) 520 000
      5.2×10^5

   d) 60000
      6×10^4

   e) 1 003
      1.003×10^3

   f) 6 450 000
      6.45×10^6

4) Change the following to standard form.

   a) 0.071
      7.1×10^{-2}

   b) 0.0008
      8×10^{-4}

   c) 0.00076
      7.6×10^{-4}

   d) 0.0928
      9.28×10^{-2}

   e) 0.00009
      9×10^{-5}

   f) 0.00000173
      1.73×10^{-6}

5) Work out the following, giving your answer in standard form.

   a) $3\,000 \times 5\,000$
      1.5×10^7

   b) 240×0.0002
      4.8×10^{-2}

   c) $9 \times 1.1 \times 10^7$
      9.9×10^7

   d) $5 \times 4 \times 10^3$
      2×10^4

   e) $\dfrac{8 \times 10^4}{4 \times 10^2}$
      2×10^2

   f) $9 \times 10^2 \times 2 \times 10^{-5}$
      1.8×10^{-2}

   g) $7 \times 10^2 \times 3 \times 10^{-4}$
      2.1×10^{-1}

   h) $2 \times 3.6 \times 10^{-5}$
      7.2×10^{-5}

   i) $6 \times 4.1 \times 10^3$
      2.46×10^4

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

    a) Write down the least possible mass of the necklace.

    b) Write down the greatest possible mass of the necklace.

2) Each of these measurements was made correct to one decimal place.
    Write the maximum and minimum possible measurement in each case.

    a) 4.6 cm   b) 0.8 kg   c) 12.5 litres   d) 25.0 km/h

    e) 10.3 s   f) 36.1 m   g) 136.7 m/s   h) 0.1 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

    a) Write down the least possible length of each side.

    b) Write down the greatest possible length of each side.

    c) Write down the greatest possible perimeter of the octagon.

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
    Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.

    Explain why it might not be possible for her to fit the pen in the pencil case.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

    a) Calculate the lower bound for the perimeter of the square.

    b) Calculate the upper bound for the area of the square.

Bounds - Introduction

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

   a) Write down the least possible mass of the necklace. 122.5 g

   b) Write down the greatest possible mass of the necklace. 123.5 g

2) Each of these measurements was made correct to one decimal place.
   Write the maximum and minimum possible measurement in each case.

   a) 4.6 cm
   max: 4.65 cm
   min: 4.55 cm

   b) 0.8 kg
   max: 0.85 kg
   min: 0.75 kg

   c) 12.5 litres
   max: 12.55 l
   min: 12.45 l

   d) 25.0 km/h
   max: 25.05 km/h
   min: 24.95 km/h

   e) 10.3 s
   max: 10.35 s
   min: 10.25 s

   f) 36.1 m
   max: 36.15 m
   min: 36.05 m

   g) 136.7 m/s
   max: 136.75 m/s
   min: 136.65 m/s

   h) 0.1 g
   max: 0.15 g
   min: 0.05 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

   a) Write down the least possible length of each side. 20.55 cm

   b) Write down the greatest possible length of each side. 20.65 cm

   c) Write down the greatest possible perimeter of the octagon. 165.2 cm

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
   Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.

   Explain why it might not be possible for her to fit the pen in the pencil case.
   12 cm to the nearest cm has a maximum possible length of 12.5 cm.
   12.5 cm to the nearest mm has a minimum possible length of 12.45 cm.
   A 12.5 cm pencil won't fit into a pencil case with a diagonal length of 12.45 cm.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

   a) Calculate the lower bound for the perimeter of the square. 26 cm

   b) Calculate the upper bound for the area of the square. 56.25 cm^2

Reverse Percentage Problems

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt.

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car.

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder.

4) A salesman gets a basic wage of £160 per week plus a commision of 30%
of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week.

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account.

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why

b) Work out Jonathan's weekly pay last year.

7) The price of all rail season tickets to London increased by 4%.
a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase.
b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase.

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt.   £32.50

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car.   £7200

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder.   £125

4) A salesman gets a basic wage of £160 per week plus a commision of 30%
of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week.   £1600

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account.   £1900

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why   Tess has calculated 20% of £960, and subtracted it.

b) Work out Jonathan's weekly pay last year.   £800

7) The price of all rail season tickets to London increased by 4%.
a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase.   £3060
b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase.   £2820

1) Layla deposits £2000 into a bank account.
She receives 5% compound interest for the first 3 years, which drops to 2% for the next 3 years.
How much money will Layla have in her bank account at the end of the 6 years?

2) Ted decides to invest £3500
He receives 3% interest for the first 2 years, followed by 1.5% for the next 3 years.
How much money will Ted have in his bank account at the end of the 5 years?

3) Ellie deposits £460 into a stocks and shares ISA.
She receives 2.5% interest for the first year which drops to 0.6% for every year after.
How much interest will Ellie have received after 5 years?

4) Dan buys a car for £5500
It depreciates by 6% for the first 2 years, then 8% for the next 3 years.
How much is the car worth after 5 years?

5) Amber purchases some artwork for £960
It depreciates in value by 3.2% for the first 4 years, then 0.6% for the next 6 years.
By how much has the artwork decreased in price over the last 10 years?

6) Elliot has £6200 worth of stocks.
During the first two years, his stocks go down by 2.7%
For the next three years, his stocks increase by 1.2%
How much are Elliot's stocks now worth?

7) Farah is looking to put £4000 into a bank account. She has two options:
Bank A: 3% for the first 2 years, reduced to 0.8% for every year after
Bank B: 4% for the first 2 years, reduced to 0.3% for every year after
If Farah is planning to not withdraw any money from her account for the next 5 years, which bank should she choose?

8) Ola decides to invest her money in stocks.
For the first 3 years, she gains 6% interest. Following this, the interest drops to 4%.
After how many years will Ola have doubled her investment?

9) Tony owns two motorbikes. Over the first 5 years, each motorbike depreciates by 4%. They then depreciate by 2.3% every year after.
His 125cc motorbike cost £4000 and is 6 years old.
His 250cc motorbike cost £4600 and is 10 years old.
Which motorbike is worth more?

10) A bar of chocolate depreciates in price by 10%.
Due to inflation, it rises by 15% the following year.
By what percentage has the price of the chocolate bar changed compared to its original price?

1) Layla deposits £2000 into a bank account.
   She receives 5% compound interest for the first 3 years, which drops to 2% for the next 3 years.
   How much money will Layla have in her bank account at the end of the 6 years?
   $2000 \times 1.05^3 \times 1.02^3 = £2456.96$

2) Ted decides to invest £3500
   He receives 3% interest for the first 2 years, followed by 1.5% for the next 3 years.
   How much money will Ted have in his bank account at the end of the 5 years?
   $3500 \times 1.03^2 \times 1.015^3 = £3882.76$

3) Ellie deposits £460 into a stocks and shares ISA.
   She receives 2.5% interest for the first year which drops to 0.6% for every year after.
   How much interest will Ellie have received after 5 years?
   $460 \times 1.025 \times 1.006^4 = £482.92$ £482.92 – £460 = £22.92

4) Dan buys a car for £5500
   It depreciates by 6% for the first 2 years, then 8% for the next 3 years.
   How much is the car worth after 5 years?
   $5500 \times 0.94^2 \times 0.92^3 = £3784.27$

5) Amber purchases some artwork for £960
   It depreciates in value by 3.2% for the first 4 years, then 0.6% for the next 6 years.
   By how much has the artwork decreased in price over the last 10 years?
   $960 \times 0.968^4 \times 0.994^6 = £813$ £960 – £813 = £147

6) Elliot has £6200 worth of stocks.
   During the first two years, his stocks go down by 2.7%
   For the next three years, his stocks increase by 1.2%
   How much are Elliot's stocks now worth?
   $6200 \times 0.973^2 \times 1.012^3 = £6083.58$

7) Farah is looking to put £4000 into a bank account. She has two options:
   Bank A: 3% for the first 2 years, reduced to 0.8% for every year after
   Bank B: 4% for the first 2 years, reduced to 0.3% for every year after
   If Farah is planning to not withdraw any money from her account for the next 5 years, which bank should she choose?
   Bank A: $4000 \times 1.03^2 \times 1.008^3 = £4346.26$ ank B: $4000 \times 1.04^2 \times 1.003^3 = £4365.45$

8) Ola decides to invest her money in stocks.
   For the first 3 years, she gains 6% interest. Following this, the interest drops to 4%.
   After how many years will Ola have doubled her investment?
   17 years

9) Tony owns two motorbikes. Over the first 5 years, each motorbike depreciates by 4%. They then depreciate by 2.3% every year after.
   His 125cc motorbike cost £4000 and is 6 years old.
   His 250cc motorbike cost £4600 and is 10 years old.
   Which motorbike is worth more?
   125cc: $4000 \times 0.96^5 \times 0.977 = £3186.48$ c: $4000 \times 0.96^5 \times 0.977^5 = £3338.77$

10) A bar of chocolate depreciates in price by 10%.
    Due to inflation, it rises by 15% the following year.
    By what percentage has the price of the chocolate bar changed compared to its original price?
    3.5%

1) Write the definition of a rational number.

2) From the list below, circle the irrational numbers:

   6   –3 $2\frac{1}{3}$ $\sqrt{5}$ 0.12 π 268 $\sqrt{4}$ $0.\dot{4}$ $\frac{4}{7}$

3) Decide which of the following is a rational or irrational number.

   a) $\sqrt{64}$

   b) $\sqrt{20}$

   c) $\sqrt{31}$

   d) $\sqrt{0.49}$

   e) $\sqrt{2} \times \sqrt{3}$

   f) $\sqrt{8} \times \sqrt{2}$

   g) $\dfrac{8}{\sqrt{4}}$

   h) $\dfrac{1}{\sqrt{4} \times \sqrt{2}}$

   i) $\dfrac{3}{\sqrt{6} \times \sqrt{5}}$

   j) $\dfrac{14}{\sqrt{12} \times \sqrt{3}}$

4) Are the solutions to the equations below rational or irrational?

   a) $3x^2 = 60$

   b) $4x^2 = 36$

5) The equation $3x^2 = n$ has rational solutions.

   Write down a value of n such that $70 < n < 80$

1)   Write the definition of a rational number.
      A number that can be written as a fraction

2)   From the list below, circle the irrational numbers:

      6   –3 $2\frac{1}{3}$ $\boxed{\sqrt{5}}$ 0.12 $\boxed{\pi}$ 268 $\sqrt{4}$ $0.\dot{4}$ $\frac{4}{7}$

3)   Decide which of the following is a rational or irrational number.

      a) $\sqrt{64} = 8$ rational

      b) $\sqrt{20} = 2\sqrt{5}$ irrational

      c) $\sqrt{31}$ irrational

      d) $\sqrt{0.49} = 0.7$ rational

      e) $\sqrt{2} \times \sqrt{3} = \sqrt{6}$ irrational

      f) $\sqrt{8} \times \sqrt{2} = \sqrt{16} = 4$ rational

      g) $\frac{8}{\sqrt{4}} = \frac{8}{2} = 4$ rational

      h) $\frac{1}{\sqrt{4} \times \sqrt{2}} = \frac{1}{\sqrt{8}}$ irrational

      i) $\frac{3}{\sqrt{6} \times \sqrt{5}} = \frac{3}{\sqrt{30}}$ irrational

      j) $\frac{14}{\sqrt{12} \times \sqrt{3}} = \frac{14}{\sqrt{36}} = \frac{14}{6}$ rational

4)   Are the solutions to the equations below rational or irrational?

      a) $3x^2 = 60$ $x = \pm 2\sqrt{5}$ irrational

      b) $4x^2 = 36$ $x = \pm 3$ rational

5)   The equation $3x^2 = n$ has rational solutions.

      Write down a value of n such that $70 < n < 80$

      $n = 75$

1) a) Convert the recurring decimal $0.\overset{\bullet\bullet}{3}6$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.\overset{\bullet\bullet}{7}2 = \dfrac{8}{11}$

2) a) Change $\dfrac{4}{9}$ to a decimal.

   b) Prove that the recurring decimal $0.\overset{\bullet\bullet}{5}7 = \dfrac{19}{33}$

3) a) Change $\dfrac{3}{11}$ to a decimal.

   b) Prove that the recurring decimal $0.\overset{\bullet\bullet}{4}5 = \dfrac{15}{33}$

4) a) Change $\dfrac{1}{6}$ to a decimal.

   b) Prove that the recurring decimal $0.\overset{\bullet}{1}3\overset{\bullet}{5} = \dfrac{5}{37}$

5) a) Convert the recurring decimal $0.\overset{\bullet}{2}6\overset{\bullet}{1}$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.2\overset{\bullet}{7} = \dfrac{5}{18}$

6) a) Convert the recurring decimal $5.\overset{\bullet}{2}$ to a fraction in its simplest form.

   b) Prove that the recurring decimal $0.1\overset{\bullet}{3}\overset{\bullet}{6} = \dfrac{3}{22}$

Recurring Decimals - Proof

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form. $\dfrac{4}{11}$

   b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \dfrac{8}{11}$

   $0.\dot{7}\dot{2} = 2 \times 0.\dot{3}\dot{6}$
   $0.\dot{7}\dot{2} = 2 \times \dfrac{4}{11}$
   $0.\dot{7}\dot{2} = \dfrac{8}{11}$

2) a) Change $\dfrac{4}{9}$ to a decimal. $0.\dot{4}$

   b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \dfrac{19}{33}$

   $x = 0.5757...$
   $100x = 57.5757...$
   $99x = 57$
   $x = \dfrac{57}{99} = \dfrac{19}{33}$

3) a) Change $\dfrac{3}{11}$ to a decimal. $0.\dot{2}\dot{7}$

   b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \dfrac{15}{33}$

   $x = 0.4545...$
   $100x = 45.4545...$
   $99x = 45$
   $x = \dfrac{45}{99} = \dfrac{15}{33}$

4) a) Change $\dfrac{1}{6}$ to a decimal. $0.1\dot{6}$

   b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \dfrac{5}{37}$

   $x = 0.135135...$
   $1000x = 135.135135...$
   $999x = 135$
   $x = \dfrac{135}{999} = \dfrac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form. $\dfrac{29}{111}$

   b) Prove that the recurring decimal $0.2\dot{7} = \dfrac{5}{18}$

   $x = 0.2777...$
   $100x = 27.777...$
   $99x = 27.5$
   $x = \dfrac{27.5}{99} = \dfrac{55}{198} = \dfrac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

   $x = 5.222...$
   $10x = 52.222...$
   $9x = 47$
   $x = \dfrac{47}{9} = 5\dfrac{2}{9}$

   b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \dfrac{3}{22}$

   $x = 0.13636...$
   $100x = 13.63636...$
   $99x = 13.5$
   $x = \dfrac{13.5}{99} = \dfrac{27}{198} = \dfrac{3}{22}$

Identities

1) State whether each of the following is an equation, expression, formula or identity.

a) $6x + 9y$

b) $5y - 4 = 16$

c) $5x + 3x \equiv 8x$

d) $a^2 + b^2 = c^2$

2) Show that:

a) $4(x + 6) - 3x \equiv x + 24$

b) $2(y + 3) + 4(5y - 4) \equiv 22y - 10$

c) $(2a + 3)^2 - 8 \equiv 4a^2 + 12a + 1$

d) $(5b - 2)(2b + 3) - (3b - 1)^2 \equiv b^2 + 17b - 7$

3) Find the values of a and b when:

a) $(3x + a)(bx + 1) \equiv 6x^2 + 11x + 4$

b) $(5x + a)(bx - 4) \equiv 15x^2 - 26x + 8$

c) $(5x + a)(ax + b) \equiv 20x^2 + 31x + 12$

d) $(3x + a)(3ax + b) \equiv 18x^2 - 3x - 10$

4) Find the values of a and b when:

a) $x^2 + 12x + a \equiv (x + b)(x + 4)$

b) $x^2 - 8x + a \equiv (x + b)(x - 10)$

c) $x^2 - 11x + a \equiv (x + b)(x - 3)$

d) $x^2 + bx + 36 \equiv (x + 4a)(x + a)$

5) Find the values of a and b when:

a) $(a - 5)x^2 + 4b \equiv 9x^2 + 28$

b) $6(2x + a) + b(x + 4) \equiv 17x + 38$

c) $(x + a)^2 + 3(x + 2) \equiv x^2 + bx + 22$

Identities

1) State whether each of the following is an equation, expression, formula or identity.

a) $6x + 9y$ Expression

b) $5y - 4 = 16$ Equation

c) $5x + 3x \equiv 8x$ Identity

d) $a^2 + b^2 = c^2$ ormula

2) Show that:

a) $4(x + 6) - 3x \equiv x + 24$ $x + 24 - 3x = x + 24$

b) $2(y + 3) + 4(5y - 4) \equiv 22y - 10$ $2y + 6 + 20y - 16 = 22y - 10$

c) $(2a + 3)^2 - 8 \equiv 4a^2 + 12a + 1$ $4a^2 + 12a + 9 - 8 = 4a^2 + 12a + 1$

d) $(5b - 2)(2b + 3) - (3b - 1)^2 \equiv b^2 + 17b - 7$ $b^2 + 11b - 6 - (9b^2 - 6b + 1) = b^2 + 17b - 7$

3) Find the values of a and b when:

a) $(3x + a)(bx + 1) \equiv 6x^2 + 11x + 4$ $a = 4$ $b = 2$

b) $(5x + a)(bx - 4) \equiv 15x^2 - 26x + 8$ $a = -2$ $b = 3$

c) $(5x + a)(ax + b) \equiv 20x^2 + 31x + 12$ $a = 4$ $b = 3$

d) $(3x + a)(3ax + b) \equiv 18x^2 - 3x - 10$ $a = 2$ $b = -5$

4) Find the values of a and b when:

a) $x^2 + 12x + a \equiv (x + b)(x + 4)$ $a = 32$ $b = 8$

b) $x^2 - 8x + a \equiv (x + b)(x - 10)$ $a = -20$ $b = 2$

c) $x^2 - 11x + a \equiv (x + b)(x - 3)$ $a = 24$ $b = -8$

d) $x^2 + bx + 36 \equiv (x + 4a)(x + a)$ $a = 3$ $b = 15$

5) Find the values of a and b when:

a) $(a - 5)x^2 + 4b \equiv 9x^2 + 28$ $a = 14$ $b = 7$

b) $6(2x + a) + b(x + 4) \equiv 17x + 38$ $a = 3$ $b = 5$

c) $(x + a)^2 + 3(x + 2) \equiv x^2 + bx + 22$ $a = 4$ $b = 11$

Simultaneous Equations Algebraically

1) Solve

$$4x + 3y = 6$$
$$5x - 3y = 21$$

2) Solve

$$4x + 3y = 19$$
$$3x - 5y = 7$$

3) Solve

$$3x + 5y = 13$$
$$2x + 3y = 8$$

4) Solve

$$x + 4y = 5$$
$$4x - 2y = 11$$

5) Solve

$$2a + b = 3$$
$$4a - 5b = 20$$

6) Solve

$$5x + 3y = 4$$
$$3x + 4y = 9$$

7) Solve

$$6x - 2y = 13$$
$$2x + 3y = -3$$

8) Solve

$$3a - 2b = 14$$
$$4a + 3b = 13$$

9) Solve

$$5x + 4y = 5$$
$$2x + 7y = 29$$

10) Solve

$$6x - 4y = 39$$
$$2x + y = 6$$

1) Solve

$$4x + 3y = 6$$
$$5x - 3y = 21$$

x = 3 and *y* = -2

2) Solve

$$4x + 3y = 19$$
$$3x - 5y = 7$$

x = 4 and *y* = 1

3) Solve

$$3x + 5y = 13$$
$$2x + 3y = 8$$

x = 1 and *y* = 2

4) Solve

$$x + 4y = 5$$
$$4x - 2y = 11$$

x = 3 and *y* = 0.5

5) Solve

$$2a + b = 3$$
$$4a - 5b = 20$$

a = 2.5 and *b* = -2

6) Solve

$$5x + 3y = 4$$
$$3x + 4y = 9$$

x = -1 and *y* = 3

7) Solve

$$6x - 2y = 13$$
$$2x + 3y = -3$$

x = 1.5 and *y* = -2

8) Solve

$$3a - 2b = 14$$
$$4a + 3b = 13$$

a = 4 and *b* = -1

9) Solve

$$5x + 4y = 5$$
$$2x + 7y = 29$$

x = -3 and *y* = 5

10) Solve

$$6x - 4y = 39$$
$$2x + y = 6$$

x = 4.5 and *y* = -3

Equation of a Straight Line - $y = mx + c$

1) Find the equations of lines A, B and C on the axes below
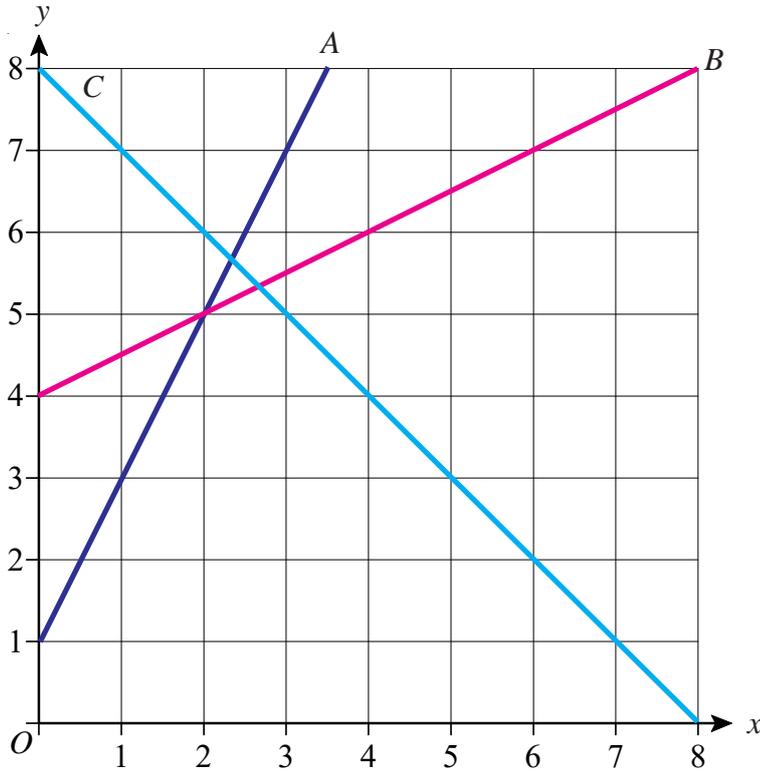
2) Find the equations of lines A, B and C on the axes below
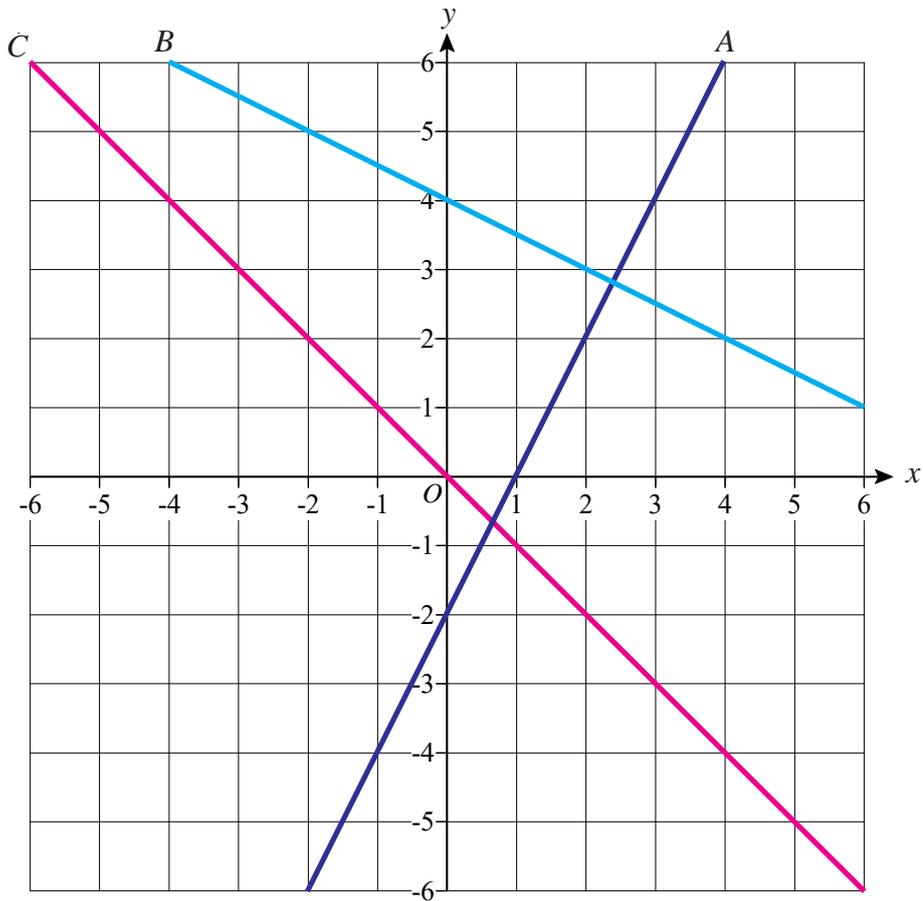
Equation of a Straight Line - $y = mx + c$

1) Find the equations of lines A, B and C on the axes below

A: $y = 2x + 1$
B: $y = 0.5x + 4$
C: $y = -x + 8$
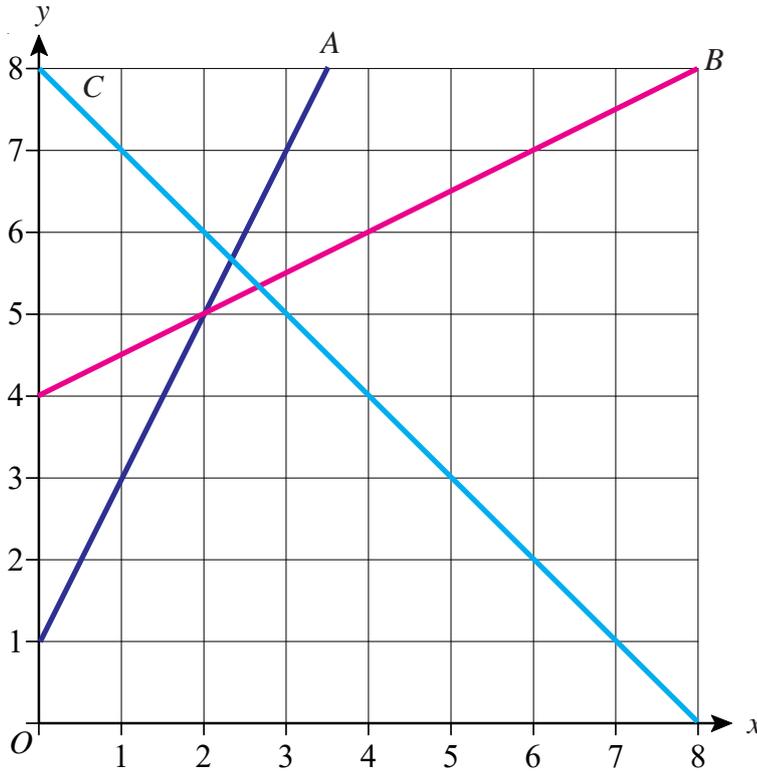
2) Find the equations of lines A, B and C on the axes below

A: $y = 2x - 2$
B: $y = -0.5x + 4$
C: $y = -x$

Page 149 A
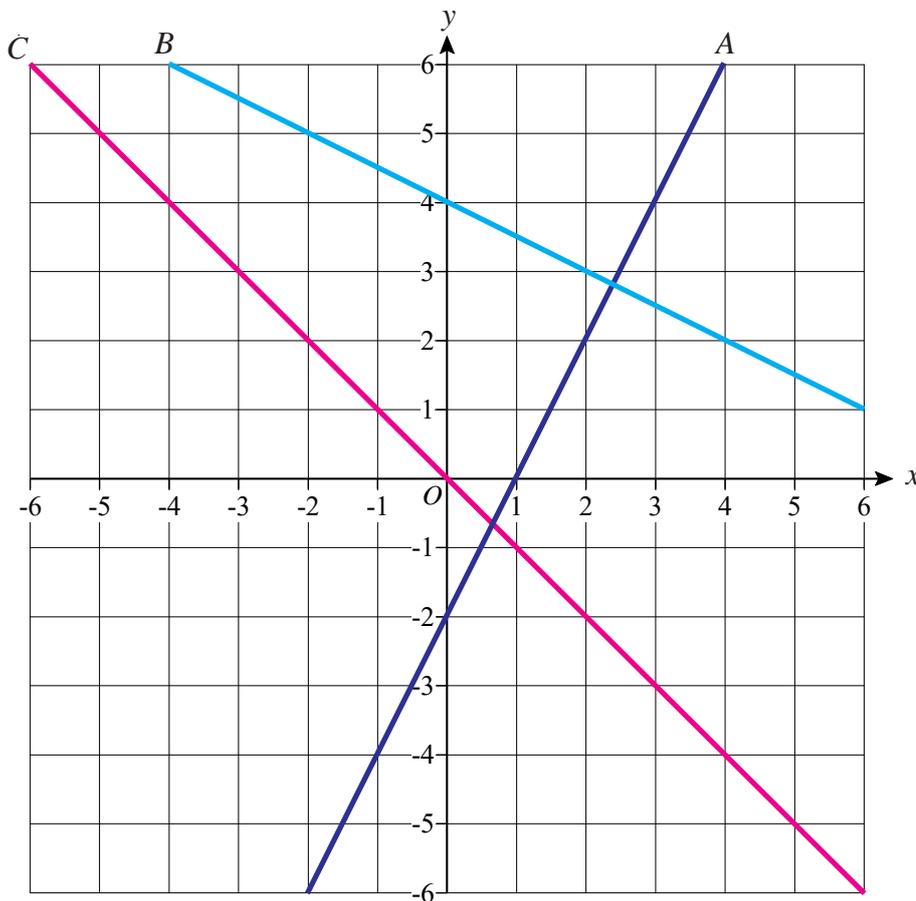
1) Find the equation of line *A* on the grid below.
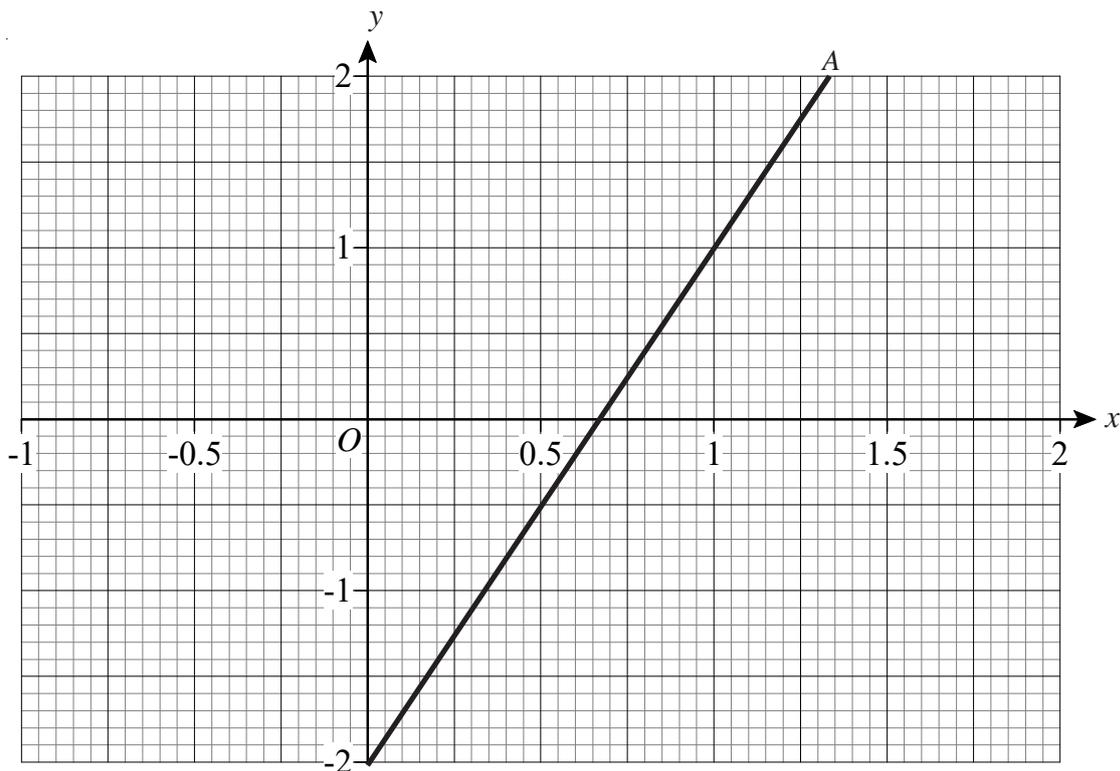
2) A straight line passes through points (0, 4) and (3, 13).
   What is its equation?

3) A straight line passes through points (0, 7) and (2, -1).
   What is its equation?

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
   What is its equation?

5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
   What is its equation?

6) *A* is the point (-1, 2).
   B is the point (1, 6).
   C is the point (0, -1).
   Find the equation of the line which passes through *C*
   and is parallel to *AB*.

B (1, 6)

A (-1, 2)

C (0, -1)
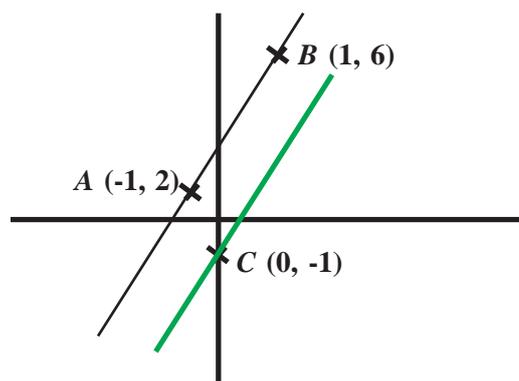
1) Find the equation of line *A* on the grid below. $y = 3x - 2$
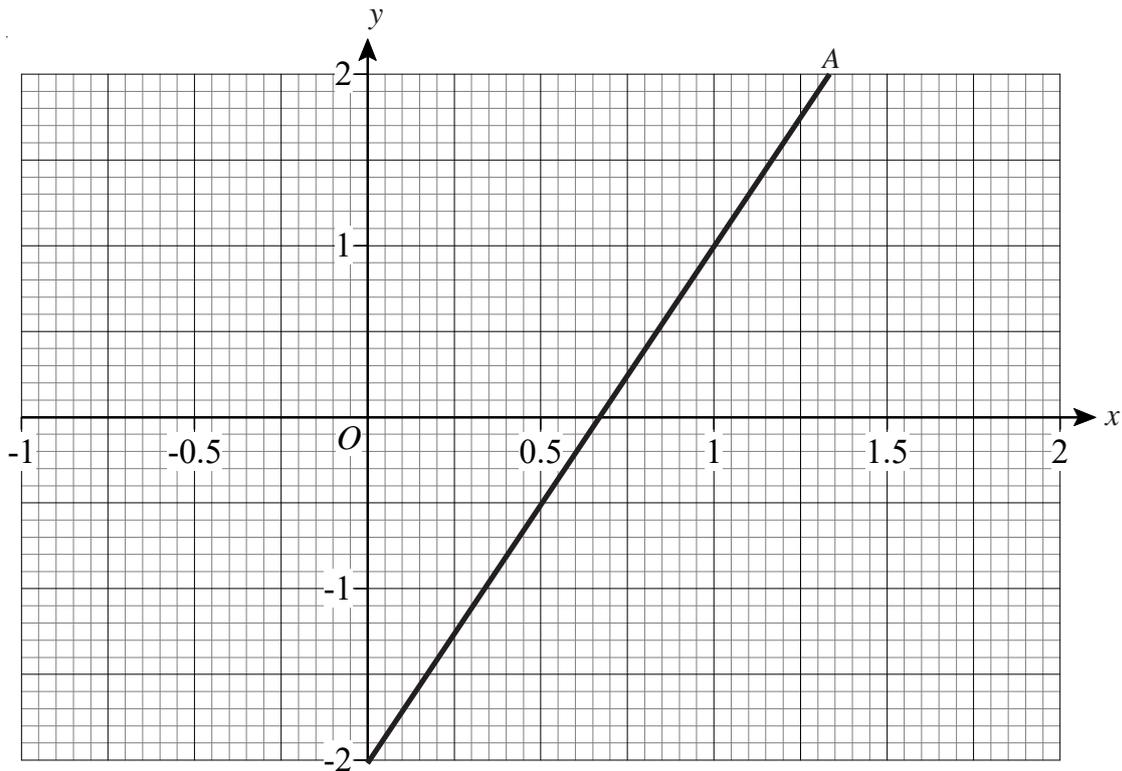
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation? $y = 3x + 4$

3) A straight line passes through points (0, 7) and (2, -1).
What is its equation? $y = -4x + 7$

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation? $y = 3x + 5$

5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation? $y = 2x - 4$

6) *A* is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through *C*
and is parallel to *AB*. $y = 2x - 1$
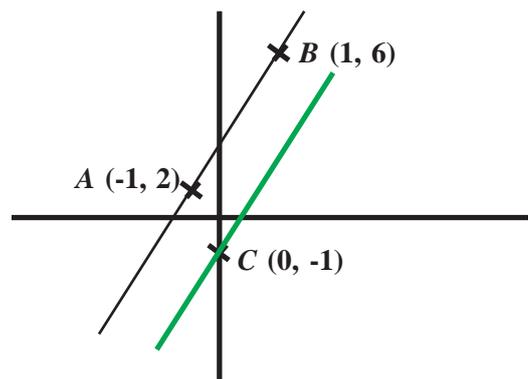
1)
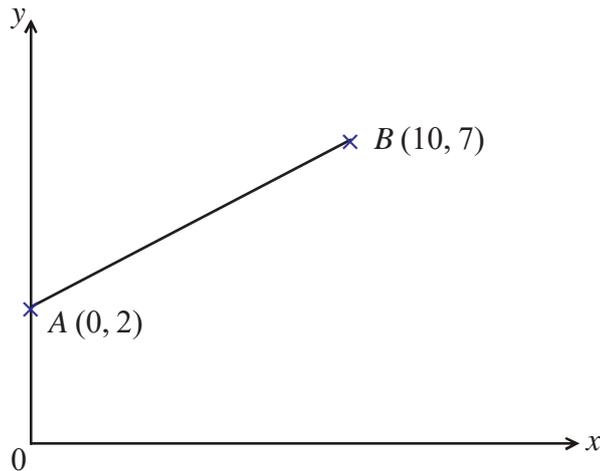
A is the point $(0, 2)$
B is the point $(10, 7)$

a) Write down the equation of the straight line which passes through points A and B.

b) Find the equation of the line perpendicular to AB passing through B.

2) A straight line has equation $y = 2x - 5$
The point P lies on the straight line.
The y coordinate of P is -6

a) Find the x coordinate of P.

A straight line L is parallel to $y = 2x - 5$ and passes through the point $(3, 2)$.

b) Find the equation of line L.

c) Find the equation of the line that is perpendicular to line L and passes through point $(3, 2)$.

3) In the diagram A is the point $(0, -2)$
B is the point $(-4, 2)$
C is the point $(0, 2)$

a) Find the equation of the line that passes through
C and is parallel to AB.

b) Find the equation of the line that passes through
C and is perpendicular to AB.
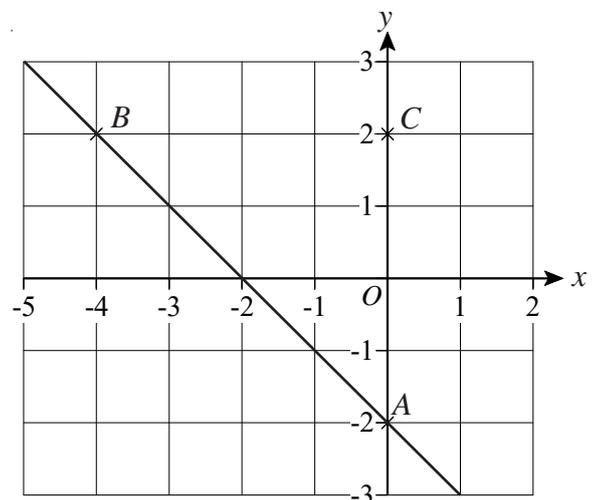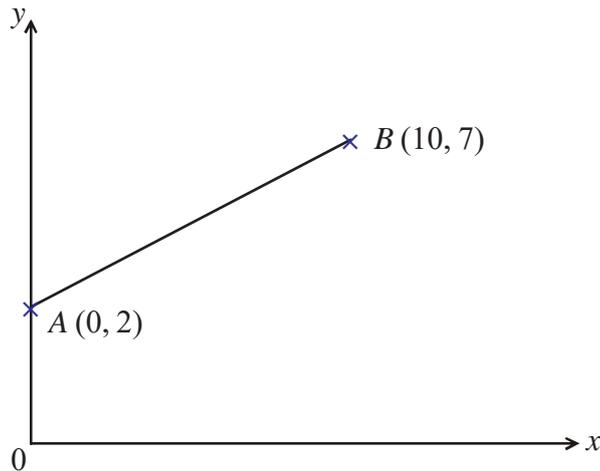
Equation of a Straight Line - Perpendicular Lines

1)

A is the point $(0, 2)$
B is the point $(10, 7)$

a) Write down the equation of the straight line which passes through points A and B. $y = \frac{1}{2}x + 2$

b) Find the equation of the line perpendicular to AB passing through B. $y = -2x + 27$

2)   A straight line has equation $y = 2x - 5$
The point P lies on the straight line.
The y coordinate of P is -6

a) Find the x coordinate of P. $x = -0.5$

A straight line L is parallel to $y = 2x - 5$ and passes through the point $(3, 2)$.

b) Find the equation of line L. $y = 2x - 4$

c) Find the equation of the line that is perpendicular to line L and passes through point $(3, 2)$.
$y = -\frac{1}{2}x + 3\frac{1}{2}$

3)   In the diagram A is the point $(0, -2)$
B is the point $(-4, 2)$
C is the point $(0, 2)$

a) Find the equation of the line that passes through
C and is parallel to AB. $y = -x + 2$

b) Find the equation of the line that passes through
C and is perpendicular to AB. $y = x + 2$
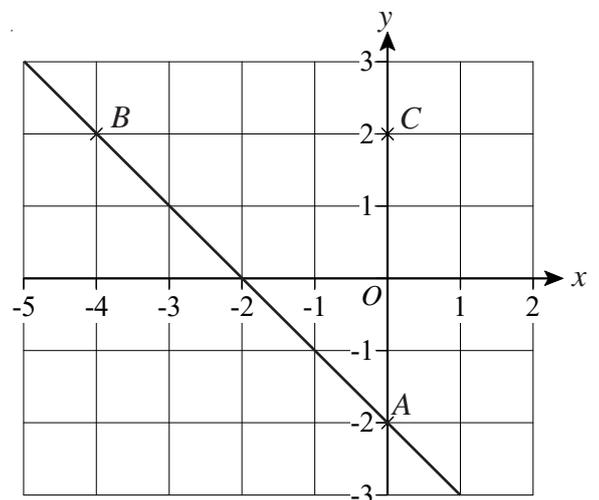
Inequalities on a Graph

1) For each question below, find the inequality that is represented by the shaded region.

a)
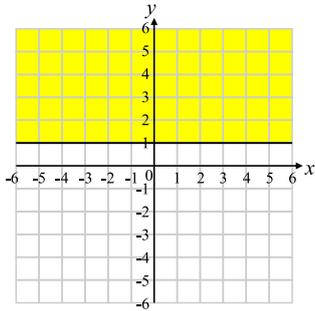
b)
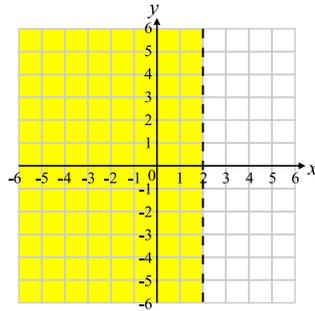
c)
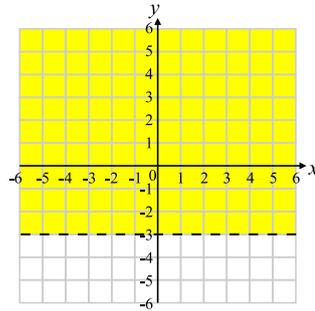
d)
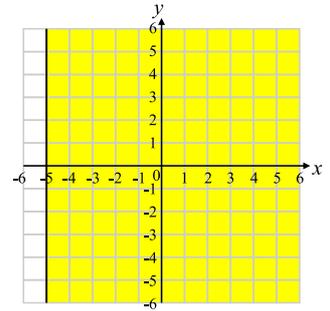
e)
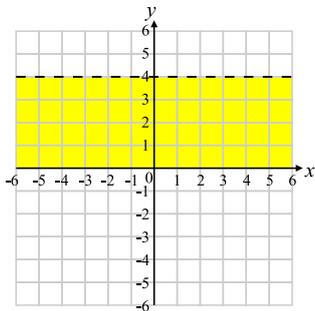
f)
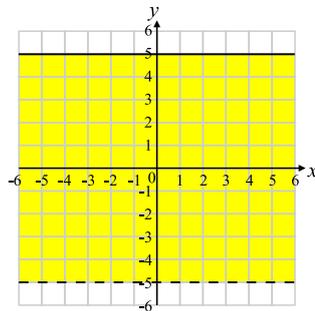
g)
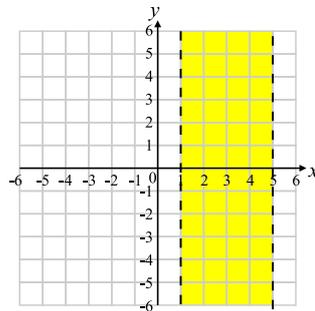
h)
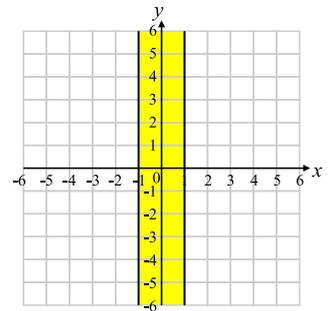
2) For each question below, shade the region represented by the inequality given.

a) $x \geq 3$

b) $y < 1$

c) $x < -4$

d) $y \geq 2$
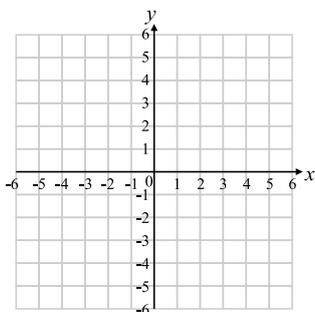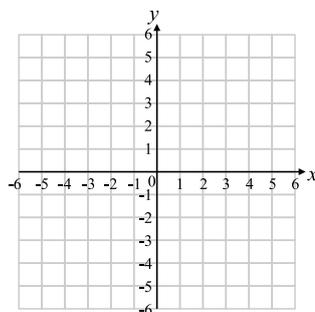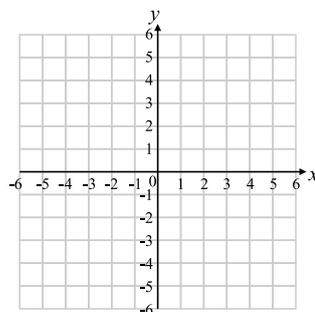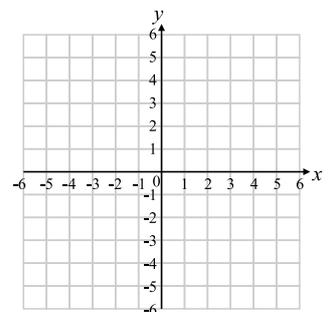
e) $-1 \leq x \leq 4$
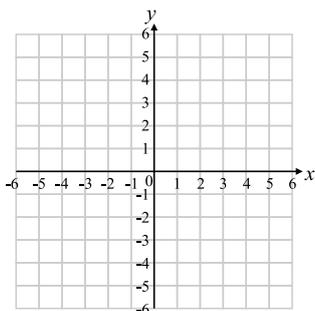
f) $-3 < y < 4$
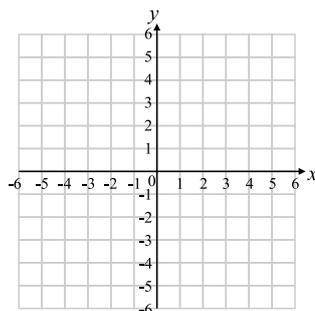
g) $-2 \leq y < 2$
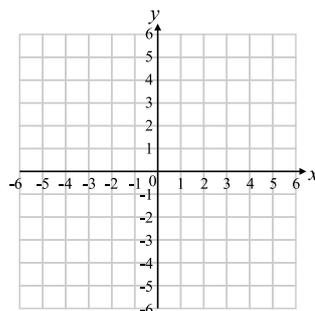
h) $-5 < x \leq -1$
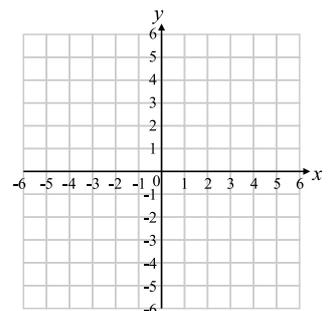
Inequalities on a Graph

1) For each question below, find the inequality that is represented by the shaded region.

a) $y \geq 1$
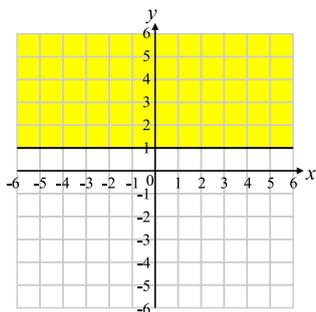
b) $x < 2$
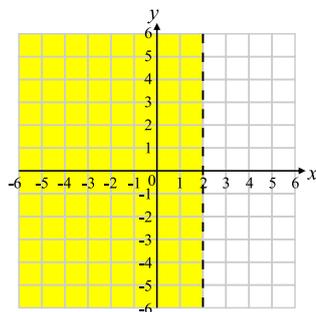
c) $y > -3$
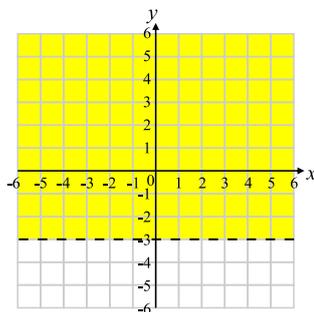
d) $x \geq -5$
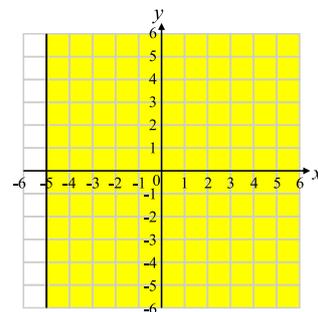
e) $0 \leq y < 4$
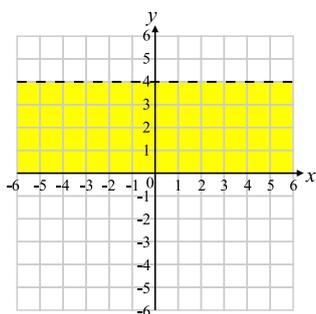
f) $-5 < y \leq 5$
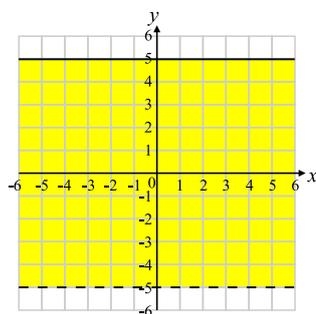
g) $1 < x < 5$
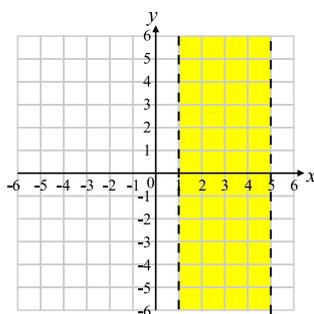
h) $-1 \leq x \leq 1$
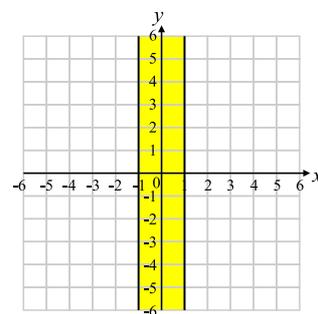
2) For each question below, shade the region represented by the inequality given.

a) $x \geq 3$

b) $y < 1$

c) $x < -4$

d) $y \geq 2$
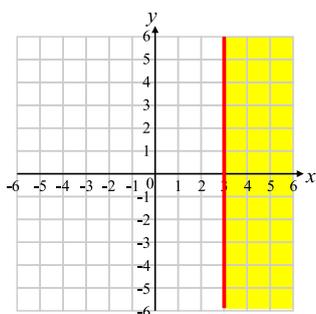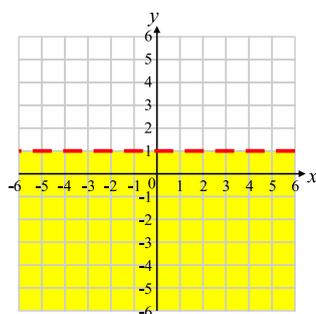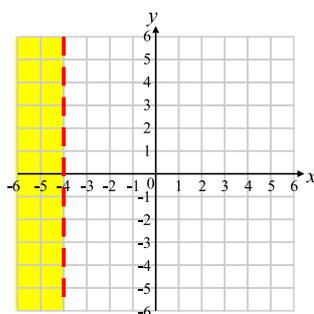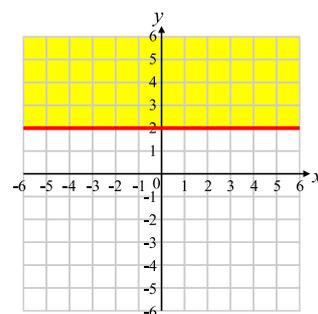
e) $-1 \leq x \leq 4$
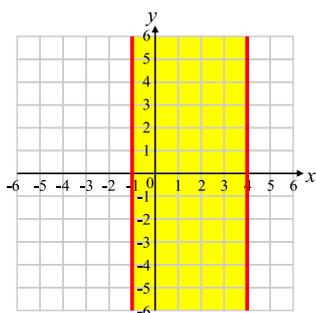
f) $-3 < y < 4$
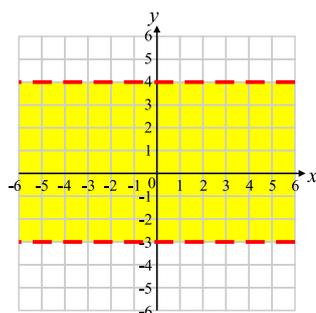
g) $-2 \leq y < 2$

h) $-5 < x \leq -1$

1) On the grid below, draw straight lines and use shading to show the region R that satisfies the inequalities $\quad x \geqslant 1 \qquad y \geqslant x \qquad x + y \leqslant 7$

2) On the grid below, draw straight lines and use shading to show the region R that satisfies the inequalities $\qquad y \geqslant x + 1 \qquad y \leqslant 5 \qquad x \geqslant 1$

Regions

1) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $x \geqslant 1$ $\quad y \geqslant x$ $\quad x + y \leqslant 7$

2) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $\quad y \geqslant x + 1$ $\quad y \leqslant 5$ $\quad x \geqslant 1$

Page 150 B
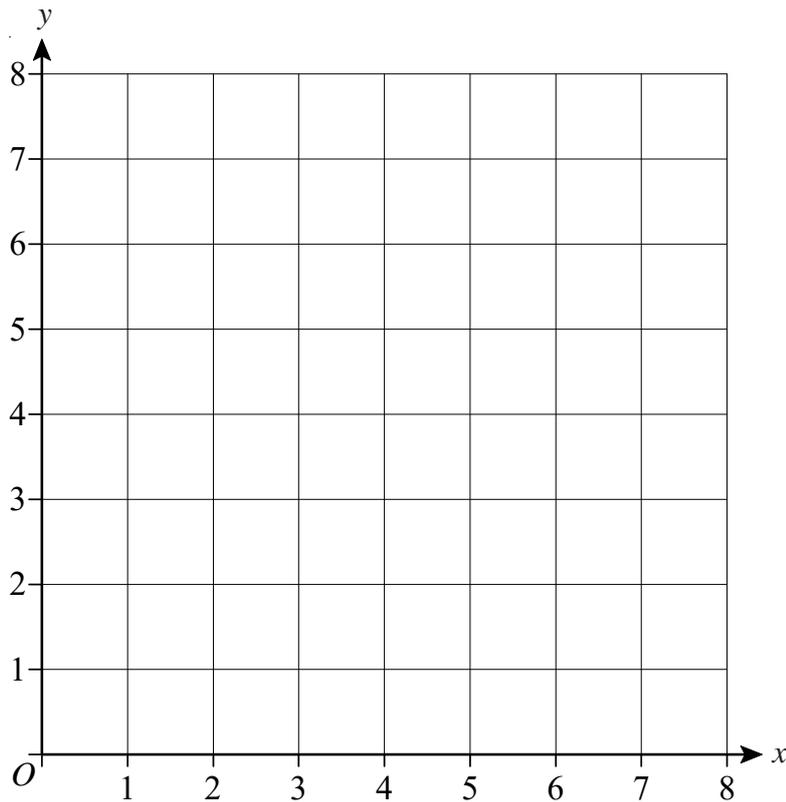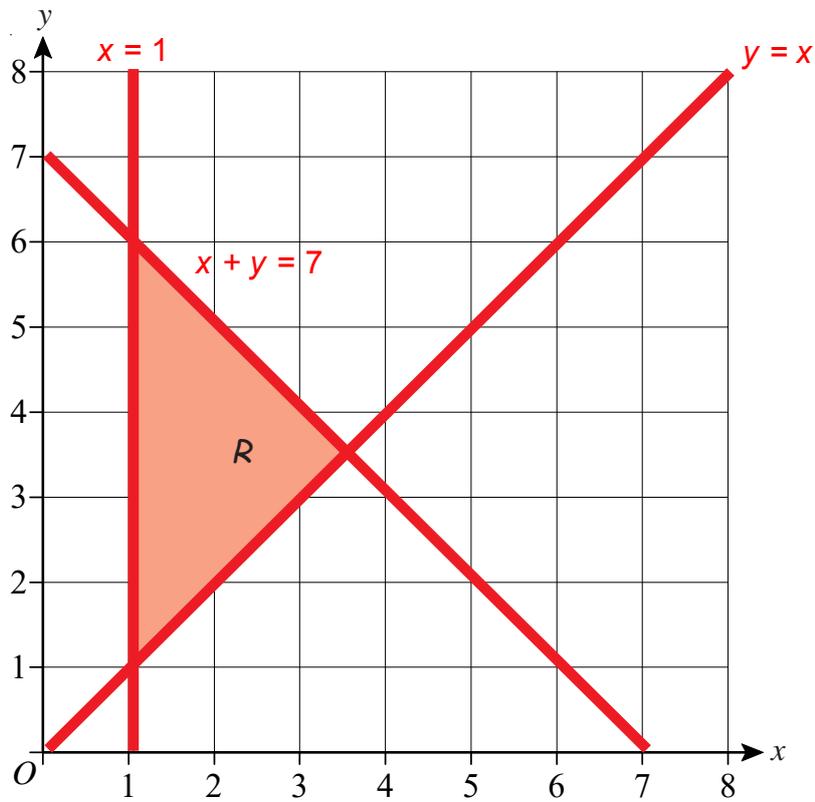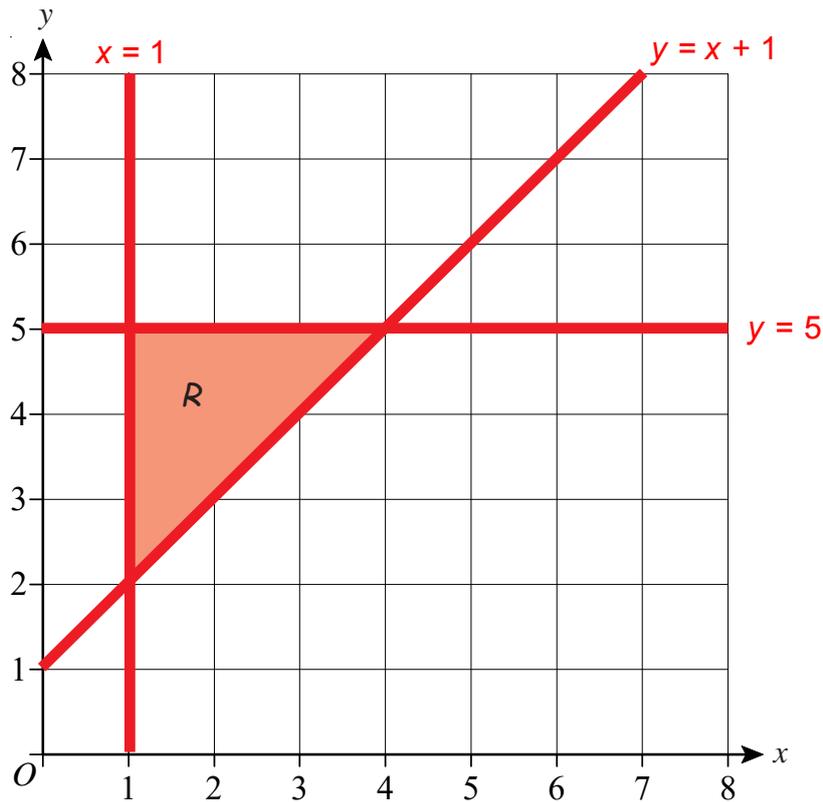
1) Solve the following inequalities:

a) $2m + 4 < 3m + 1$

b) $5n + 1 \geq 2n - 5$

c) $27 - 4x > 2x - 3$

d) $2(3y + 2) \leq 2y + 1$

2) Amy, Lucy and Tillie play Tennis each week in a league.
Since the start of the league, Amy has won n games.
Lucy has won twice as many as Amy plus 3 extra.
Tillie has won three times as many as Amy minus 4

a) Tillie has won more games than Lucy. Write an inequality to show this.

b) Work out the least number of games Amy could have won.

3) If n is an integer, list all the possible values that satisfy the following inequalities:

a) $10 \leq 5n < 40$

b) $-8 < 3n \leq 6$

4) Solve the following inequalities:

a) $9 < 2n + 3 < 15$

b) $-16 < 3m - 4 \leq 2$

c) $-11 \leq 3a - 5 \leq -1$

d) $5 \leq 5b + 3 < 10$

5) Solve the following inequalities:

a) $a + 1 < 2a + 3 < 9$

b) $3b + 1 < 5b - 2 \leq 2b + 13$

c) $2 - 3c \leq 2c + 7 \leq 6 - 2c$

d) $2(2n + 3) \leq 7n + 10 < 25 - 5n$

6) If n is an integer, list all the possible values that satisfy the following inequalities:

a) $2n + 1 \leq 3n + 4 < 12 - n$

b) $2(n - 2) < 5n + 4 \leq 2 - 3n$

1) Solve the following inequalities:

   a) $2m + 4 < 3m + 1$ m

   b) $5n + 1 \geq 2n - 5$ $n \geq -2$

   c) $27 - 4x > 2x - 3$ x

   d) $2(3y + 2) \leq 2y + 1$ $y \leq -0.75$

2) Amy, Lucy and Tillie play Tennis each week in a league.
   Since the start of the league, Amy has won n games.
   Lucy has won twice as many as Amy plus 3 extra.
   Tillie has won three times as many as Amy minus 4

   a) Tillie has won more games than Lucy. Write an inequality to show this. $n + 3 < 3n - 4$

   b) Work out the least number of games Amy could have won.

3) If n is an integer, list all the possible values that satisfy the following inequalities:

   a) $10 \leq 5n < 40$

   b) $-8 < 3n \leq 6$

4) Solve the following inequalities:

   a) $9 < 2n + 3 < 15$ $n < 6$

   b) $-16 < 3m - 4 \leq 2$ $-4 < m \leq 2$

   c) $-11 \leq 3a - 5 \leq -1$ $- \leq a \leq \dfrac{4}{3}$

   d) $5 \leq 5b + 3 < 10$ $0.4 \leq b < 1.4$

5) Solve the following inequalities:

   a) $a + 1 < 2a + 3 < 9$ $-2 < a < 3$

   b) $3b + 1 < 5b - 2 \leq 2b + 13$ $1.5 < b \leq 5$

   c) $2 - 3c \leq 2c + 7 \leq 6 - 2c$ $1 \leq c \leq -0.25$

   d) $2(2n + 3) \leq 7n + 10 < 25 - 5n$ $-\dfrac{4}{3} \leq n < 1.25$

6) If n is an integer, list all the possible values that satisfy the following inequalities:

   a) $2n + 1 \leq 3n + 4 < 12 - n$ $-2, -1, 0, 1$

   b) $2(n - 2) < 5n + 4 \leq 2 - 3n$ $-2, -1$

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$

b) $x^2 + 9x + 20 = 0$

c) $x^2 + x - 6 = 0$

d) $x^2 + 5x - 24 = 0$

e) $x^2 - 6x + 8 = 0$

f) $x^2 - 3x - 28 = 0$

g) $2x^2 + 7x + 3 = 0$

h) $6x^2 + 11x + 3 = 0$

i) $3x^2 + 13x - 10 = 0$

j) $3x^2 - 34x + 63 = 0$

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

Was Lucy correct?
Show working to justify your answer

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct?
Show working to justify your answer

Factorising and Solving Quadratics

1) Factorise and solve the following equations:

   a) $x^2 + 5x + 6 = 0$ $(x + 2)(x + 3) = 0$ $x = -2$ or -3

   b) $x^2 + 9x + 20 = 0$ $(x + 4)(x + 5) = 0$ $x = -4$ or -5

   c) $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3$ or 2

   d) $x^2 + 5x - 24 = 0$ $(x + 8)(x - 3) = 0$ $x = -8$ or 3

   e) $x^2 - 6x + 8 = 0$ $(x - 2)(x - 4) = 0$ $x = 2$ or 4

   f) $x^2 - 3x - 28 = 0$ $(x - 7)(x + 4) = 0$ $x = 7$ or -4

   g) $2x^2 + 7x + 3 = 0$ $(x + 3)(2x + 1) = 0$ $x = -3$ or $-\dfrac{1}{2}$

   h) $6x^2 + 11x + 3 = 0$ $(2x + 3)(3x + 1) = 0$ $x = -\dfrac{3}{2}$ or $-\dfrac{1}{3}$

   i) $3x^2 + 13x - 10 = 0$ $(x + 5)(3x - 2) = 0$ $x = -5$ or $\dfrac{2}{3}$

   j) $3x^2 - 34x + 63 = 0$ $(3x - 7)(x - 9) = 0$ $x = \dfrac{7}{3}$ or 9

2) Lucy said that -1 is the only solution of x that satisfies the equation
   $x^2 + 2x + 1 = 0$

   Was Lucy correct? Yes
   Show working to justify your answer
   $x^2 + 2x + 1 = 0$
   $(x + 1)(x + 1) = 0$
   so $x = -1$

3) Ben said that -5 is the only solution of x that satisfies the equation
   $x^2 + 10x + 25 = 0$

   Was Ben correct?   Yes
   Show working to justify your answer
   $x^2 + 10x + 25 = 0$
   $(x + 5)(x + 5) = 0$
   so $x = -5$

1) Factorise

    a) $x^2 - 16$ c) $y^2 - 9$ e) $x^2 - \dfrac{1}{4}$

    b) $a^2 - b^2$ d) $x^2 - 1$ f) $x^2 - \dfrac{1}{9}$

2) Factorise

    a) $x^2 - 4y^2$ c) $9x^2 - 16y^2$ e) $4x^2 - 25y^2$

    b) $9a^2 - b^2$ d) $\dfrac{1}{4}x^2 - y^2$ f) $x^2 - \dfrac{1}{9}y^2$

3) Simplify

    a) $\dfrac{y^2 - 4}{y + 2} \times \dfrac{5}{y + 5}$

    b) $\dfrac{3}{2x + 1} \times \dfrac{4x^2 - 1}{x - 2}$

    c) $\dfrac{12x^2 + 8x}{9x^2 - 4}$

    d) $\dfrac{25a^2 - 16b^2}{10ab - 8b^2}$

4) Solve

    a) $4x^2 - 16 = 0$ c) $49x^2 = 121$

    b) $25x^2 = 1$ d) $9x^2 - 9 = 7$

The Difference of Two Squares

1) Factorise

a) $x^2 - 16$

$(x - 4)(x + 4)$

b) $a^2 - b^2$

$(a - b)(a + b)$

c) $y^2 - 9$

$(y - 3)(y + 3)$

d) $x^2 - 1$

$(x - 1)(x + 1)$

e) $x^2 - \dfrac{1}{4}$

$(x - \tfrac{1}{2})(x + \tfrac{1}{2}$

f) $x^2 - \dfrac{1}{9}$

$(x - \tfrac{1}{3})(x + \tfrac{1}{3})$

2) Factorise

a) $x^2 - 4y^2$

$(x - 2y)(x + 2y)$

b) $9a^2 - b^2$

$(3a - b)(3a + b)$

c) $9x^2 - 16y^2$

$(3x - 4y)(3x + 4y)$

d) $\dfrac{1}{4}x^2 - y^2$

$(\tfrac{1}{2}x - y)(\tfrac{1}{2}x + y)$

e) $4x^2 - 25y^2$

$(2x - 5y)(2x + 5y)$

f) $x^2 - \dfrac{1}{9}y^2$

$(x - \tfrac{1}{3}y)(x + \tfrac{1}{3}y)$

3) Simplify

a) $\dfrac{y^2 - 4}{y + 2} \times \dfrac{5}{y + 5}$ $\dfrac{5(y - 2)}{y + 5}$

b) $\dfrac{3}{2x + 1} \times \dfrac{4x^2 - 1}{x - 2}$ $\dfrac{3(2x - 1)}{x - 2}$

c) $\dfrac{12x^2 + 8x}{9x^2 - 4}$ $\dfrac{4x}{3x - 2}$

d) $\dfrac{25a^2 - 16b^2}{10ab - 8b^2}$ $\dfrac{5a + 4b}{2b}$

4) Solve

a) $4x^2 - 16 = 0$

$x = 2$, $x = -2$

b) $25x^2 = 1$

$x = \dfrac{1}{5}$, $x = -\dfrac{1}{5}$

c) $49x^2 = 121$

$x = 1\tfrac{4}{7}$, $x = -1\tfrac{4}{7}$

d) $9x^2 - 9 = 7$

$x = 1\tfrac{1}{3}$, $x = -1\tfrac{1}{3}$

1) The graph of $y = x^2 - 2x - 3$ is shown.

Write down the coordinates of:

a) The turning point of the curve.

b) The roots of the equation $x^2 - 2x - 3 = 0$

c) The intersection of the curve with the y-axis.
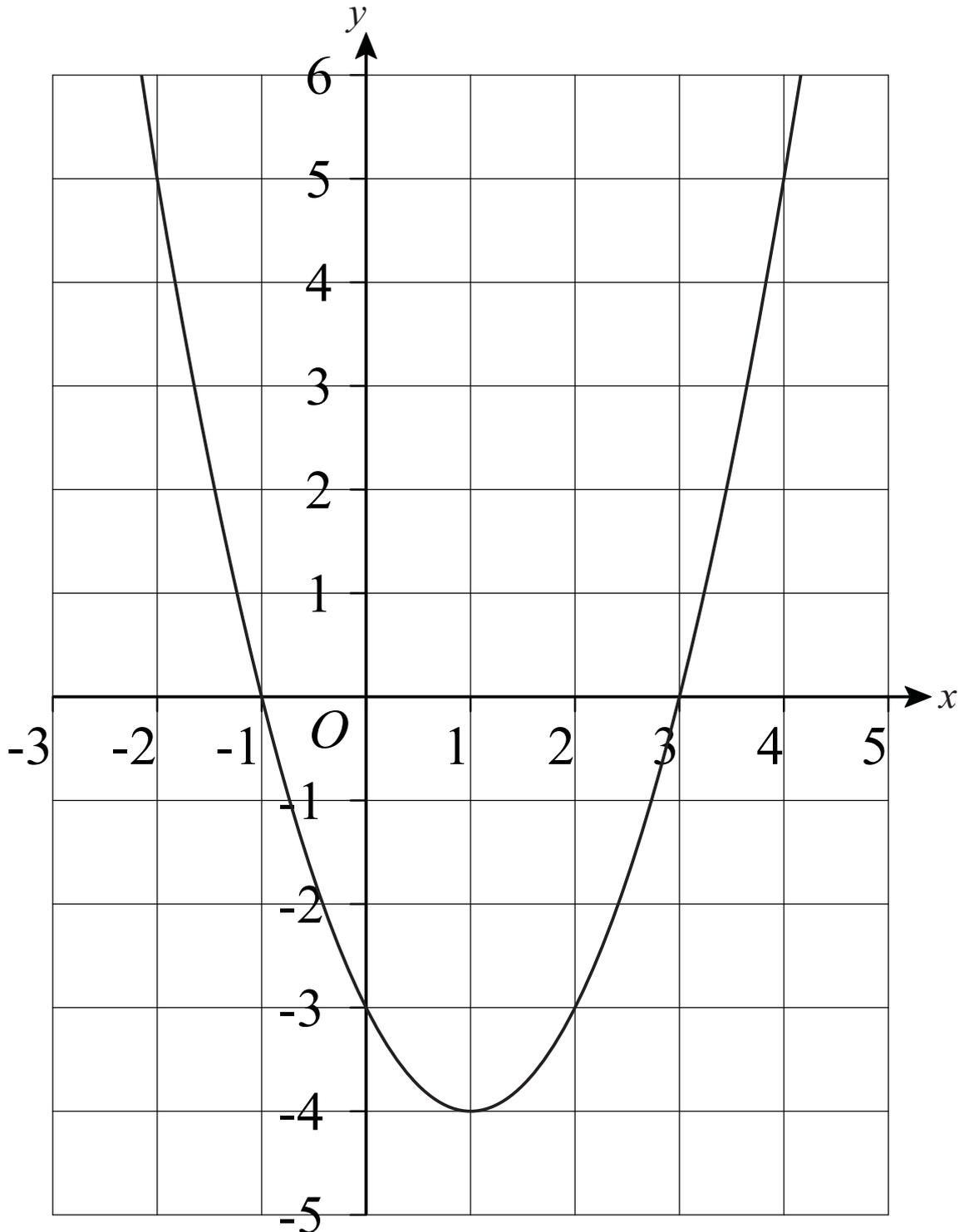
1) The graph of $y = x^2 - 2x - 3$ is shown.

Write down the coordinates of:

a) The turning point of the curve.   (1, -4)

b) The roots of the equation $x^2 - 2x - 3 = 0$ (-1, 0), (3, 0)

c) The intersection of the curve with the y-axis.   (0, -3)
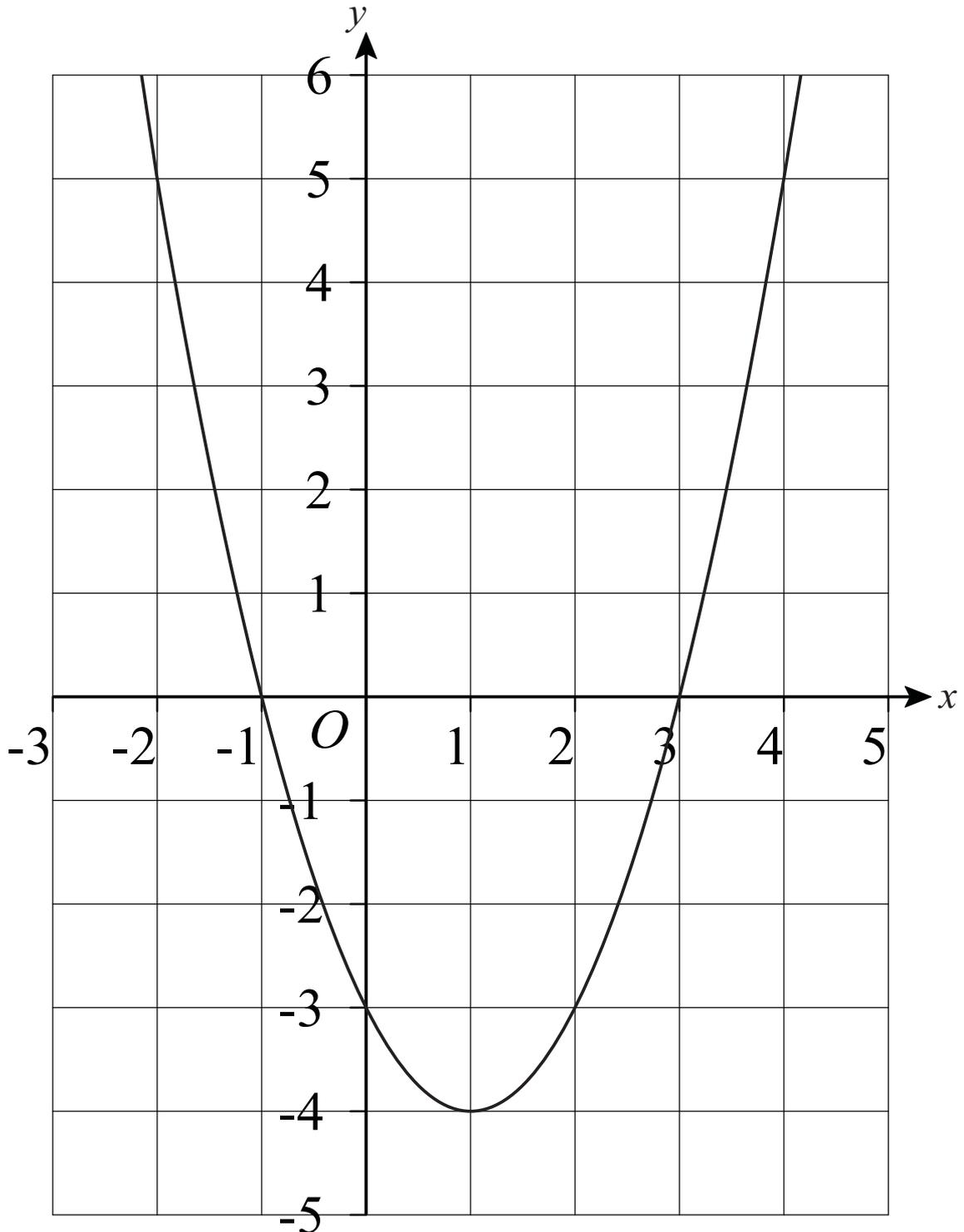
1) Expand and simplify:

 a) $(2x^2 + 5)(x + 4)$

 b) $(3x^2 + 2x)(x + 1)$

 c) $(5y - 3)(4y^2 + y)$

2) Expand and simplify

 a) $(x^2 + 3x + 8)(5x + 1)$

 b) $(4a^2 - 2a + 6)(3a + 2)$

 c) $(2x - 5)(3x^2 + 6x - 2)$

3) Expand and simplify:

 a) $x(x + 2)(x + 3)$

 b) $y(y - 7)(y + 6)$

 c) $m(m + 5)(3m + 2)$

 d) $x(3x - 7)(2x - 3)$

4) Expand and simplify

 a) $(x + 3)(x + 1)(x + 8)$

 b) $(b - 5)(b + 5)(b + 2)$

 c) $(x - 2)(x + 6)(x - 2)$

 d) $(r - 7)(r - 2)(r - 4)$

5) Expand and simplify:

 a) $(2x + 1)(5x + 2)(x + 3)$

 b) $(a + 2)(3a - 1)(a + 6)$

 c) $(2x - 5)(x - 4)(3x + 1)$

 d) $(2c - 3)(2c - 1)(3c - 2)$

1) Expand and simplify:

a) $(2x^2 + 5)(x + 4)$ $2x^3 + 8x^2 + 5x + 20$

b) $(3x^2 + 2x)(x + 1)$ $3x^3 + 5x^2 + 2x$

c) $(5y - 3)(4y^2 + y)$ $20y^3 - 7y^2 - 3y$

2) Expand and simplify

a) $(x^2 + 3x + 8)(5x + 1)$ $5x^3 + 16x^2 + 43x + 8$

b) $(4a^2 - 2a + 6)(3a + 2)$ $12a^3 + 2a^2 + 14a + 12$

c) $(2x - 5)(3x^2 + 6x - 2)$ $6x^3 - 3x^2 - 34x + 10$

3) Expand and simplify:

a) $x(x + 2)(x + 3)$ $x^3 + 5x^2 + 6x$

b) $y(y - 7)(y + 6)$ $y^3 - y^2 - 42y$

c) $m(m + 5)(3m + 2)$ $3m^3 + 17m^2 + 10m$

d) $x(3x - 7)(2x - 3)$ $6x^3 - 23x^2 + 21x$

4) Expand and simplify

a) $(x + 3)(x + 1)(x + 8) = x^3 + 12x^2 + 35x + 24$

b) $(b - 5)(b + 5)(b + 2)$ $b^3 + 2b^2 - 25b - 50$

c) $(x - 2)(x + 6)(x - 2)$ $x^3 + 2x^2 - 20x + 24$

d) $(r - 7)(r - 2)(r - 4)$ $r^3 - 13r^2 + 50r - 56$

5) Expand and simplify:

a) $(2x + 1)(5x + 2)(x + 3) = 10x^3 + 39x^2 + 29x + 6$

b) $(a + 2)(3a - 1)(a + 6)$ $3a^3 + 23a^2 + 28a - 12$

c) $(2x - 5)(x - 4)(3x + 1)$ $6x^3 - 37x^2 + 47x + 20$

d) $(2c - 3)(2c - 1)(3c - 2)$ $12c^3 - 32c^2 + 25c - 6$

Cubic and Reciprocal Graphs

1) a) Complete this table of values for
$$y = x^3 + x - 4$$

x	–2	–1	0	1	2
y	–14			–2	

b) On the grid, draw the graph of
$$y = x^3 + x - 4$$

c) Use the graph to find the value
of x when y = 2
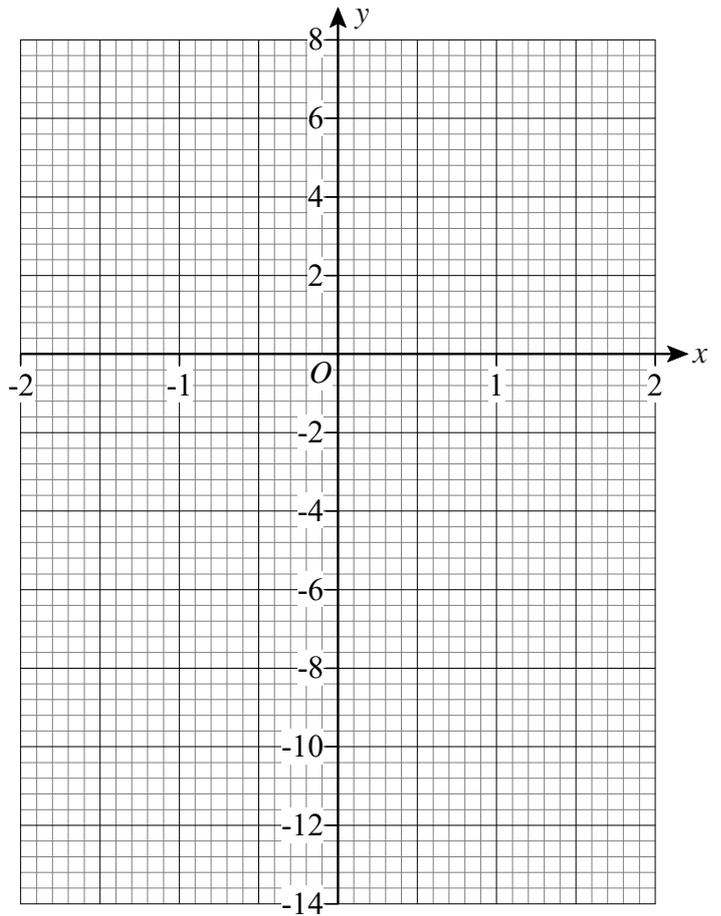
2) a) Complete this table of values for
$$y = x^3 + 2x$$

x	–2	–1	0	1	2
y	–12		0		

b) On the grid, draw the graph of
$$y = x^3 + 2x$$
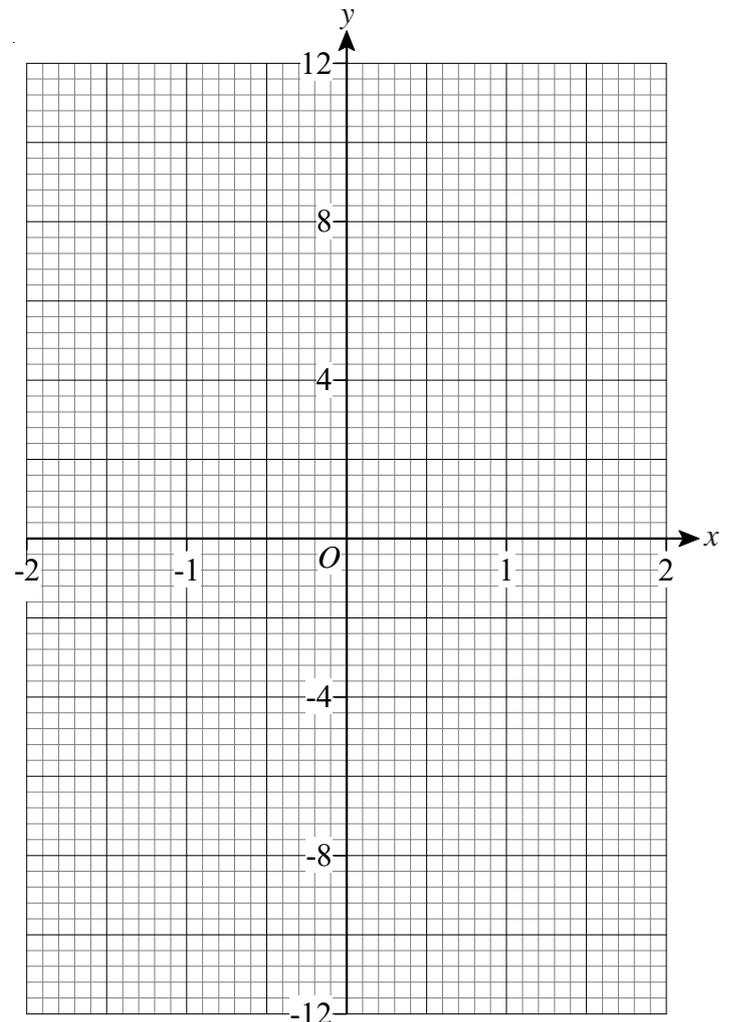
c) Use the graph to find the value
of x when y = -6

3) Sketch the graph of $y = 1 + \dfrac{1}{x}$

Page 155 A

Cubic and Reciprocal Graphs

1) a) Complete this table of values for

$y = x^3 + x - 4$

x	–2	–1	0	1	2
y	–14	-6	-4	–2	6

b) On the grid, draw the graph of

$y = x^3 + x - 4$

c) Use the graph to find the value
of x when y = 2

x = 1.75
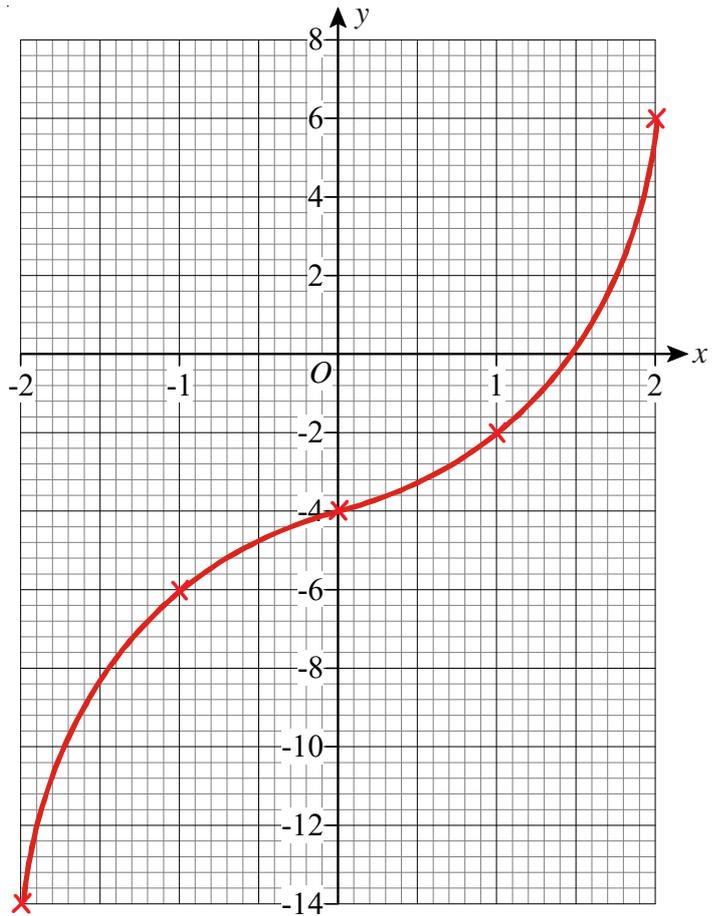
2) a) Complete this table of values for

$y = x^3 + 2x$

x	–2	–1	0	1	2
y	–12	-3	0	3	12

b) On the grid, draw the graph of

$y = x^3 + 2x$

c) Use the graph to find the value
of x when y = -6

x = -1.5
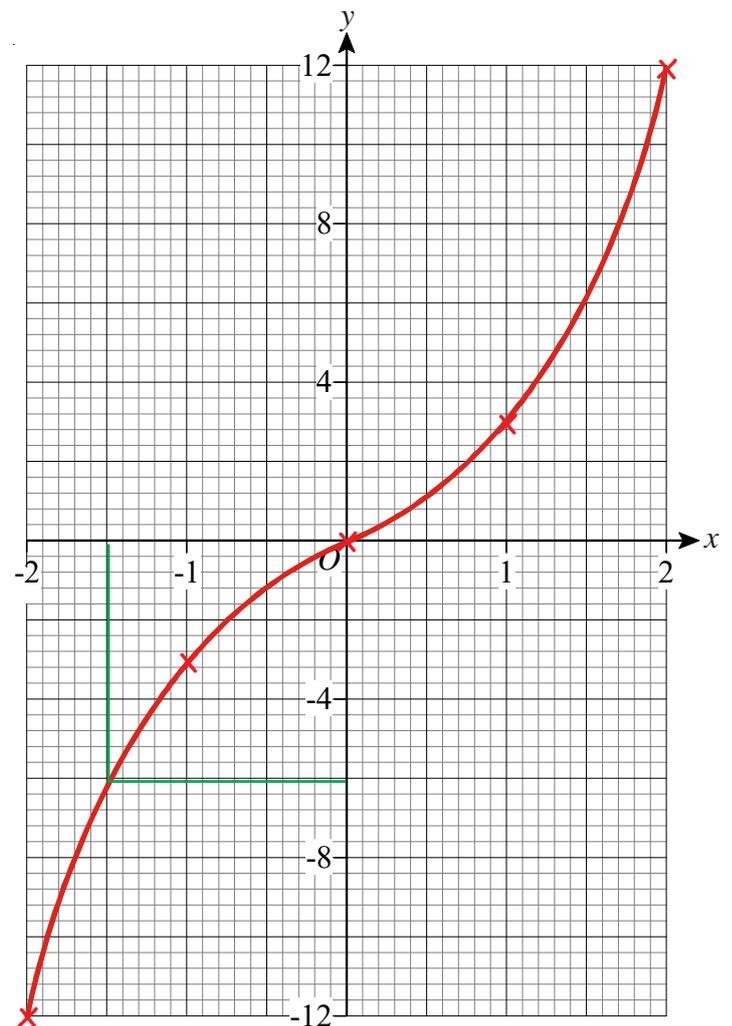
3) Sketch the graph of $y = 1 + \dfrac{1}{x}$
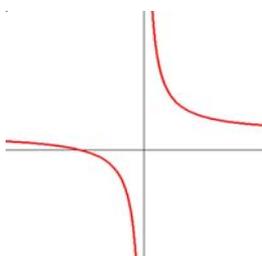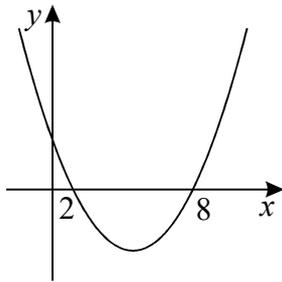
Page 155 A

1) Which one of the equations below matches the graph?

A: $y = (x + 2)(x + 8)$

B: $y = (x - 2)(x - 8)$

C: $y = (x + 2)(x - 8)$

D: $y = (x - 2)(x + 8)$

2) Which one of the equations below matches the graph?
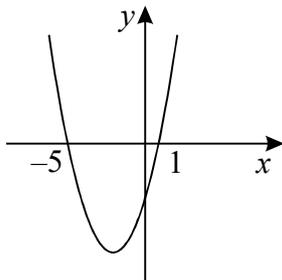
A: $y = (x + 5)(x + 1)$

B: $y = (x - 5)(x - 1)$

C: $y = (x + 5)(x - 1)$

D: $y = (x - 5)(x + 1)$

3) At which points do the equations below intersect the x-axis?

a) $y = (x + 3)(x + 2)$

b) $y = (x - 6)(x - 3)$

c) $y = (x + 2)(x - 7)$

d) $y = (x - 1)(x + 0.5)$

4) At what value of y do the graphs of the equations below intersect the y-axis?

a) $y = 4x^2 + 11$

b) $y = 8x^2 + 2x - 3$

c) $y = (x + 5)(x + 2)$

d) $y = (x + 3)(x - 4)$

5) Match each equation to its corresponding graph
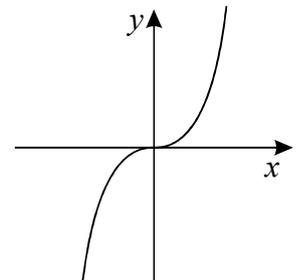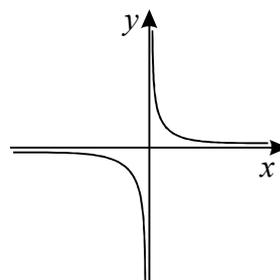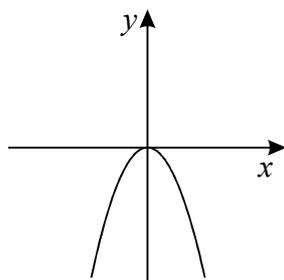
A $y = 2x^3$

B $y = -3x^2$

C $y = \dfrac{4}{x}$

1) Which one of the equations below matches the graph?
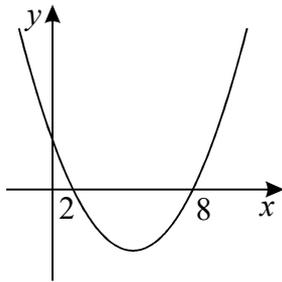
A: $y = (x + 2)(x + 8)$

B: $y = (x - 2)(x - 8)$

C: $y = (x + 2)(x - 8)$

D: $y = (x - 2)(x + 8)$

2) Which one of the equations below matches the graph?
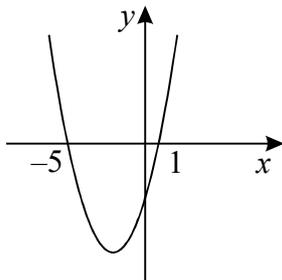
A: $y = (x + 5)(x + 1)$

B: $y = (x - 5)(x - 1)$

C: $y = (x + 5)(x - 1)$

D: $y = (x - 5)(x + 1)$

3) At which points do the equations below intersect the *x*-axis?

a) $y = (x + 3)(x + 2)$ –3 and –2

b) $y = (x - 6)(x - 3)$ 3 and 6

c) $y = (x + 2)(x - 7)$ –2 and 7

d) $y = (x - 1)(x + 0.5)$ 1 and –0.5

4) At what value of *y* do the graphs of the equations below intersect the *y*-axis?

a) $y = 4x^2 + 11$ 11

b) $y = 8x^2 + 2x - 3$ –3

c) $y = (x + 5)(x + 2)$ 10

d) $y = (x + 3)(x - 4)$ –12

5) Match each equation to its corresponding graph

A $y = 2x^3$

B $y = -3x^2$

C $y = \dfrac{4}{x}$

B

C

A

Page 155 B

1) Match each of the functions below, with the correct sketch of its graph.

   a) $y = 3x^3$ b) $y = \frac{-2}{x}$ c) $y = 3x - 1$ d) $y = -2x^3$
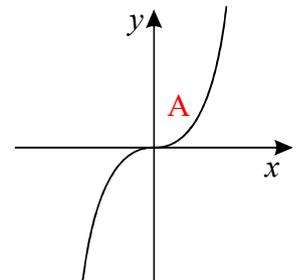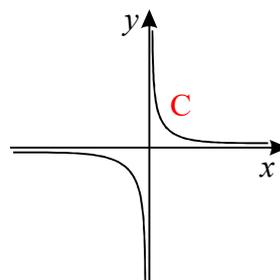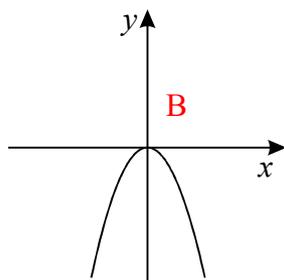
   e) $y = 2x^2 + 1$ f) $y = \frac{2}{x}$ g) $y = 5x - x^3$

Recognising and Sketching Functions - Advanced

1) Match each of the functions below, with the correct sketch of its graph.

a) $y = 3x^3$ b) $y = \frac{-2}{x}$ c) $y = 3x - 1$ d) $y = -2x^3$

e) $y = 2x^2 + 1$ f) $y = \frac{2}{x}$ g) $y = 5x - x^3$

$y = 5x - x^3$

$y = 2x^2 + 1$

$y = \frac{2}{x}$

$y = 3x^3$

$y = -2x^3$

$y = \frac{-2}{x}$

$y = 3x - 1$

1)

25 cm

R

Q

105°

10 cm

C

B

105°

6 cm

82°

82°

A

D

P

12 cm

S
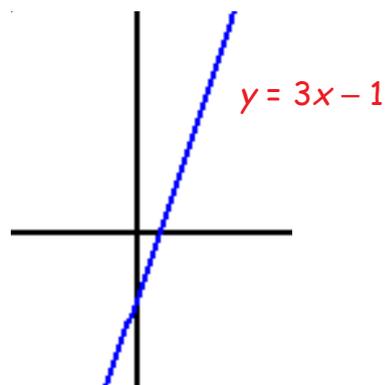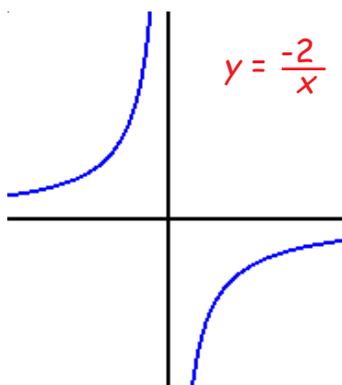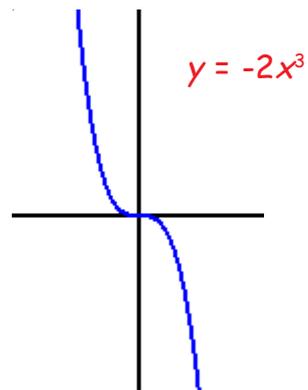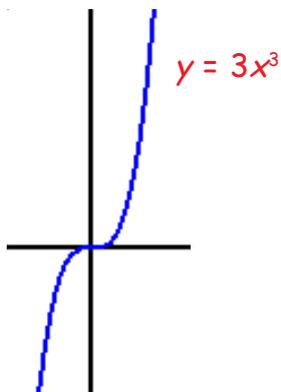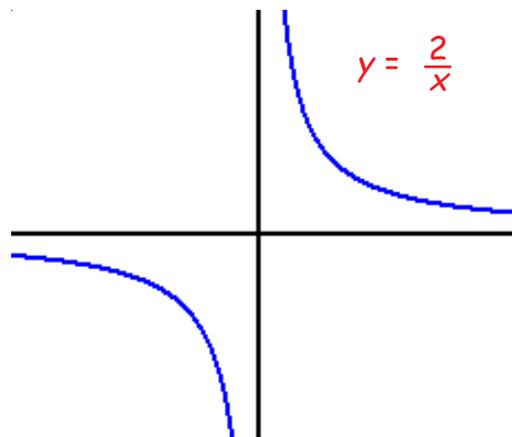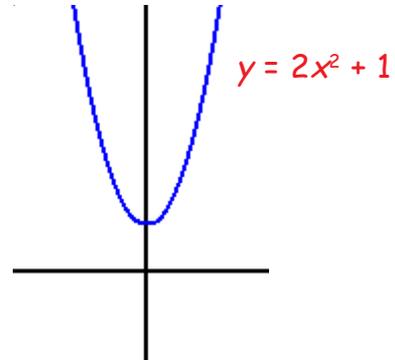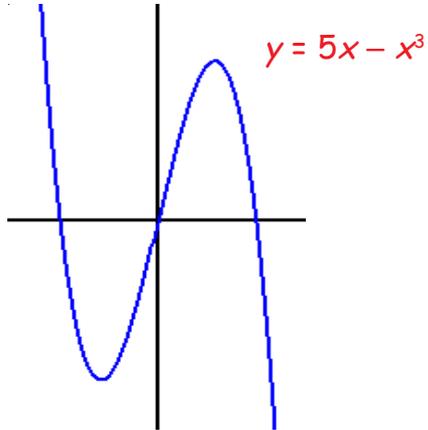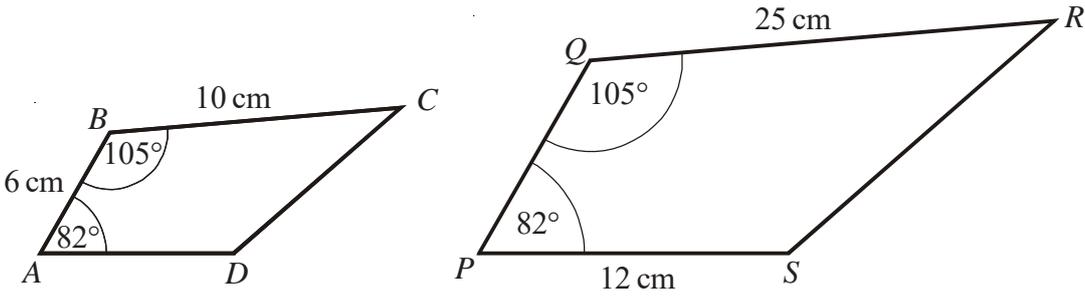
ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*.

b) Find the length of *AD*.

2)
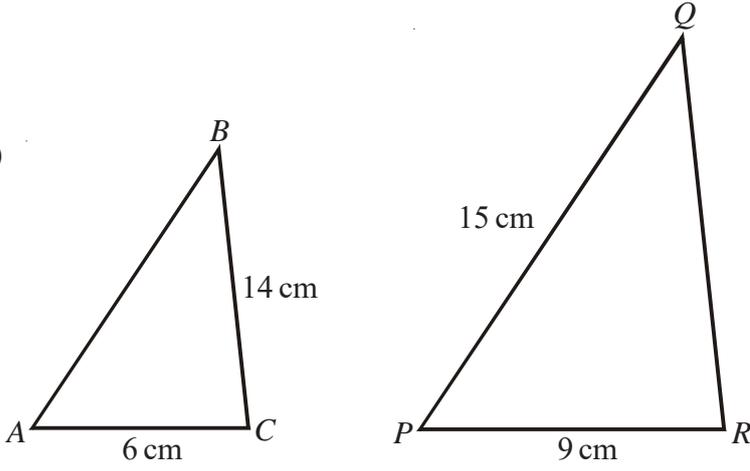
B

Q

15 cm

14 cm

A

6 cm

C

P

9 cm

R

Triangles *ABC* and *PQR* are mathematically similar.

Angle *A* = angle *P*.
Angle *B* = angle *Q*.
Angle *C* = angle *R*.
AC = 6 cm.
BC = 14 cm.
PR = 9 cm.
PQ = 15 cm

a) Work out the length of *QR*.

b) Work out the length of *AB*.

Similar Shapes

1)

× 2.5
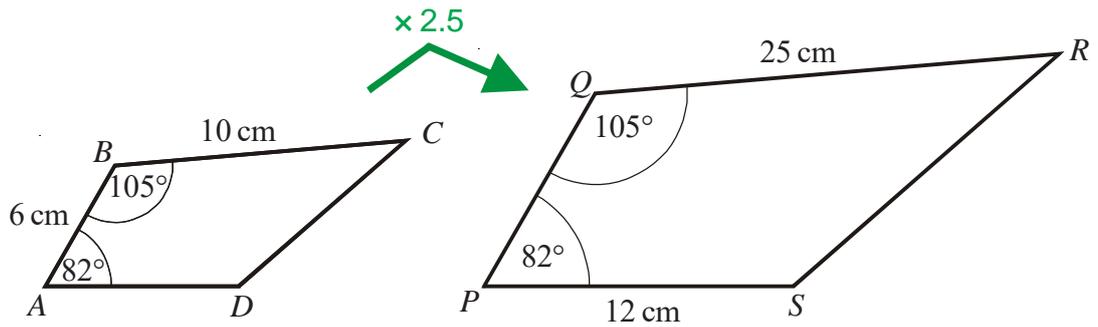
ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*. 15 cm

b) Find the length of *AD*. 4.8 cm

2)
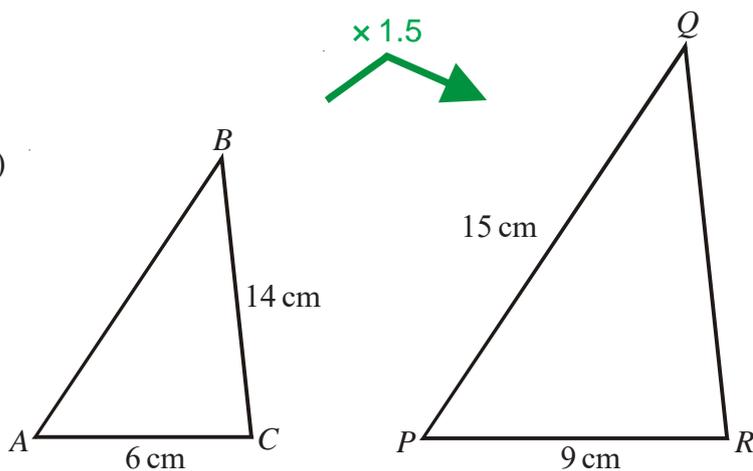
× 1.5

Triangles *ABC* and *PQR* are mathematically similar.

Angle *A* = angle *P*.
Angle *B* = angle *Q*.
Angle *C* = angle *R*.
AC = 6 cm.
BC = 14 cm.
PR = 9 cm.
PQ = 15 cm

a) Work out the length of *QR*. 21 cm

b) Work out the length of *AB*. 10 cm

Similar Shapes

1)

A

15 cm

B — 12.5 cm — C

6 cm

D   E
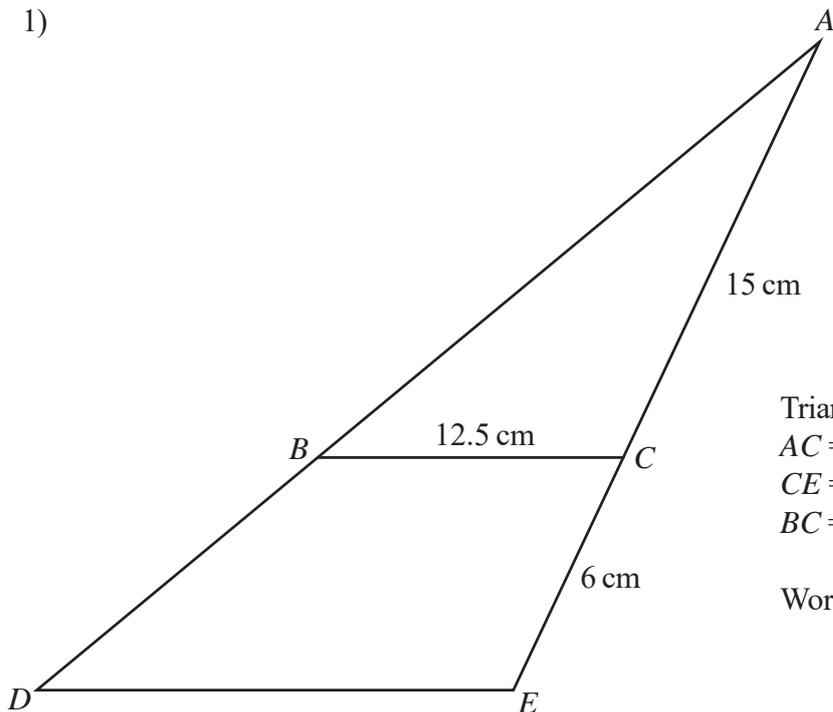
Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*.

2)   *ABC* and *AED* are straight lines.

EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

a)   Work out the length of *DC*.

b)   Work out the area of the trapezium *EBCD*.

A

10 cm

E — 6 cm — B

5 cm

D — 6 cm — C

Similar Shapes

1)

A

15 cm

B 12.5 cm C

6 cm

D E
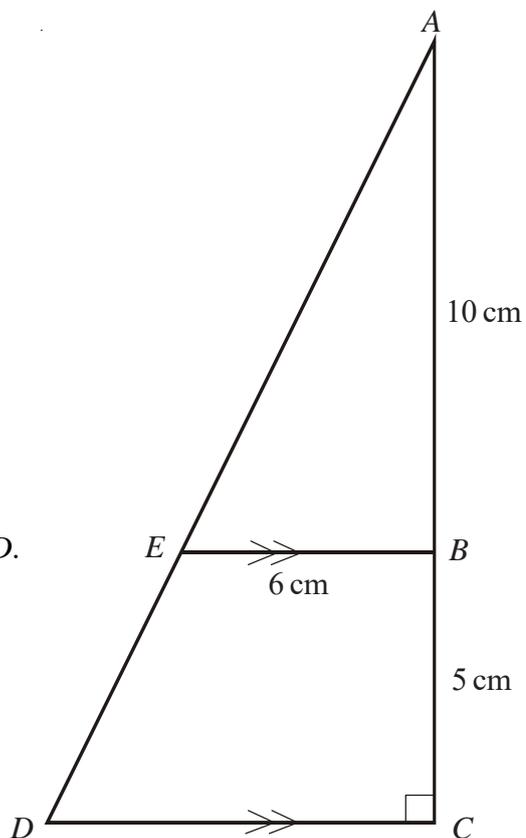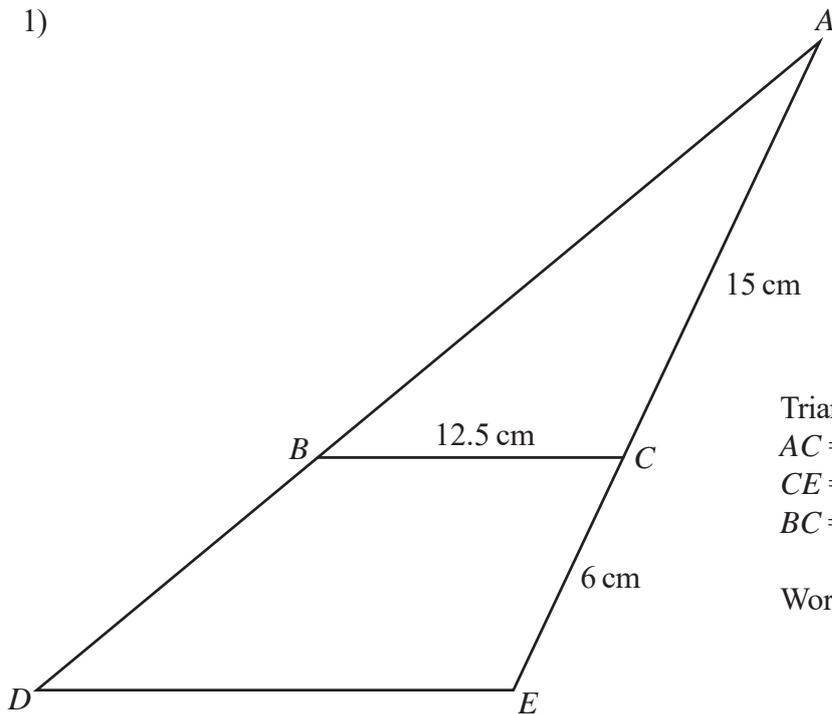
Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*.   17.5 cm

2)   *ABC* and *AED* are straight lines.

EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

a)   Work out the length of *DC*.   9 cm

b)   Work out the area of the trapezium *EBCD*.
            37.5 cm²
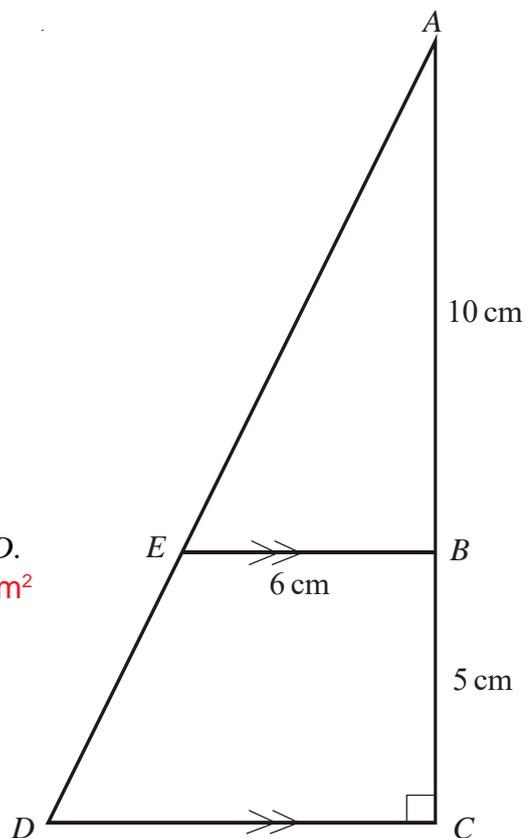
A

10 cm

E B

6 cm

5 cm

D C

Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.

   8 cm *Q*
   P
   A
   B
   21 cm
   S 4 cm *R*
   D 14 cm *C*
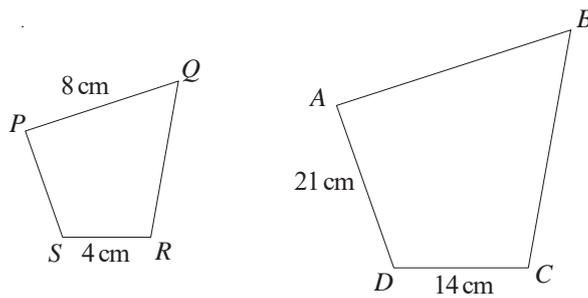
   a) Calculate the length of *AB*

   b) Calculate the length of *PS*

2) *SV* is parallel to *TU*.
   RST and *RVU* are straight lines.
   RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

   Calculate the length of *VU*.

   R
   9 cm
   6 cm
   S
   V
   3 cm
   T
   7cm
   U

3) *BE* is parallel to *CD*.
   ABC and *AED* are straight lines.
   AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

   a) Calculate the length of *CD*.

   b) Calculate the length of *ED*.

   A
   4 cm
   4.4 cm
   B
   E
   6 cm
   5 cm
   C
   D

Similar Shapes
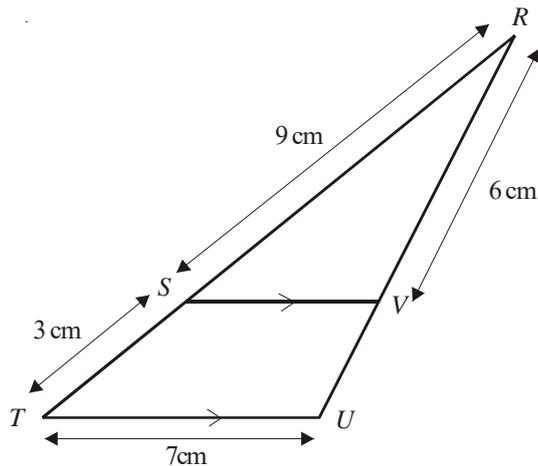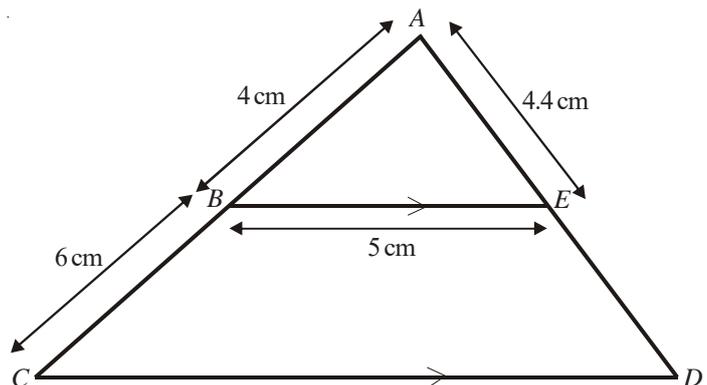
1) The diagram shows two quadrilaterals that are mathematically **similar**.
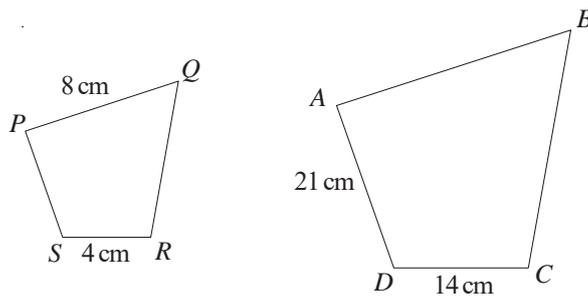
a) Calculate the length of *AB*   28 cm

b) Calculate the length of *PS*   6 cm

2) *SV* is parallel to *TU*.
RST and RVU are straight lines.
RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

Calculate the length of *VU*.   2 cm
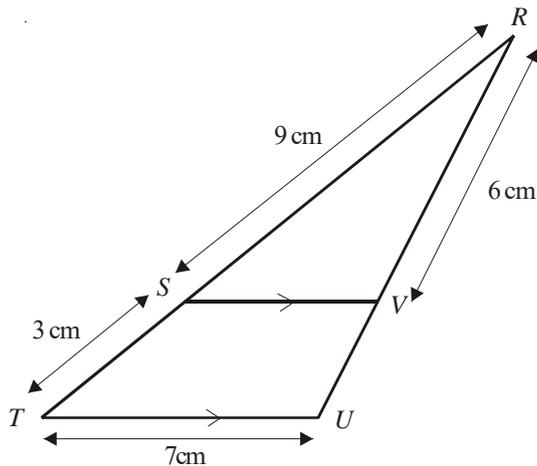
3) *BE* is parallel to *CD*.
ABC and AED are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

a) Calculate the length of *CD*.   12.5 cm

b) Calculate the length of *ED*.   6.6 cm
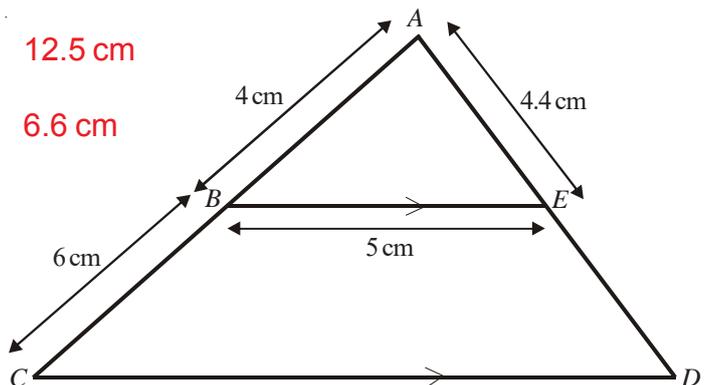
1) Two triangles, *X* and *Y*, are shown.
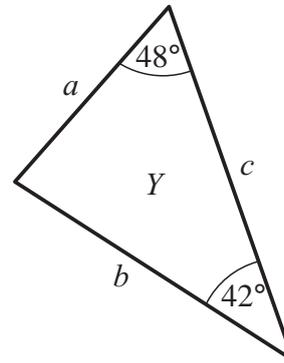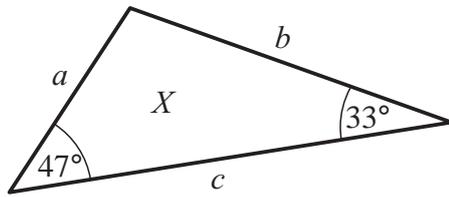
Not drawn
accurately

In which of these triangles does $a^2 + b^2 = c^2$?
Explain your answer.

2) Triangle *ABC* has sides of length 14.7 cm, 32.9 cm and 28.9 cm.

Is triangle *ABC* a right-angled triangle?
Explain your answer.

3) Triangle *PQR* has a perimeter of 40 cm.

PQ = 8 cm
QR = 15 cm

Is triangle *PQR* a right-angled triangle?
Explain your answer.

4) The diagram below shows 4 identical right-angled triangles and an enclosed square *ABCD*.
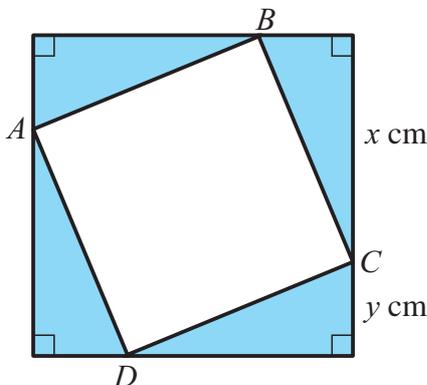
Write an expression for the area of square *ABCD*
in terms of *x* and *y*.

x cm

y cm

Pythagoras' Theorem - Algebraic Approach

1) Two triangles, X and Y, are shown.
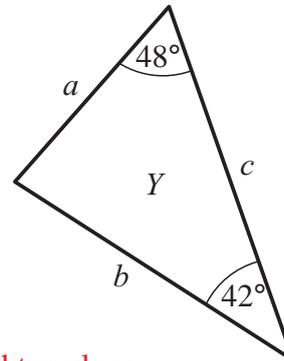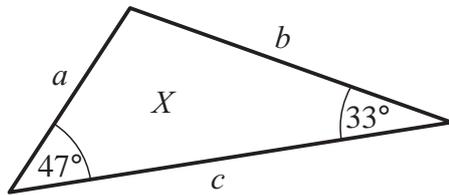
Not drawn
accurately

In which of these triangles does $a^2 + b^2 = c^2$?
Explain your answer.

Triangle Y because it has a right angle as
$180 - 48 - 42 = 90°$
therefore, using Pythagoras' Theorem
$a^2 + b^2 = c^2$

2) Triangle ABC has sides of length 14.7 cm, 32.9 cm and 28.9 cm.

Is triangle ABC a right-angled triangle?
Explain your answer.

Adding the square of both short sides:
$14.7^2 + 28.9^2 = 1051.3$
The square of the longest side: $32.9^2 = 1082.41$
Hence $14.7^2 + 28.9^2 \neq 32.9^2$
So ABC is not a right-angled triangle.

3) Triangle PQR has a perimeter of 40 cm.

$PQ = 8$ cm
$QR = 15$ cm

Is triangle PQR a right-angled triangle?
Explain your answer.

$RP = 17$ cm
Using Pythagoras' Theorem:
$PQ^2 + QR^2 = RP^2$ or ($8^2 + 15^2 = 17^2$)
So PQR is a right-angled triangle.

4) The diagram below shows 4 identical right-angled triangles and an enclosed square $ABCD$.
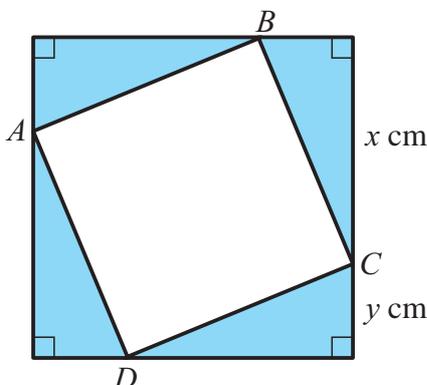
Write an expression for the area of square $ABCD$
in terms of x and y.

Area $ABCD = x^2 + y^2$
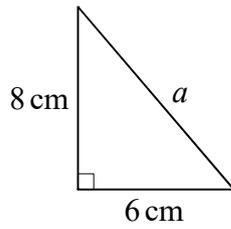
x cm

y cm

1) Work out the length of side a

8 cm
a
6 cm

2) Work out the length of side b, giving your answer to 1 decimal place.

3 cm   6 cm
b

3) Work out the length of side c, giving your answer to 2 decimal places.

11 cm
c
8 cm

4) Calculate the area of the triangle.

12 cm
13 cm
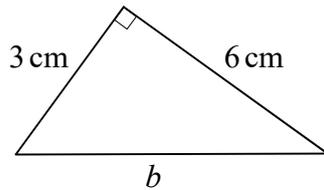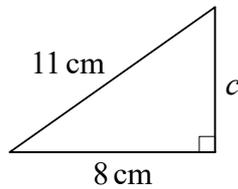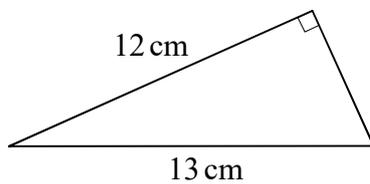
5) A square has sides of length 8 cm
The square is placed inside a circle so that it does not touch the circumference of the circle.
Calculate, to 1 decimal place, the smallest possible radius of the circle.

6) Calculate the perimeter of the trapezium, giving your answer to 1 decimal place.
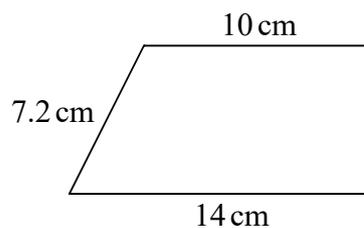
10 cm
7.2 cm
14 cm

1) Work out the length of side a

8 cm a

6 cm

$a = 10$ cm

2) Work out the length of side b, giving your answer to 1 decimal place.

3 cm 6 cm

b

$b = 6.7$ cm

3) Work out the length of side c, giving your answer to 2 decimal places.

11 cm c

8 cm

$c = 7.55$ cm

4) Calculate the area of the triangle.

12 cm

13 cm

Area $= 30$ cm^2
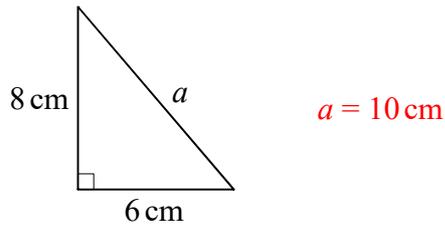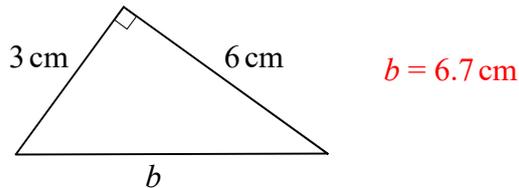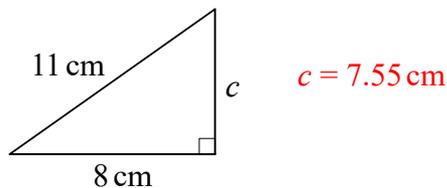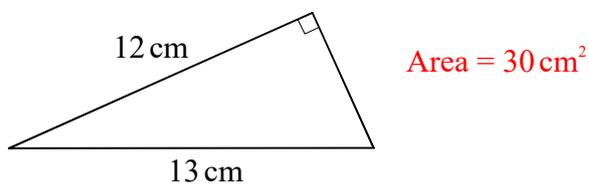
5) A square has sides of length 8 cm
    The square is placed inside a circle so that it does not touch the circumference of the circle.
    Calculate, to 1 decimal place, the smallest possible radius of the circle.

    Radius $= 5.7$ cm

6) Calculate the perimeter of the trapezium, giving your answer to 1 decimal place.
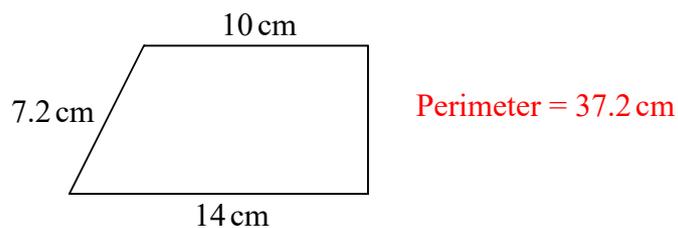
    10 cm

    7.2 cm

    14 cm

    Perimeter $= 37.2$ cm

Trigonometry

1) *ABC* is a right-angled triangle.

   AB = 50 cm.

   Angle *ABC* = 24°

   Work out the length of *BC*.
   Give your answer correct to 1 decimal place.
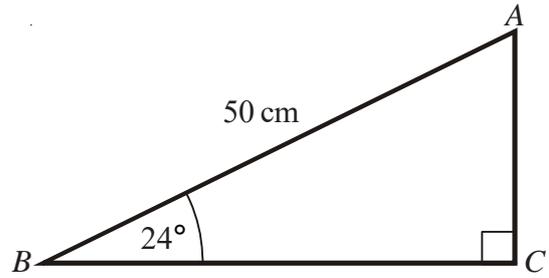
2) *ABC* is a right-angled triangle.

   AB = 23 cm.

   Angle *BCA* = 20°

   Work out the length of *AC*.
   Give your answer correct to 1 decimal place.
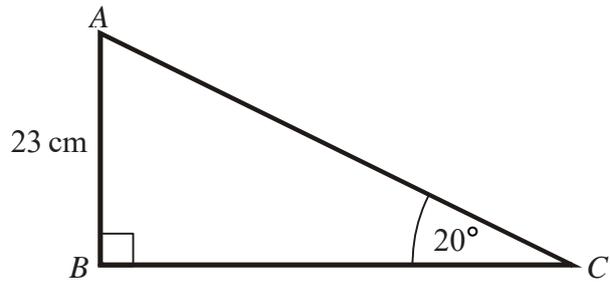
3) *ABC* is a right-angled triangle.

   AC = 16 cm.

   Angle *CAB* = 65°

   Work out the length of *BC*.
   Give your answer correct to 1 decimal place.
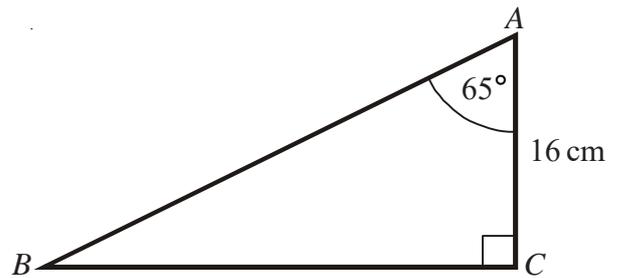
4) *ABC* is a right-angled triangle.

   AB = 13 cm.

   AC = 21 cm.

   Work out the size of angle *x*.
   Give your answer correct to 1 decimal place.
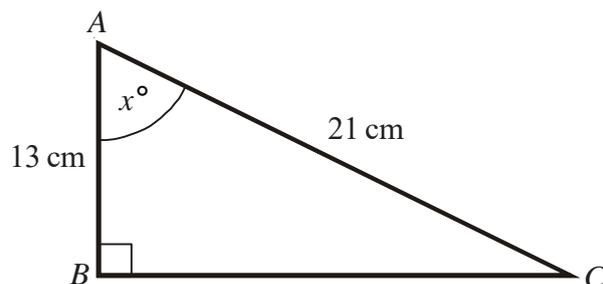
5) *ABC* is a right-angled triangle.

   AB = 18 cm.

   AC = 7 cm.

   Work out the size of angle *ABC*.
   Give your answer correct to 1 decimal place.
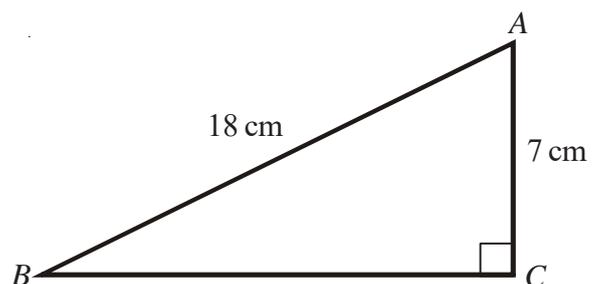
1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.

45.7 cm
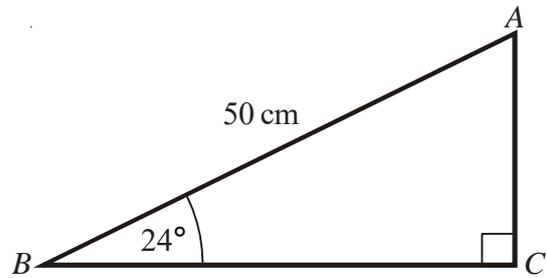
2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

Work out the length of *AC*.
Give your answer correct to 1 decimal place.

67.2 cm
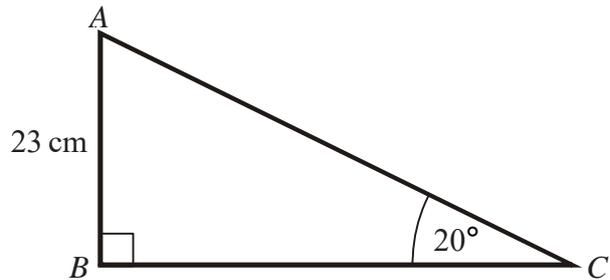
3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.

34.3 cm
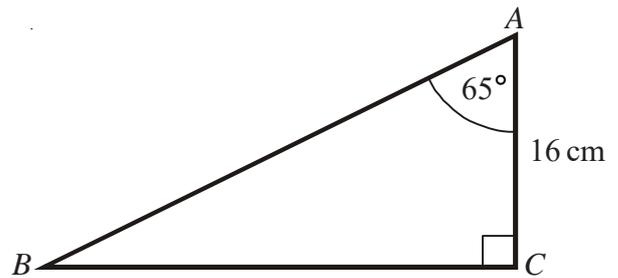
4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

Work out the size of angle *x*.
Give your answer correct to 1 decimal place.

51.8°
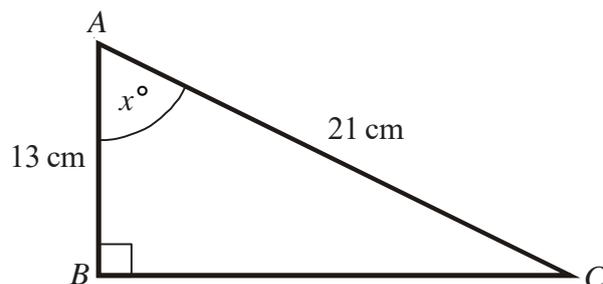
5) *ABC* is a right-angled triangle.
AB = 18 cm.
AC = 7 cm.

Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.

22.9°
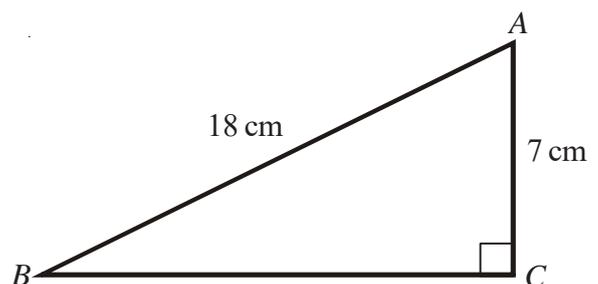
Trigonometry

1) *PQR* is a right-angled triangle.
PR = 11 cm.
QR = 4.5 cm
Angle *PRQ* = 90°

Work out the value of *x*.
Give your answer correct to 1 decimal place.
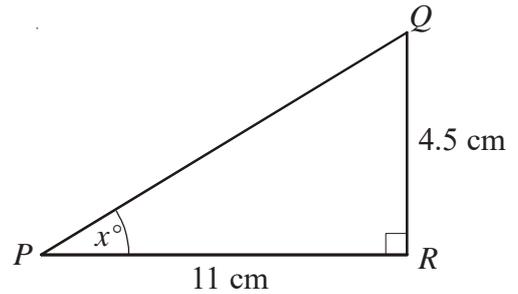
2) *AC* = 14 cm.
Angle *ABC* = 90°
Angle *ACB* = 34°

Calculate the length of *BC*.
Give your answer correct to
3 significant figures.
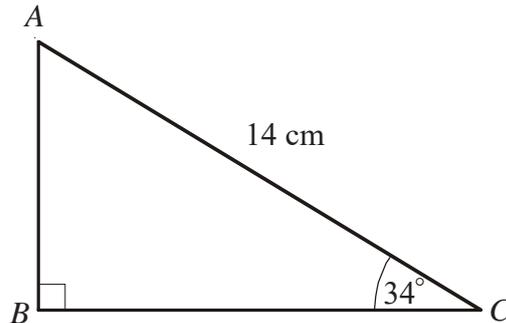
3) *PQR* is a right-angled triangle.
PQ = 18 cm.
QR = 8.4 cm
Angle *PRQ* = 90°

Work out the value of *x*.
Give your answer correct to 1 decimal place.
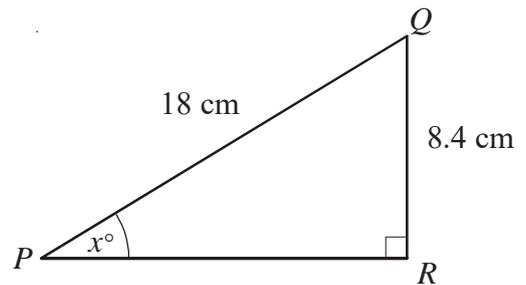
4) *AB* = 23 cm.
Angle *ABC* = 90°
Angle *ACB* = 21°

Calculate the length of *AC*.
Give your answer correct to
3 significant figures.

5) A lighthouse, *L*, is 3.4 km due West of a port, *P*.
A ship, *S*, is 1.8 km due North of the lighthouse, *L*.

Calculate the size of the angle marked *x*.
Give your answer correct to 3 significant figures.

Trigonometry
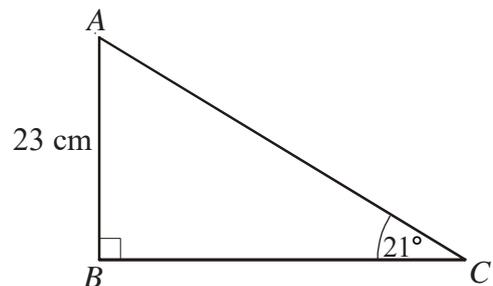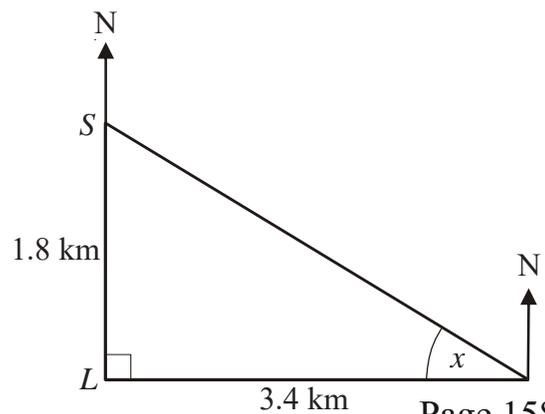
1) PQR is a right-angled triangle.
PR = 11 cm.
QR = 4.5 cm
Angle PRQ = 90°

Work out the value of x.
Give your answer correct to 1 decimal place.

22.2°
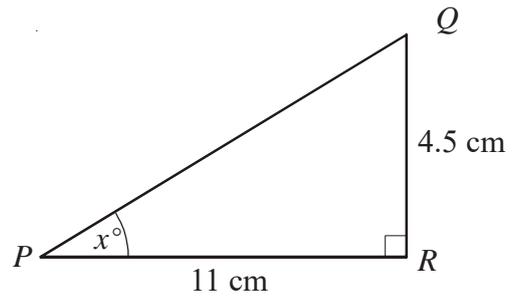
2) AC = 14 cm.
Angle ABC = 90°
Angle ACB = 34°

Calculate the length of BC.
Give your answer correct to
3 significant figures.

11.6 cm
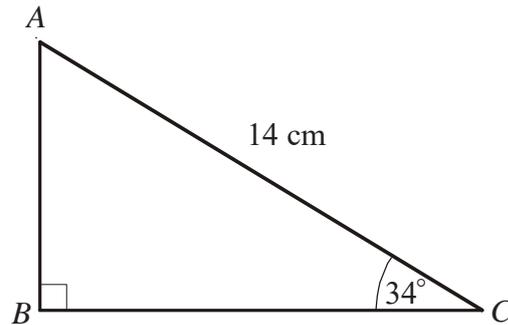
3) PQR is a right-angled triangle.
PQ = 18 cm.
QR = 8.4 cm
Angle PRQ = 90°

Work out the value of x.
Give your answer correct to 1 decimal place.

27.8°
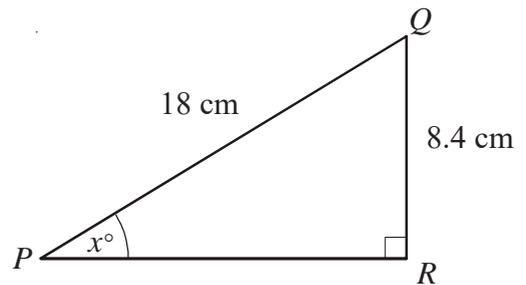
4) AB = 23 cm.
Angle ABC = 90°
Angle ACB = 21°

Calculate the length of AC.
Give your answer correct to
3 significant figures.

64.2 cm
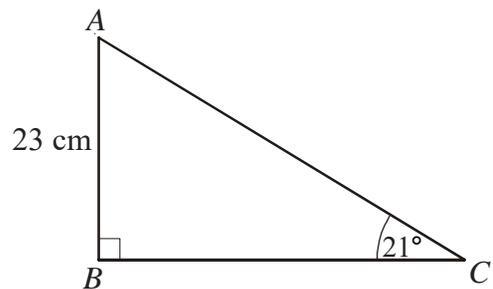
5) A lighthouse, L, is 3.4 km due West of a port, P.
A ship, S, is 1.8 km due North of the lighthouse, L.

Calculate the size of the angle marked x.
Give your answer correct to 3 significant figures.

27.9°
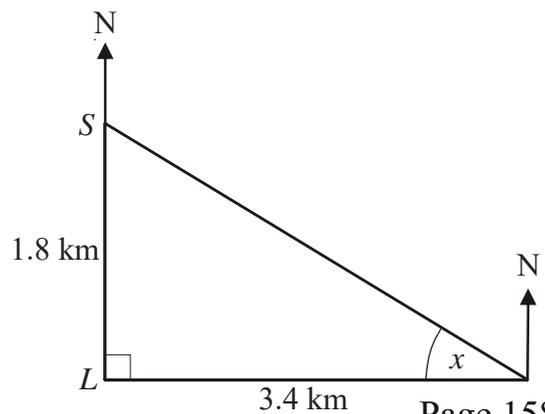
1)
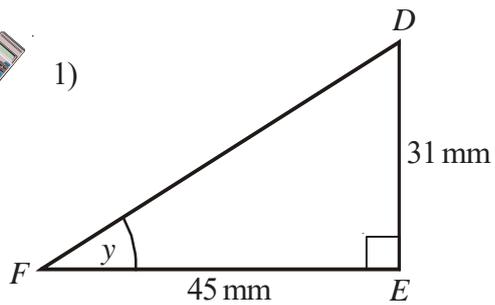
DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*.
Give your answer correct to one decimal place.

2)
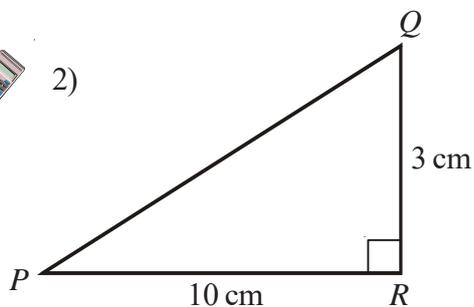
PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

3)   a)
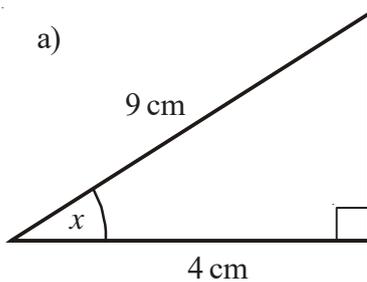
Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

b)
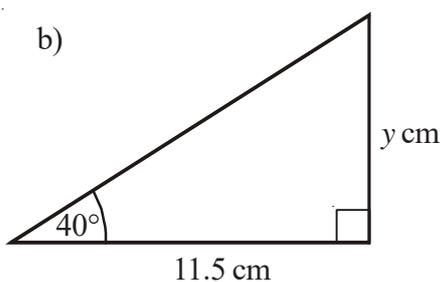
Calculate the value of *y*.
Give your answer correct to one decimal place.
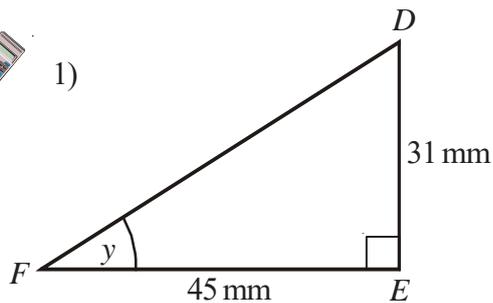
1)

DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*.
Give your answer correct to one decimal place.

34.6°

2)
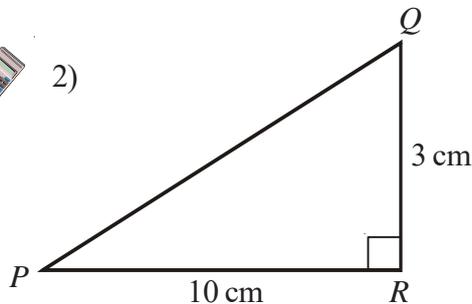
PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

16.7°

3)   a)
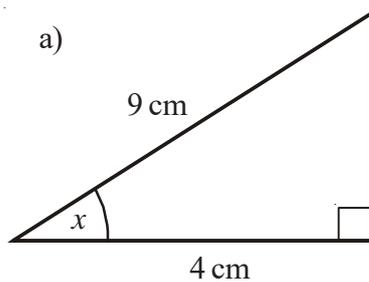
Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

63.6°

b)
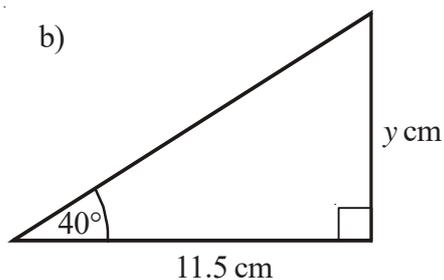
Calculate the value of *y*.
Give your answer correct to one decimal place.

y = 9.6

1)
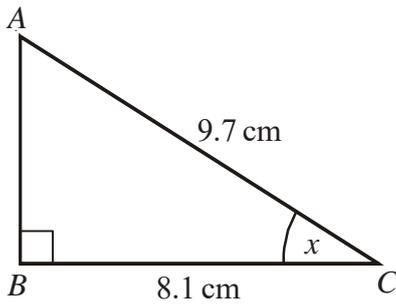
ABC is a right-angled triangle.
AC = 9.7 cm

BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

2)
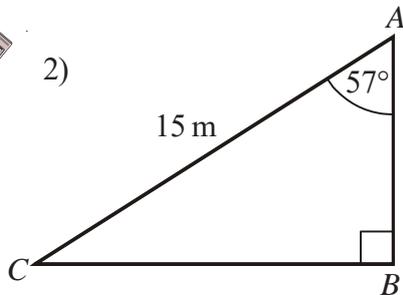
ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

3)
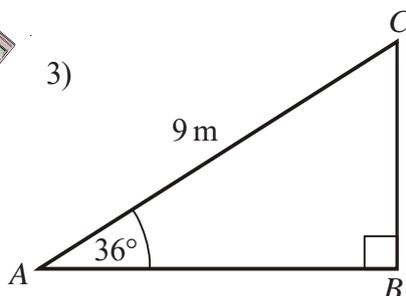
ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

Trigonometry

1)
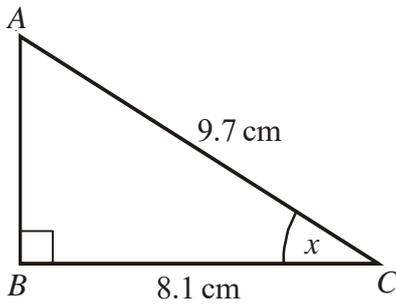
ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

33.4°

2)
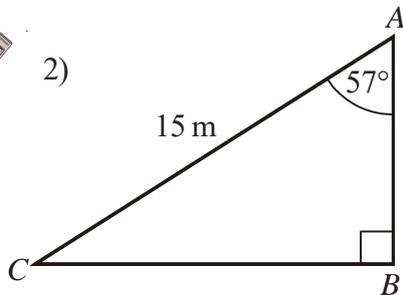
ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

8.17 cm

3)
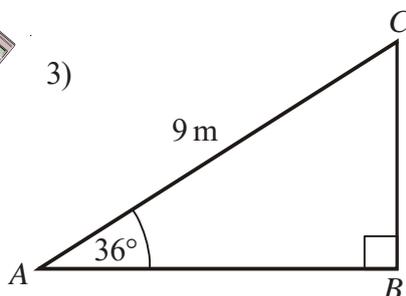
ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

7.28 cm

1)
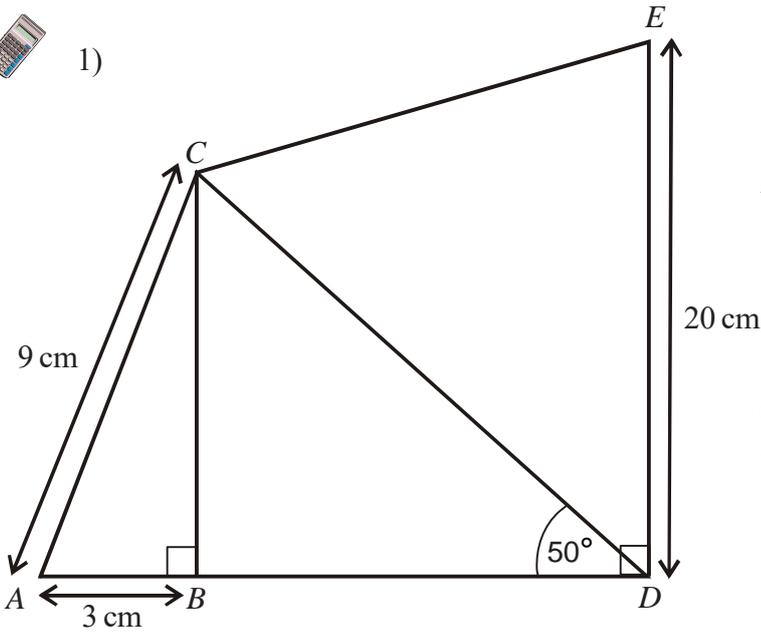
$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle BDE = 90°

Calculate the length of CD.
Give your answer to 3 significant figures.

2)

$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

Work out the length of PR.
Give your answer correct to 3 significant figures.

1)

E

$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle BDE = 90°

20 cm

Calculate the length of CD.
Give your answer to 3 significant figures.

11.1 cm
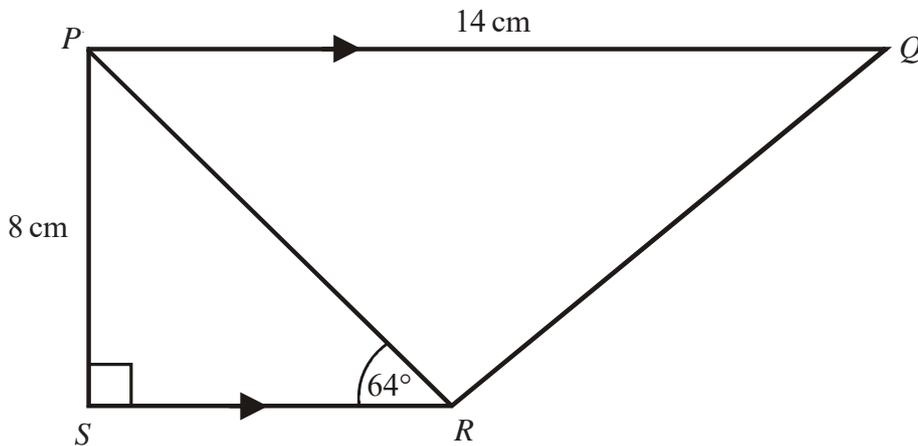
C

9 cm

50°

A

3 cm

B

D

2)

P   14 cm   Q

8 cm

64°

S   R

PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

Work out the length of *PR*.
Give your answer correct to 3 significant figures.

8.90 cm

1)   This sector of a circle has radius 16 cm.

125°

16 cm
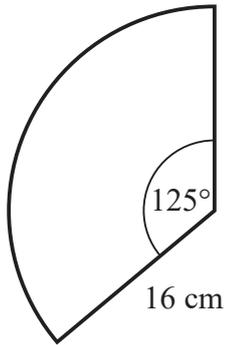
   a) Find the area of the sector.

   b) Find the perimeter of the sector.

2)   A quadrant of a circle is shown.

10 cm

10 cm
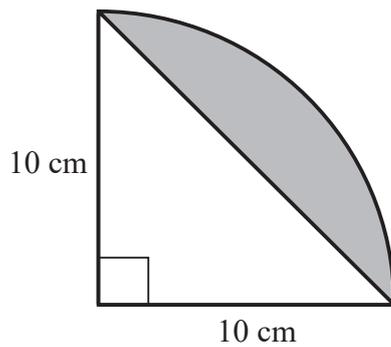
   Work out the area of the shaded section.

3)   The diagram shows a sector of a circle.

210°
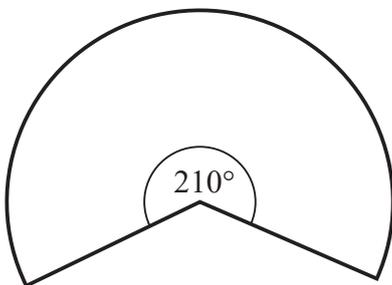
   The arc length is 47.6 cm.

   Work out the radius.

1) This sector of a circle has radius 16 cm.

125°

16 cm
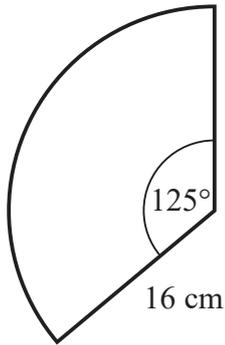
a) Find the area of the sector. **279.29 cm²**

b) Find the perimeter of the sector. **66.91 cm**

2) A quadrant of a circle is shown.

10 cm

10 cm
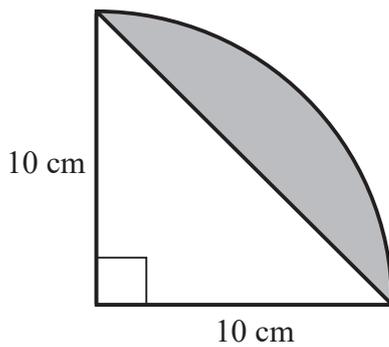
Work out the area of the shaded section. **28.55 cm²**

3) The diagram shows a sector of a circle.

210°
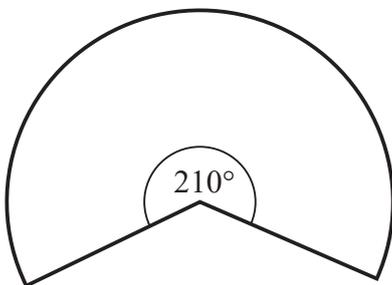
The arc length is 47.6 cm.

Work out the radius. **13 cm**

1)
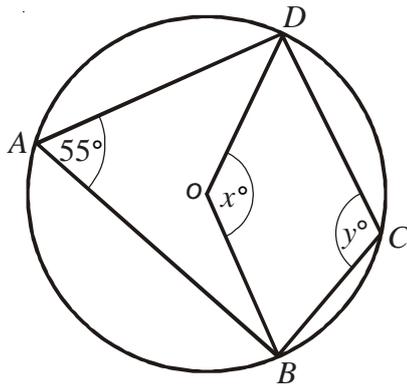
In the diagram, *A, B, C,* and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

a) (i) Work out the value of *x*.

   (ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

   (ii) Give a reason for your answer.

2)
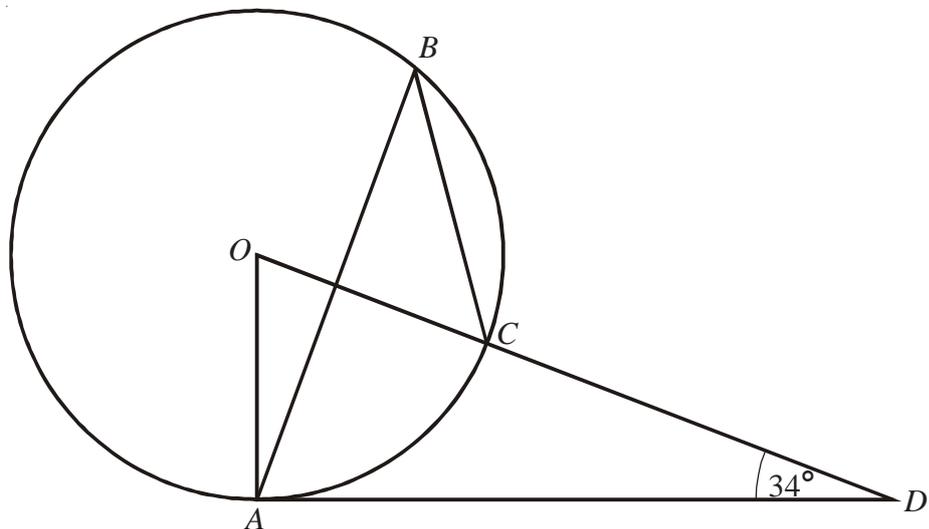
The diagram shows a circle centre *O*.
A, B and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

a)   Work out the size of angle *AOD*.

b)   (i)   Work out the size of angle *ABC*.
      (ii)   Give a reason for your answer.
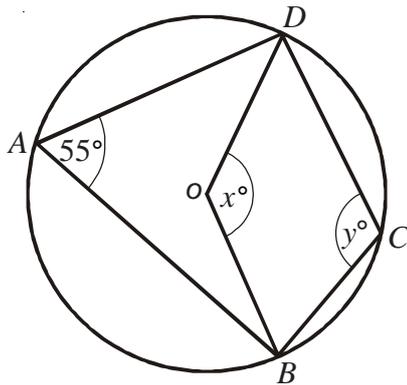
1)

In the diagram, *A, B, C,* and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

a) (i) Work out the value of *x*.   110°

   (ii) Give a reason for your answer.
        Angle at centre of circle is twice the angle on the circumference

b) (i) Work out the value of *y*.   125°

   (ii) Give a reason for your answer.
        Opposite angles of cyclic quadrilateral add up to 180°

2)
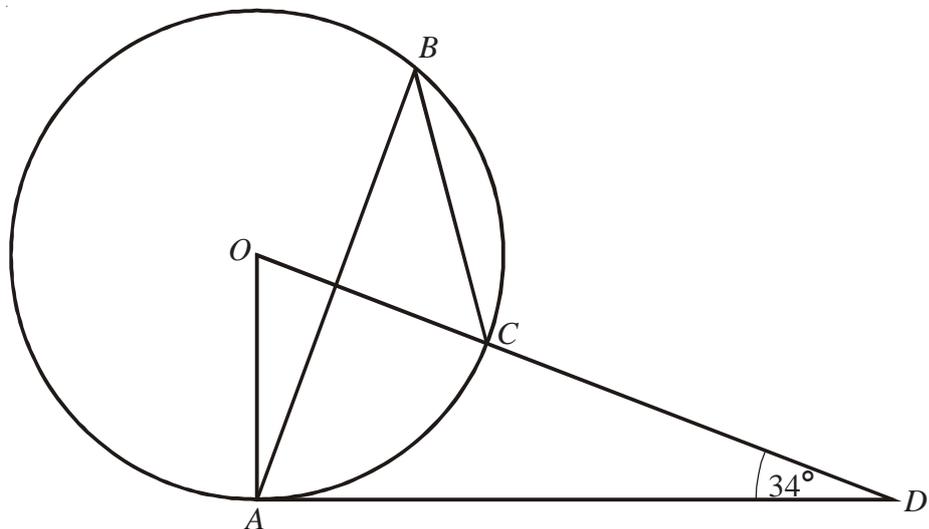
The diagram shows a circle centre *O*.
A, B and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

a) Work out the size of angle *AOD*.   56°

b) (i) Work out the size of angle *ABC*.   28°
   (ii) Give a reason for your answer.

        Angle at centre of circle is twice the angle on the circumference

1)
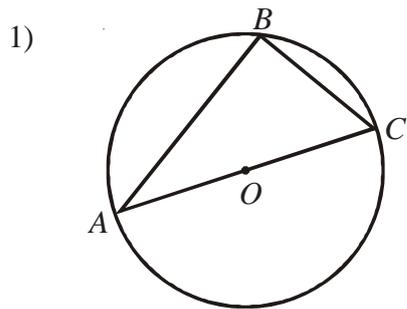
A, B and C are points on the circumference of a circle centre O.
AC is a diameter of the circle.

a) (i)   Write down the size of angle ABC.

    (ii) Give a reason for your answer.
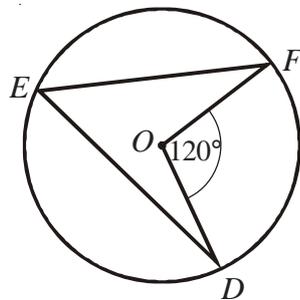
D, E and F are points on the circumference of a circle, centre O.
Angle DOF = 120°.

b) (i)   Work out the size of angle DEF.

    (ii) Give a reason for your answer.

2)   B, D and E are points on a circle centre O.
     ABC is a tangent to the circle.
     BE is a diameter of the circle.
     Angle DBE = 25°.

     a)   Find the size of angle ABD.
          Give a reason for your answer.

     b)   Find the size of angle DEB.
          Give a reason for your answer.
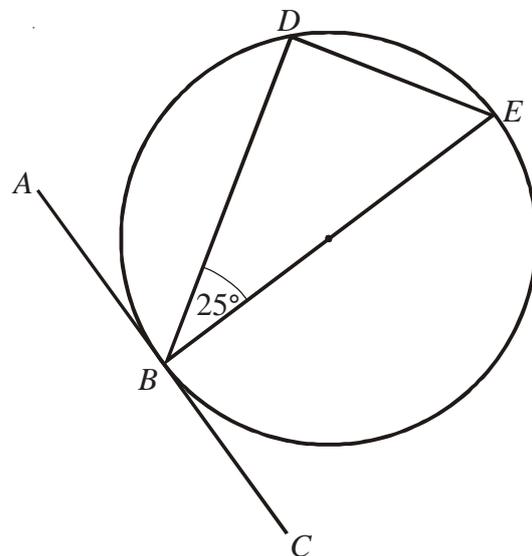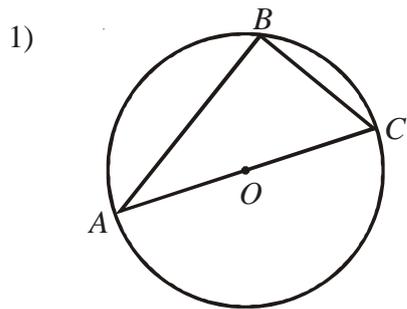
1)

A, B and *C* are points on the circumference of a circle centre *O*.
AC is a diameter of the circle.

a) (i) Write down the size of angle *ABC*. 90°

   (ii) Give a reason for your answer.
   Angle in a semi-circle is 90°
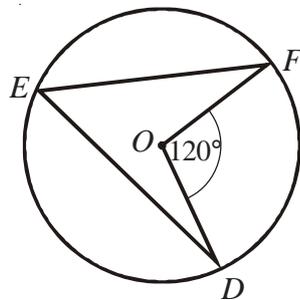
D, E and *F* are points on the circumference of a circle, centre *O*.
Angle *DOF* = 120°.

b) (i) Work out the size of angle *DEF*. 60°

   (ii) Give a reason for your answer.
   Angle at centre of circle is twice the angle on the circumference

2) *B, D* and *E* are points on a circle centre *O*.
   ABC is a tangent to the circle.
   BE is a diameter of the circle.
   Angle *DBE* = 25°.

   a) Find the size of angle *ABD*. 65°
      Give a reason for your answer.
      Radius meets a tangent at 90°

   b) Find the size of angle *DEB*. 65°
      Give a reason for your answer.
      Alternate segment theorem

Circle Theorems

1) In the diagram, *A*, *B* and *C* are points
   on the circumference of a circle, centre *O*.
   PA and *PB* are tangents to the circle.
   Angle *ACB* = 72°.
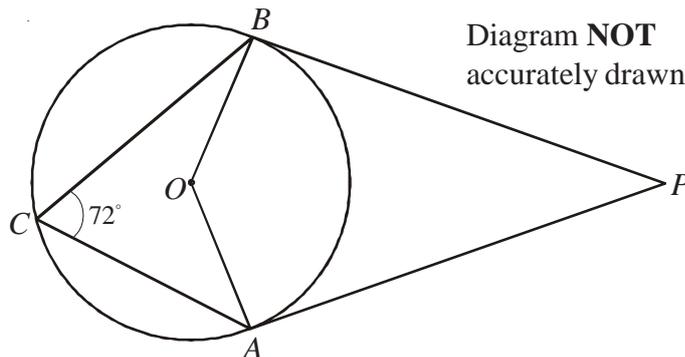
   a) (i) Work out the size of angle *AOB*.

      (ii) Give a reason for your answer.

   b) Work out the size of angle *APB*.

Diagram **NOT**
accurately drawn

2) *P*, *Q*, *R* and *S* are points on the circle.
   PQ is a diameter of the circle.
   Angle *RPQ* = 32°.
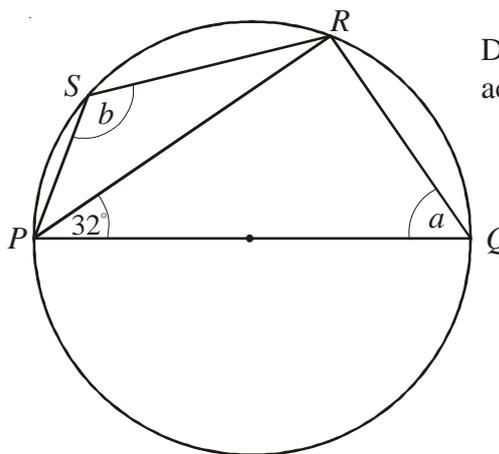
   a) (i) Work out the size of angle *PQR*.

      (ii) Give reasons for your answer.

   b) (i) Work out the size of angle *PSR*.

      (ii) Give a reason for your answer.

Diagram **NOT**
accurately drawn

3) The diagram shows a circle, centre *O*.
   AC is a diameter.
   Angle *BAC* = 31°.
   D is a point on *AC* such that angle *BDA*
   is a right angle.
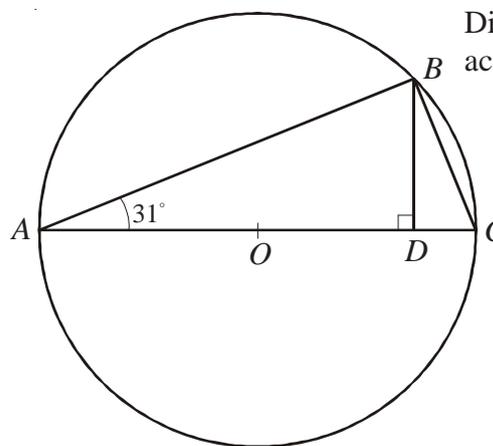
   a) Work out the size of angle *BCA*.
      Give reasons for your answer.

   b) Calculate the size of angle *DBC*.

   c) Calculate the size of angle *BOA*.

Diagram **NOT**
accurately drawn

4) *A*, *B*, *C* and *D* are four points on the circumference of a circle.
   ABE and *DCE* are straight lines.
   Angle *BAC* = 21°. Angle *EBC* = 58°.
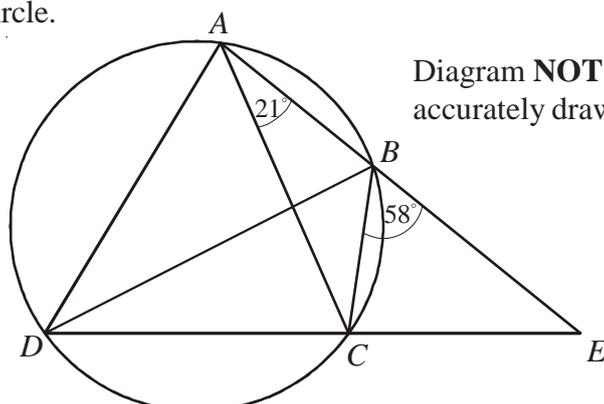
   a) Find the size of angle *ADC*.

   b) Find the size of angle *ADB*.

   Angle *CAD* = 69°.

   c) Is *BD* a diameter of the circle?
      You must explain your answer.

Diagram **NOT**
accurately drawn

Circle Theorems

1) In the diagram, *A*, *B* and *C* are points on the circumference of a circle, centre *O*. *PA* and *PB* are tangents to the circle. Angle $ACB = 72°$.

Diagram **NOT** accurately drawn

72°
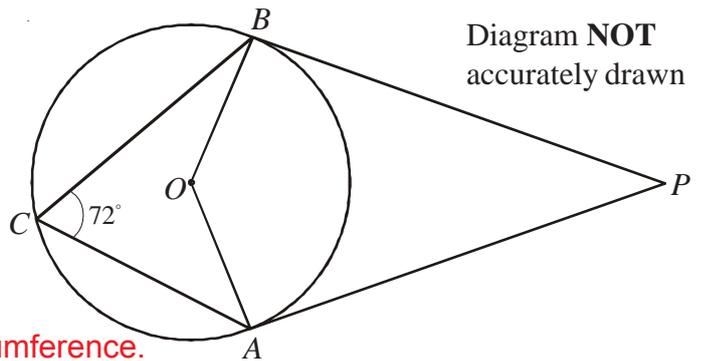
a) (i) Work out the size of angle *AOB*.   144°

(ii) Give a reason for your answer.
Angle at centre is twice angle on circumference.

b) Work out the size of angle *APB*.   36°

---

2) *P*, *Q*, *R* and *S* are points on the circle. *PQ* is a diameter of the circle. Angle $RPQ = 32°$.

Diagram **NOT** accurately drawn

b

32°   *a*
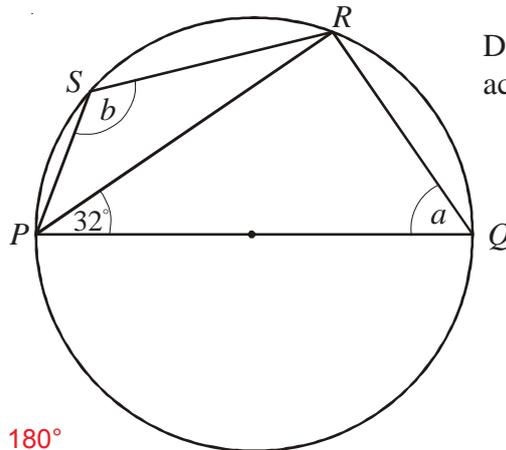
a) (i) Work out the size of angle *PQR*.   58°

(ii) Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) (i) Work out the size of angle *PSR*.   122°

(ii) Give a reason for your answer.
Opposite angles of a cyclic quadrilateral add to 180°

---

3) The diagram shows a circle, centre *O*. *AC* is a diameter. Angle $BAC = 31°$. D is a point on *AC* such that angle *BDA* is a right angle.

Diagram **NOT** accurately drawn

31°
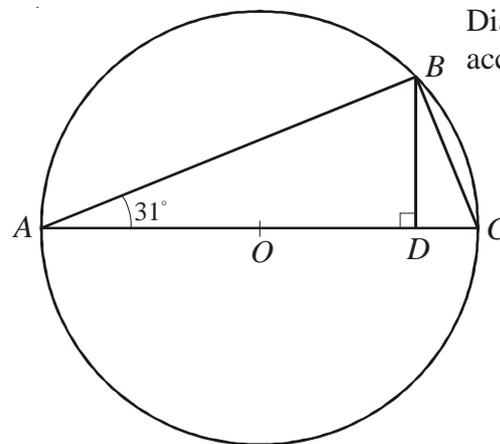
a) Work out the size of angle *BCA*.   59°
Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) Calculate the size of angle *DBC*.   31°

c) Calculate the size of angle *BOA*.   118°

---

4) *A*, *B*, *C* and *D* are four points on the circumference of a circle. *ABE* and *DCE* are straight lines. Angle $BAC = 21°$. Angle $EBC = 58°$.

Diagram **NOT** accurately drawn

21°
58°
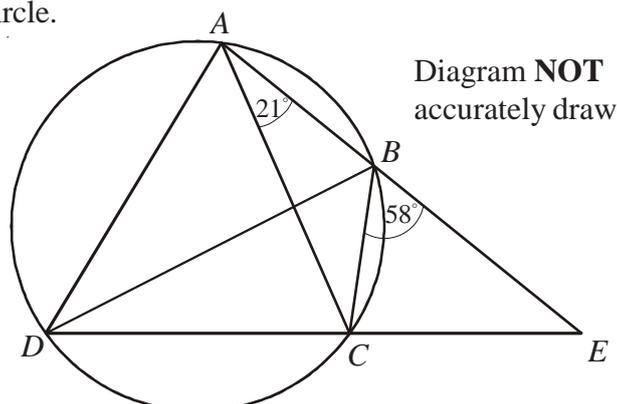
a) Find the size of angle *ADC*.   58°

b) Find the size of angle *ADB*.   37°

Angle $CAD = 69°$.

c) Is *BD* a diameter of the circle?   Yes
You must explain your answer.
Angle *DAB* = 69° + 21° = 90°
BD subtends 90° on the circumference. Therefore *BD* is a diameter.

Page 160 C

Circle Theorems

1) $a =$ _____

2) $b =$ _____
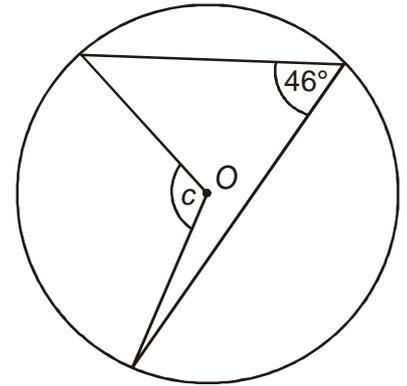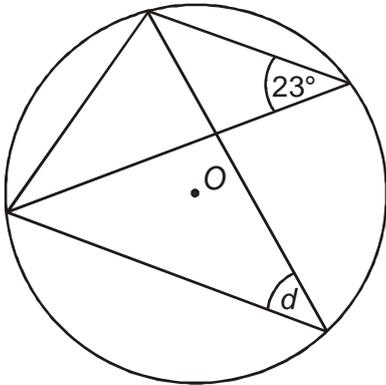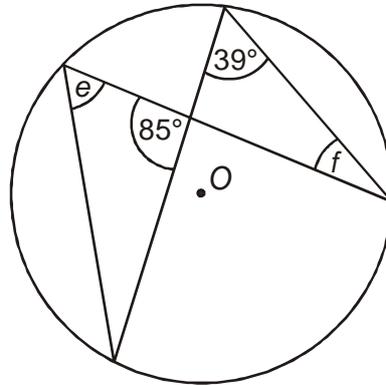
3) $c =$ _____

4) $d =$ _____

5) $e =$ _____ $f =$ _____

6) $g =$ _____

7) $h =$ _____

8) $i =$ _____

9) $j =$ _____ $k =$ _____

10) $l =$ _____ $m =$ _____

11) $n =$ _____ $p =$ _____ $q =$ _____

Page 160 D
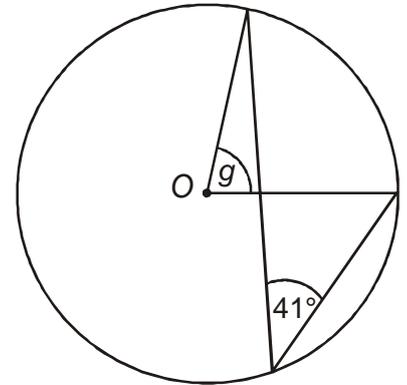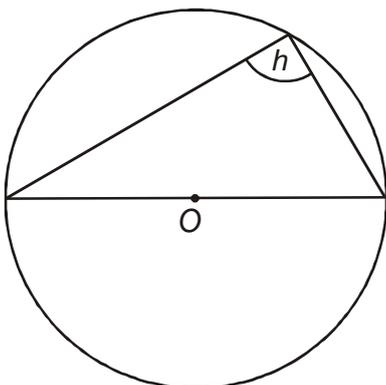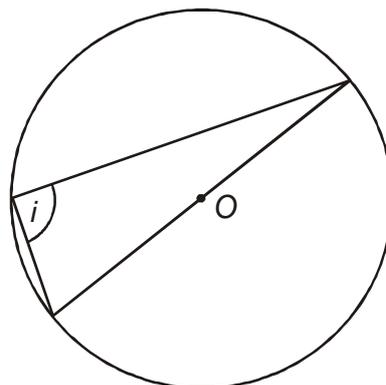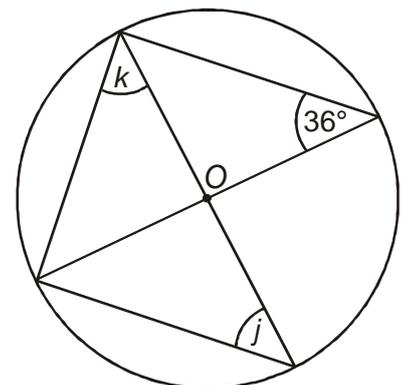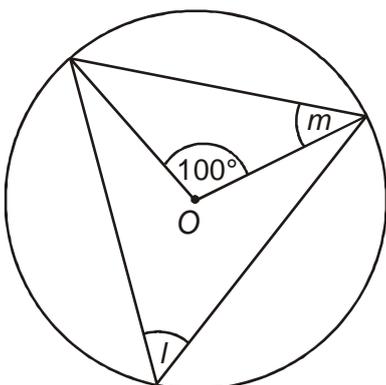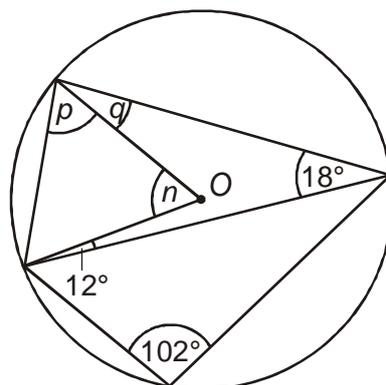
1) $a =$ **44°**
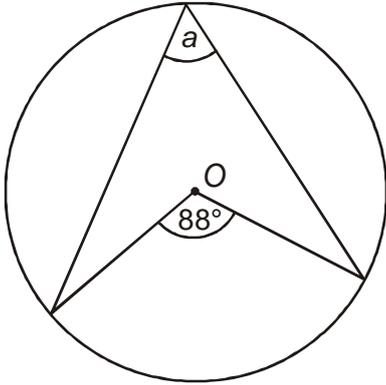
2) $b =$ **23°**

3) $c =$ **92°**

4) $d =$ **23°**

5) $e =$ **39°** $f =$ **56°**
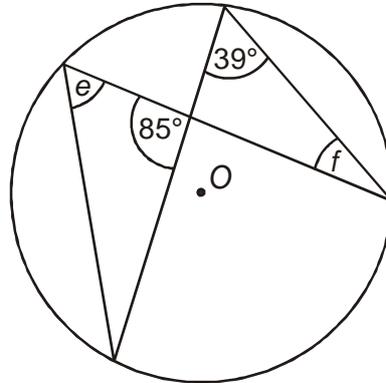
6) $g =$ **82°**
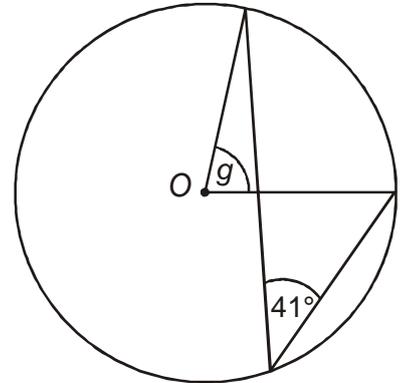
7) $h =$ **90°**
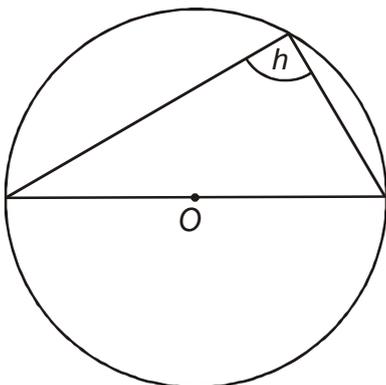
8) $i =$ **90°**
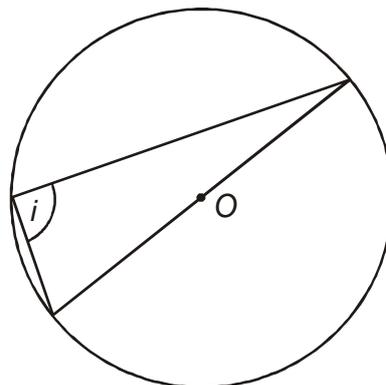
9) $j =$ **36°** $k =$ **54°**

10) $l =$ **50°** $m =$ **40°**

11) $n =$ **36°** $p =$ **72°** $q =$ **6°**

1)   a = _____   b = _____

2)   c = _____   d = _____

3)   e = _____   f = _____

4)   g = _____   h = _____

5)   i = _____

6)   j = _____

7)   k = _____   l = _____   m = _____

8)   n = _____   p = _____   q = _____

9)   r = _____   s = _____

10)   t = _____

11)   u = _____

1) $a =$ **71°** $b =$ **92°**

88°
a
•O
109°
b

2) $c =$ **60°** $d =$ **67°**

•O
d
c
113°   120°

3) $e =$ **98°** $f =$ **55°**

98°
125°
•O
e f

4) $g =$ **100°** $h =$ **85°**

85°
g
•O
h
100°

5) $i =$ **39°**

102°
•O
i

6) $j =$ **136°**

O
88°
j

7) $k =$ **56°** $l =$ **68°** $m =$ **45°**

m 34°
O
l
k

8) $n =$ **19°** $p =$ **50°** $q =$ **50°**

O
21°
p
n
q 40°

9) $r =$ **23°** $s =$ **93°**

110°
•O
r s
134°

10) $t =$ **42°**

t
•O
48°

11) $u =$ **5°**

u 30°
•O
25°

1)   a = ____

64°

2)   b = ____   c = ____

63°
51°

3)   d = ____   e = ____

d   28°
e
88°

4)   f = ____   g = ____

g
f 78°

5)   h = ____   i = ____

50°
h 65°
i

6)   j = ____   k = ____   l = ____   m = ____

40°
m
k j
l

7)   n = ____

162°
O
n

8)   p = ____   q = ____

O
q
p
76°

9)   r = ____   s = ____   t = ____

r
O 40°
s t

10)   u = ____   v = ____   w = ____

81°
v
O
u
w

Page 160 F

1) $a =$ __64°__

2) $b =$ __51°__ $c =$ __66°__

3) $d =$ __92°__ $e =$ __28°__

28°

88°

64°

63°
51°

4) $f =$ __78°__ $g =$ __24°__

5) $h =$ __50°__ $i =$ __65°__

6) $j =$ __100°__ $k =$ __40°__ $l =$ __40°__ $m =$ __100°__
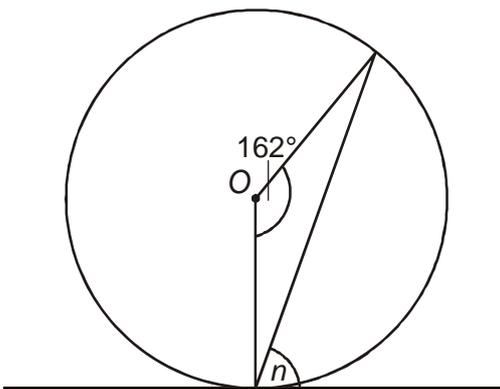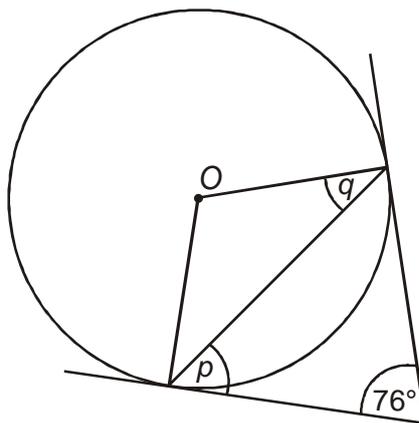
g
f 78°

50°
h 65°
i

40°
m
k j
l

7) $n =$ __81°__

8) $p =$ __52°__ $q =$ __38°__

9) $r =$ __50°__ $s =$ __70°__ $t =$ __20°__
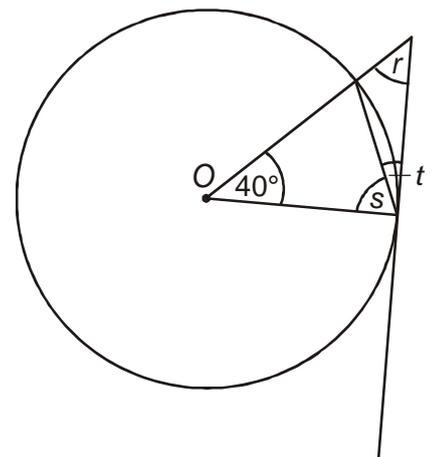
162°
O
n
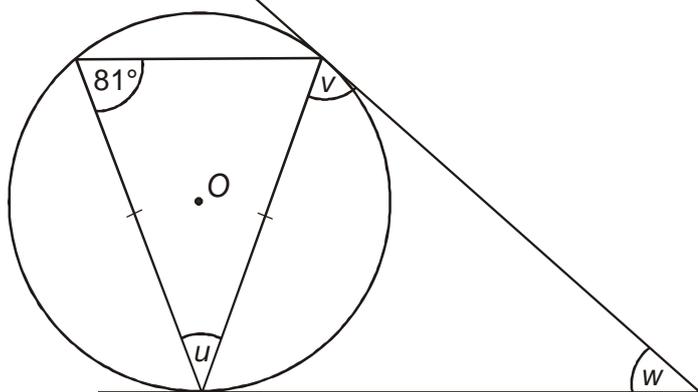
O
q
p
76°

O 40°
r
s t

10) $u =$ __18°__ $v =$ __81°__ $w =$ __18°__

81°
v
O
u
w

Page 160 F

1) Enlarge triangle T by scale factor -2 using coordinates (2, 2) as the centre of enlargement.

2) Describe fully the single transformation which maps triangle T to triangle U.
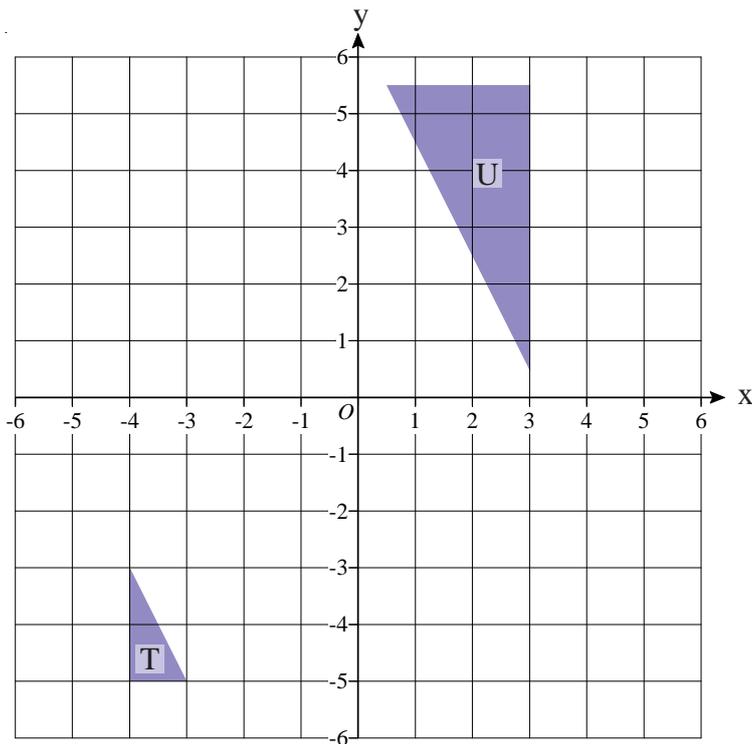
1) Enlarge triangle T by scale factor -2 using coordinates (2, 2)
    as the centre of enlargement.

2) Describe fully the single transformation which maps triangle T to triangle U.
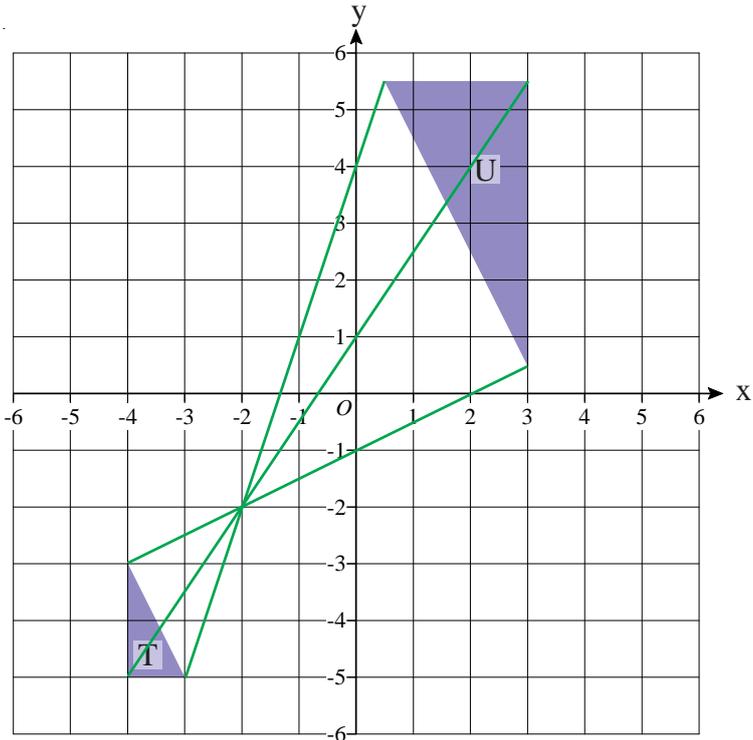
Enlargement with scale
factor -2.5
Centre of enlargement at
(-2, -2)

Combinations of Transformations
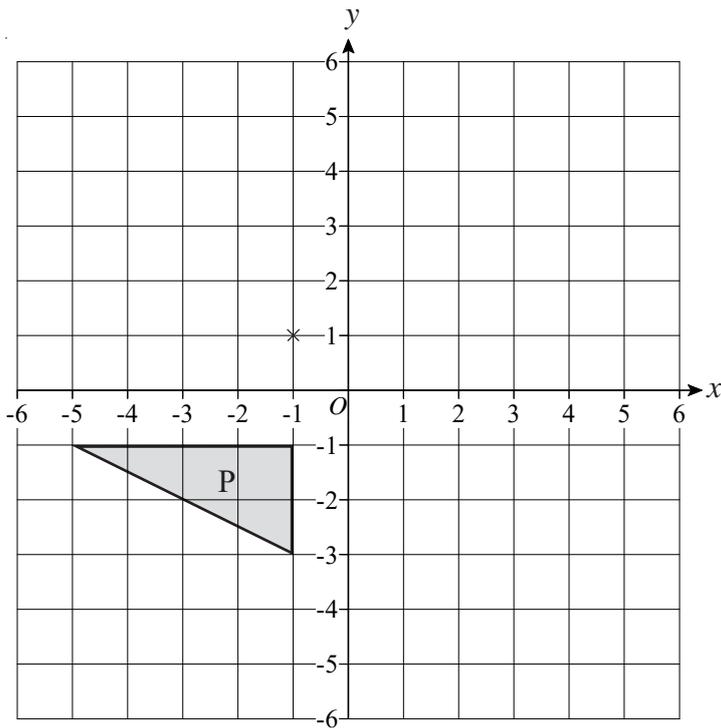
1)

a) Rotate triangle P 180° about the point (-1, 1).
   Label the new triangle A.

b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
   Label the new triangle B.

c) Reflect triangle Q in the line $y = x$.
   Label the new triangle C.

1)

a) Rotate triangle P 180° about the point (-1, 1).
   Label the new triangle A.

b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
   Label the new triangle B.
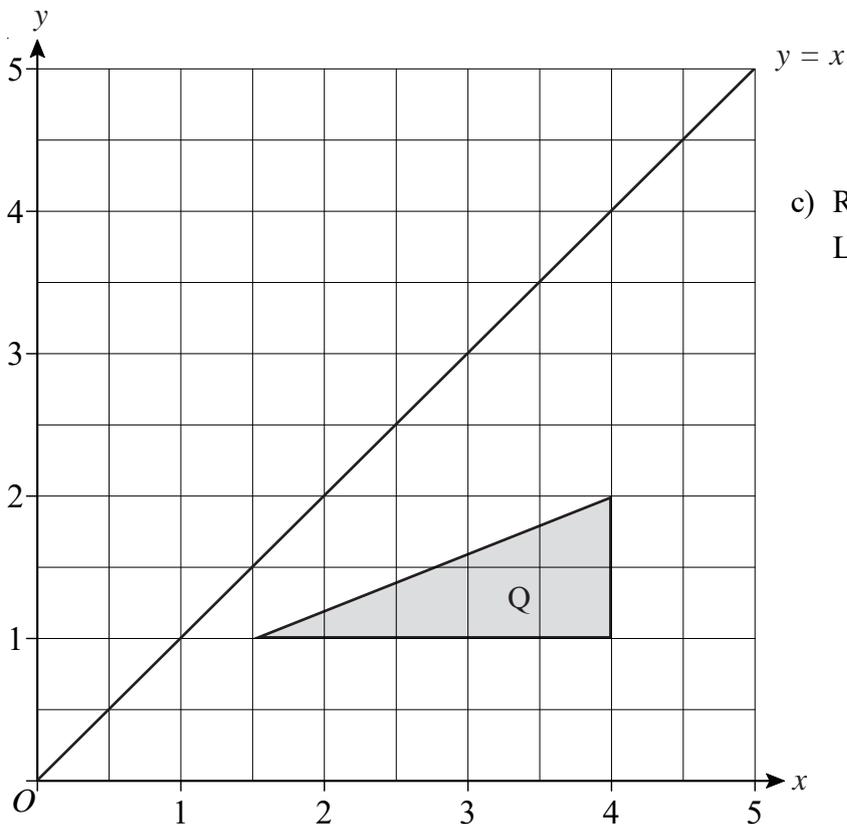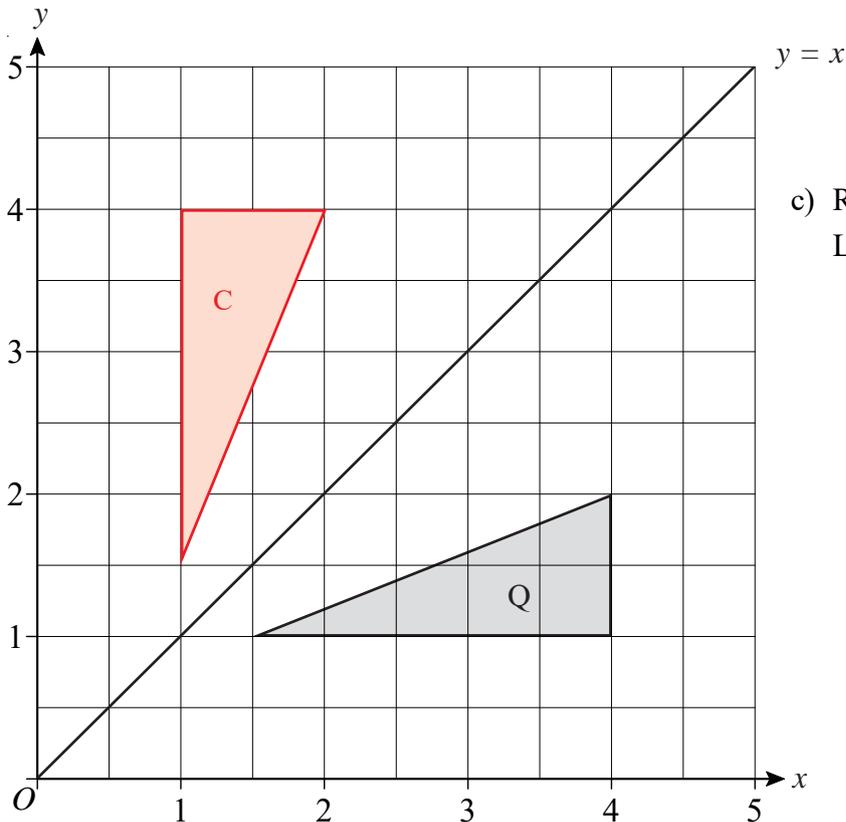
c) Reflect triangle Q in the line $y = x$.
   Label the new triangle C.

Combinations of Transformations
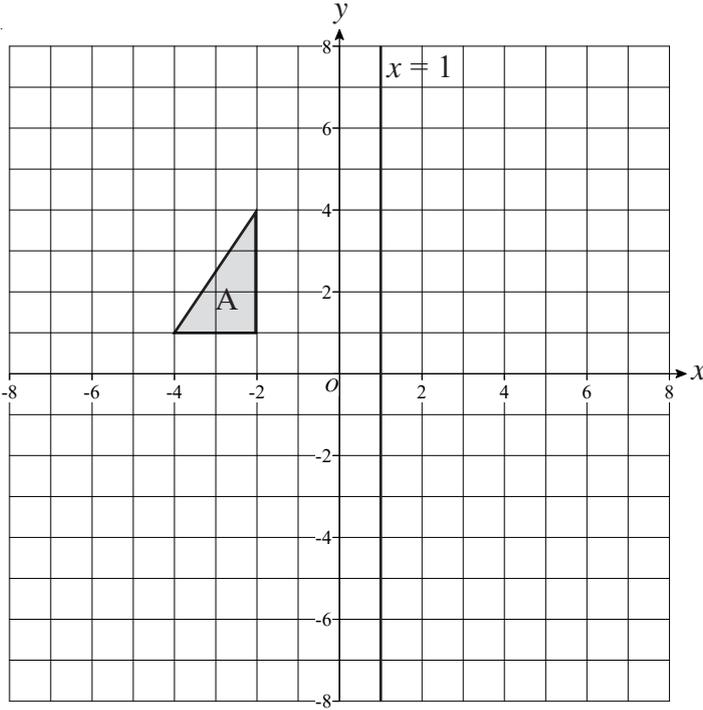
1)

Triangle A is reflected in the *x*-axis to give triangle B.

Triangle B is reflected in the line *x* = 1 to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.

2)
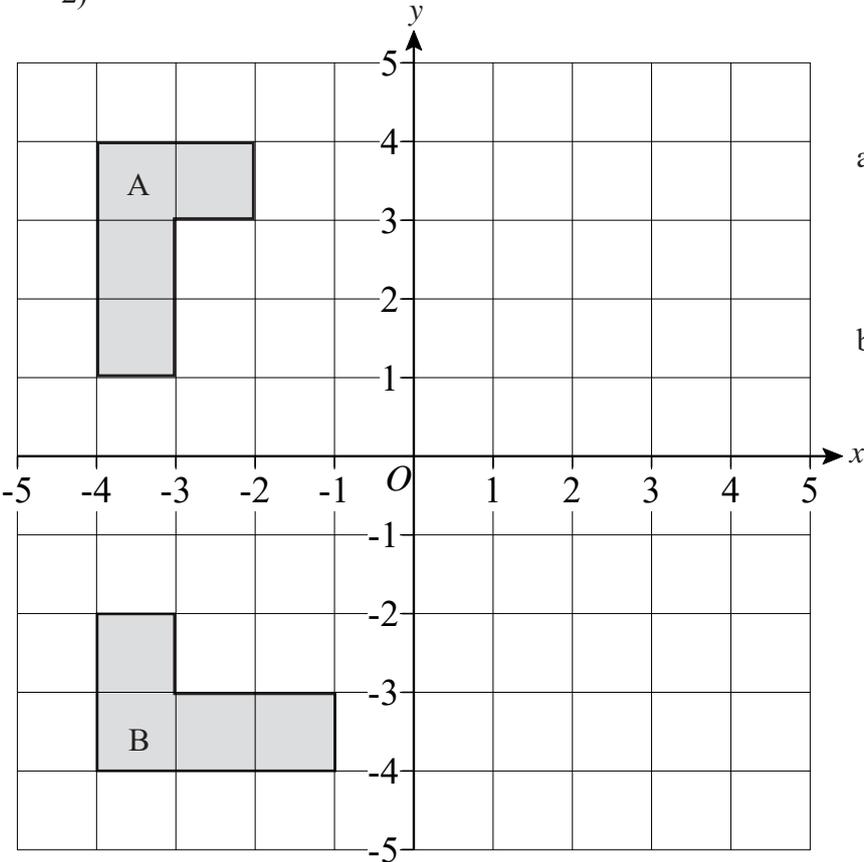
a) Reflect shape A in the *y*-axis.

b) Describe fully the **single** transformation which takes shape A to shape B.

Combinations of Transformations
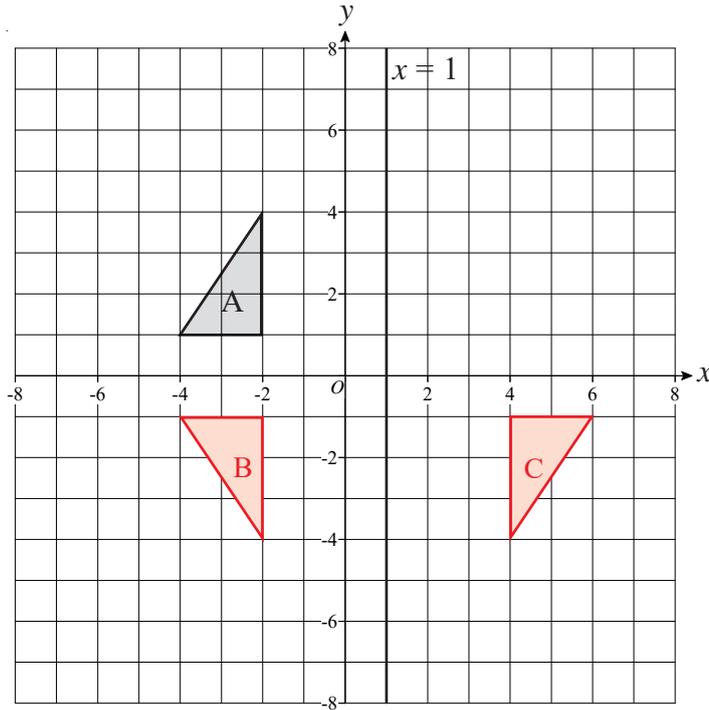
1)

Triangle A is reflected in the *x*-axis to give triangle B.

Triangle B is reflected in the line *x* = 1 to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.

Rotation of 180° about the point (1, 0)

2)
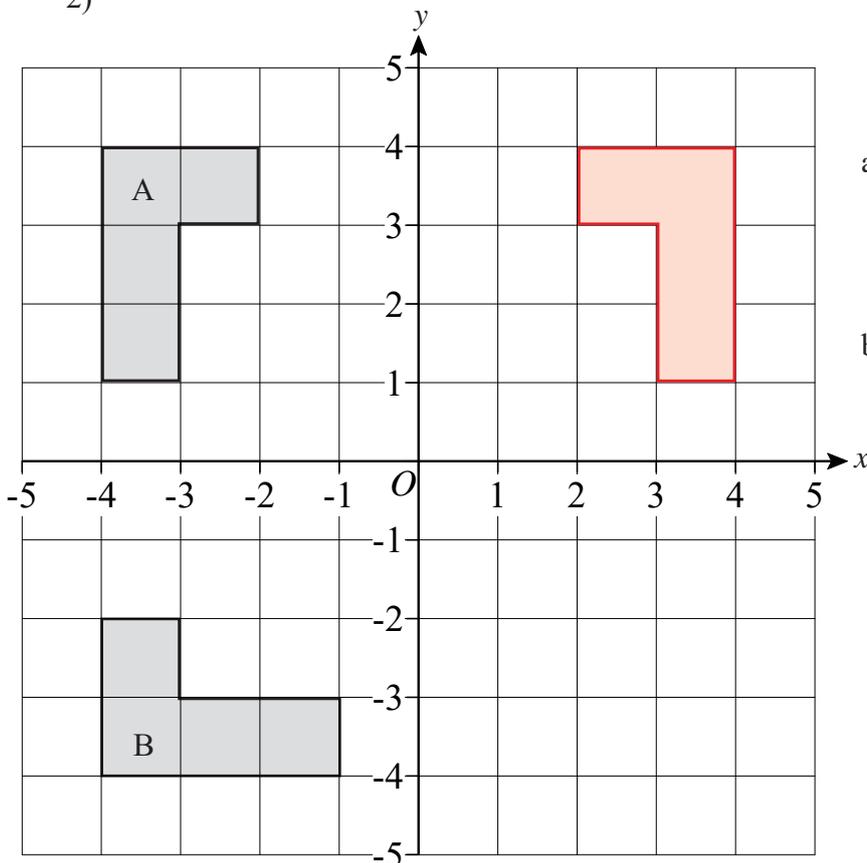
a) Reflect shape A in the *y*-axis.

b) Describe fully the **single** transformation which takes shape A to shape B.

Rotation of 90° anticlockwise about the point (0, 0)
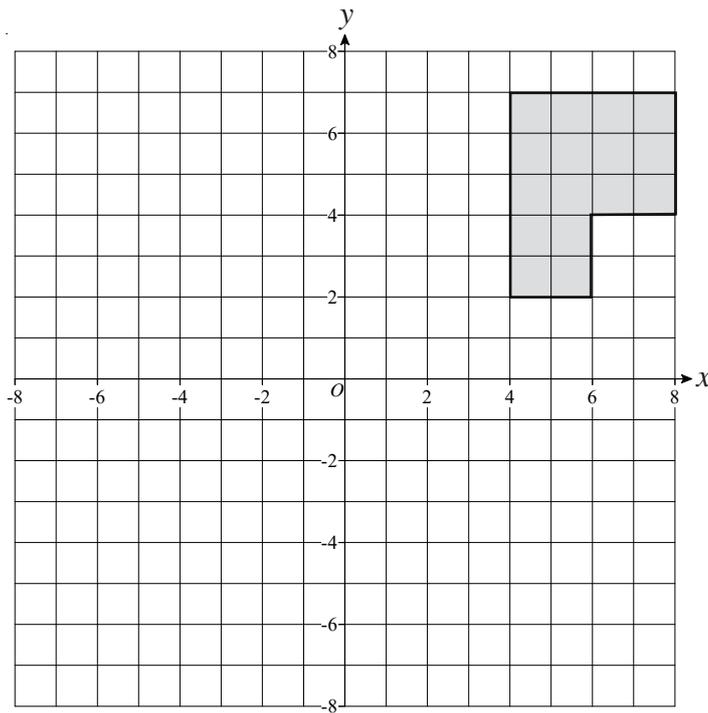
a) Rotate the shaded shape 90° clockwise about the point *0*.
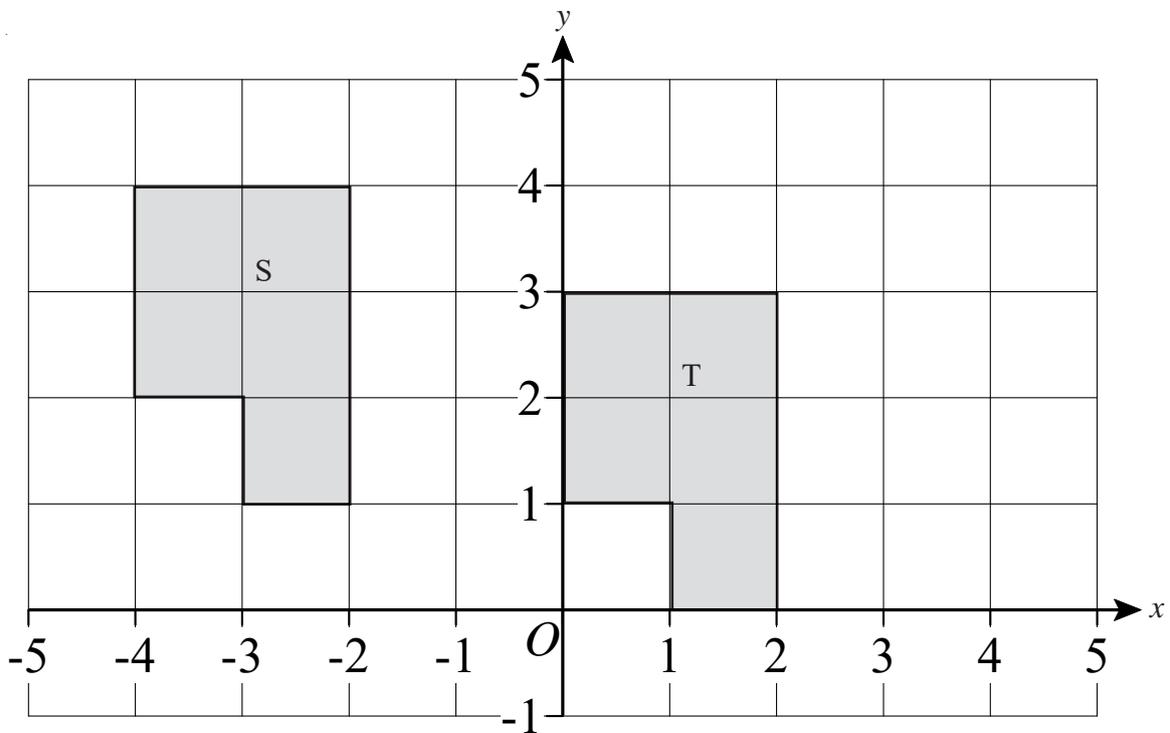
b) Describe fully the single transformation that will map shape S onto shape T.

Combinations of Transformations
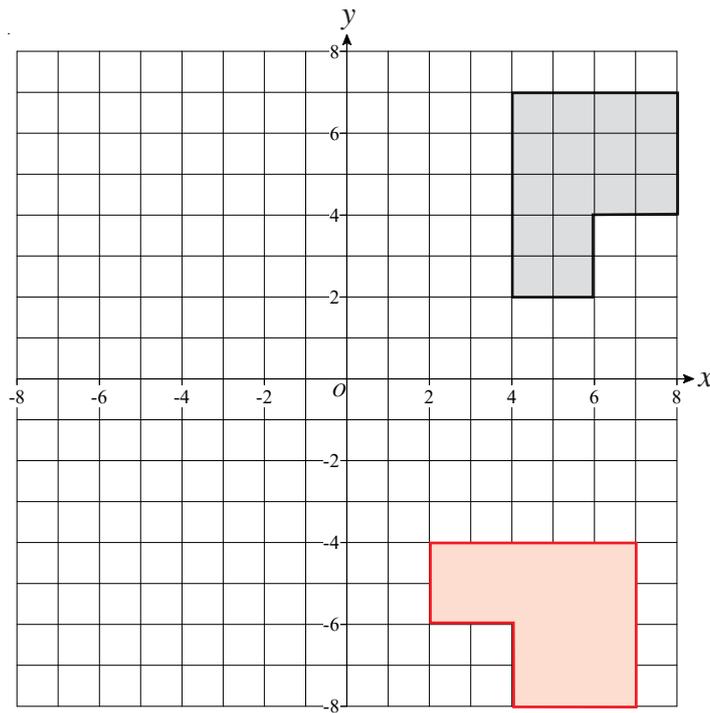
a) Rotate the shaded shape 90° clockwise about the point *0*.
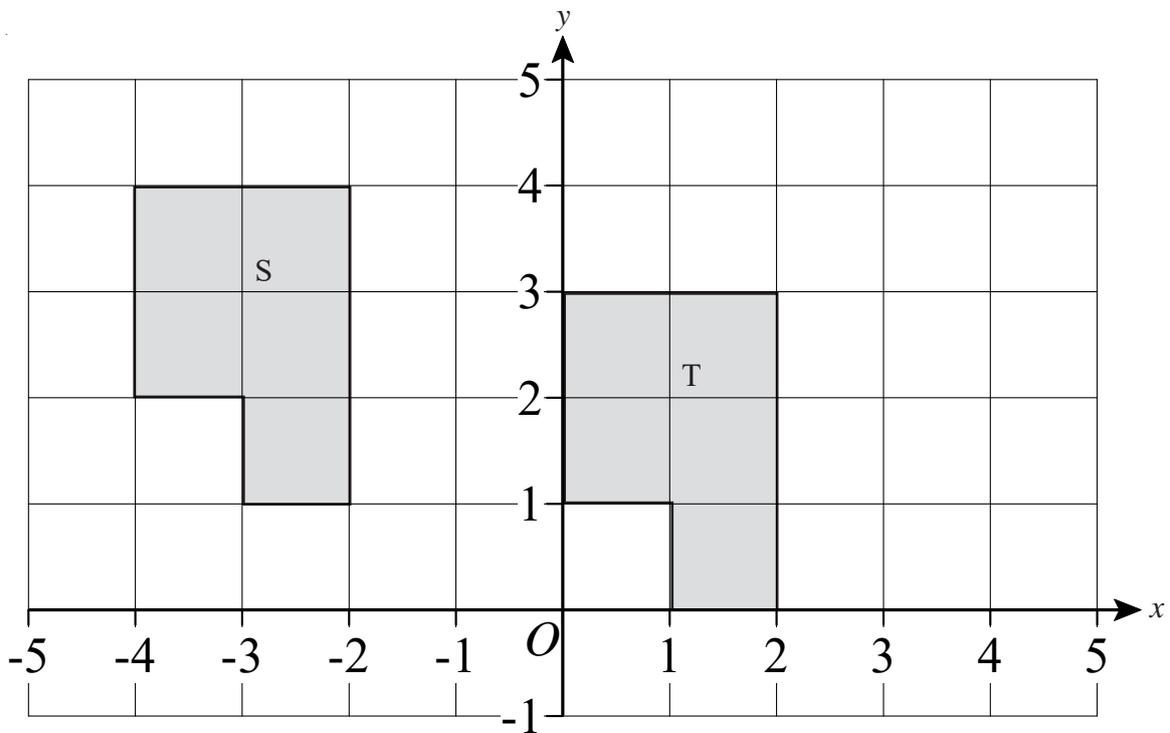
b) Describe fully the single transformation that will map shape S onto shape T.

Translate shape S by the vector $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

1)
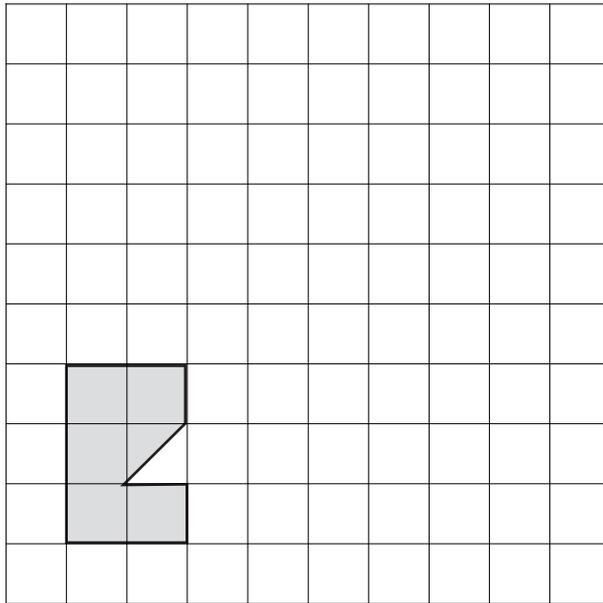
a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.
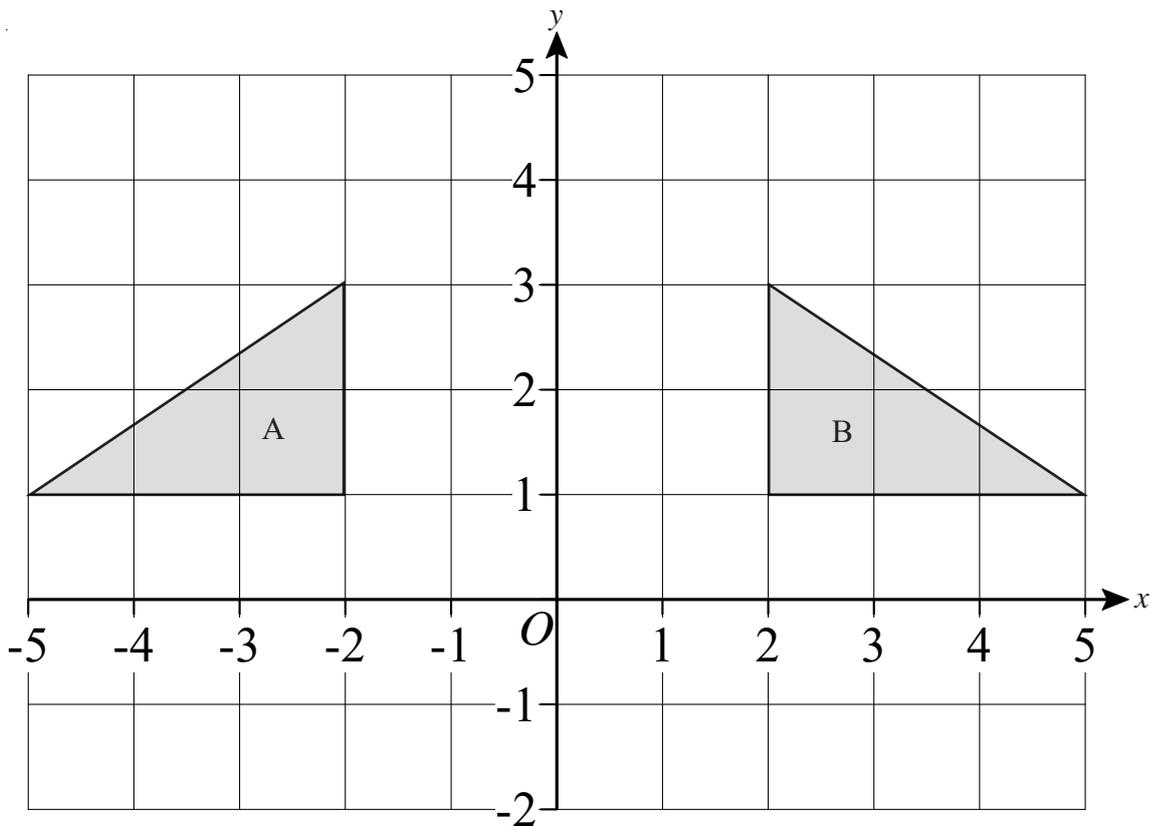
b) Describe fully the single transformation that maps triangle A onto triangle B.

1)
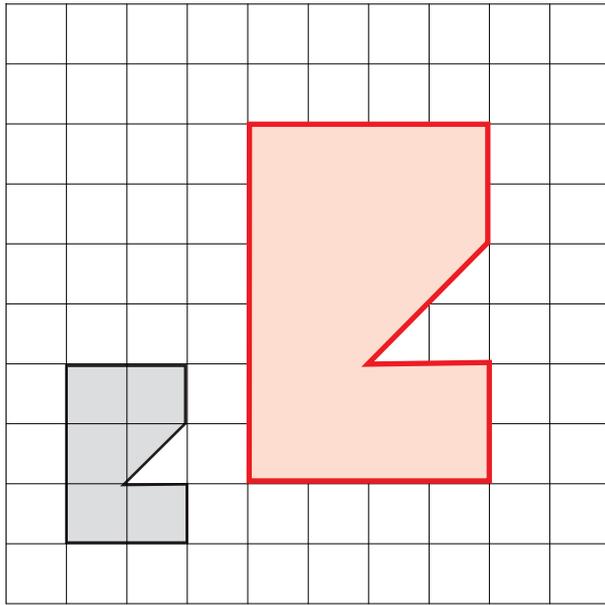
a)   On the grid, draw an enlargement, scale factor 2, of the shaded shape.
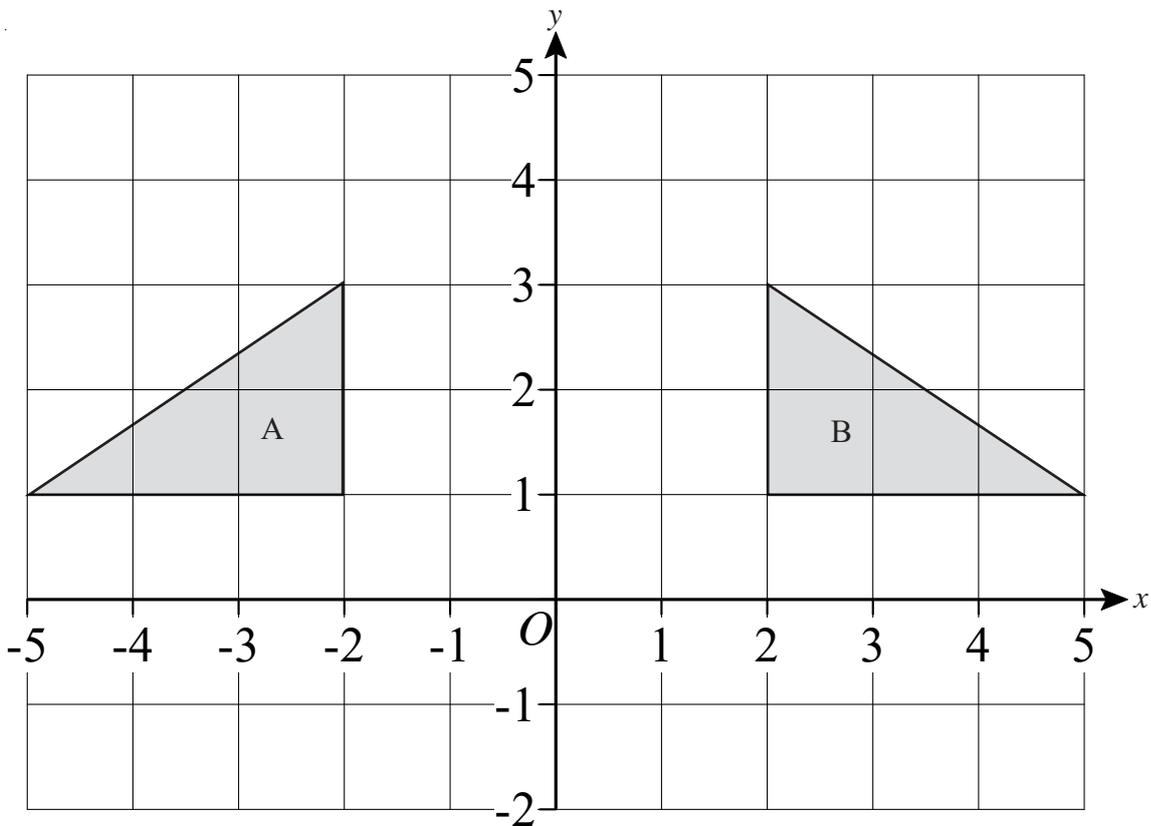
b)   Describe fully the single transformation that maps triangle A onto triangle B.

Reflection in the *y* - axis
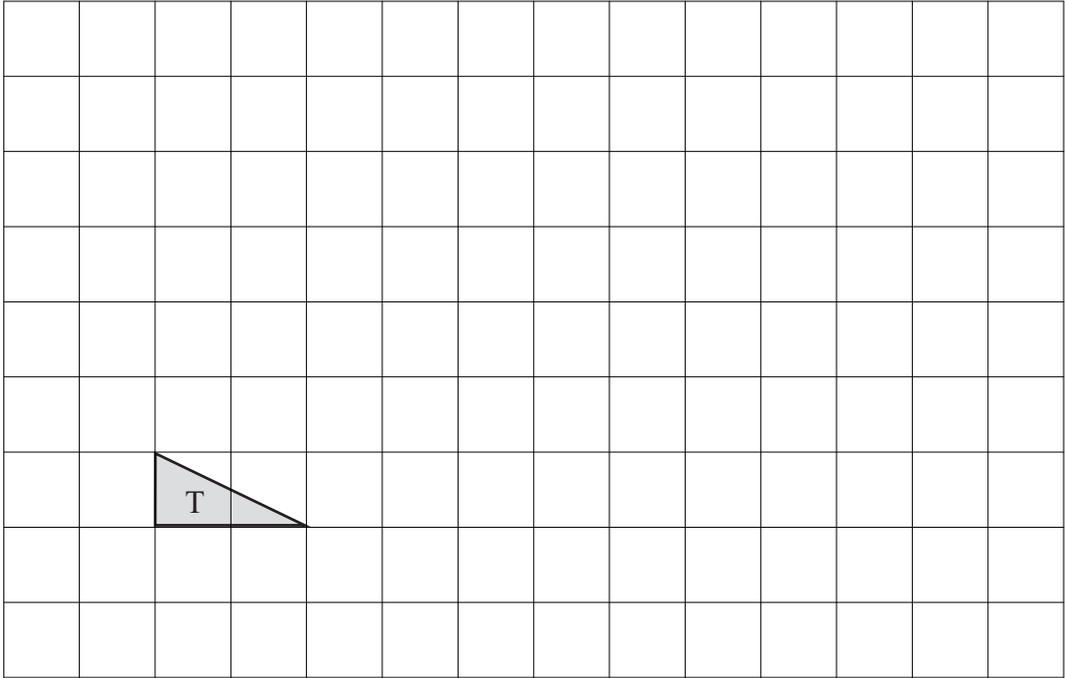
Triangle T has been drawn on a grid.

a)   On the grid, draw an enlargement of the triangle T with scale factor 3.
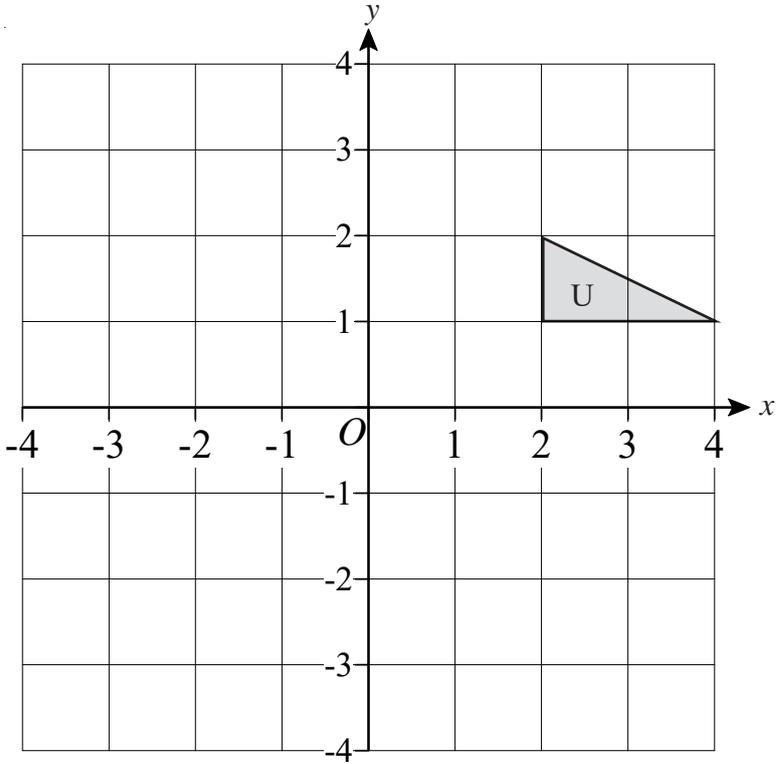
Triangle U has been drawn on a grid.

b)   On the grid, rotate triangle U 90° clockwise about the centre *O*.
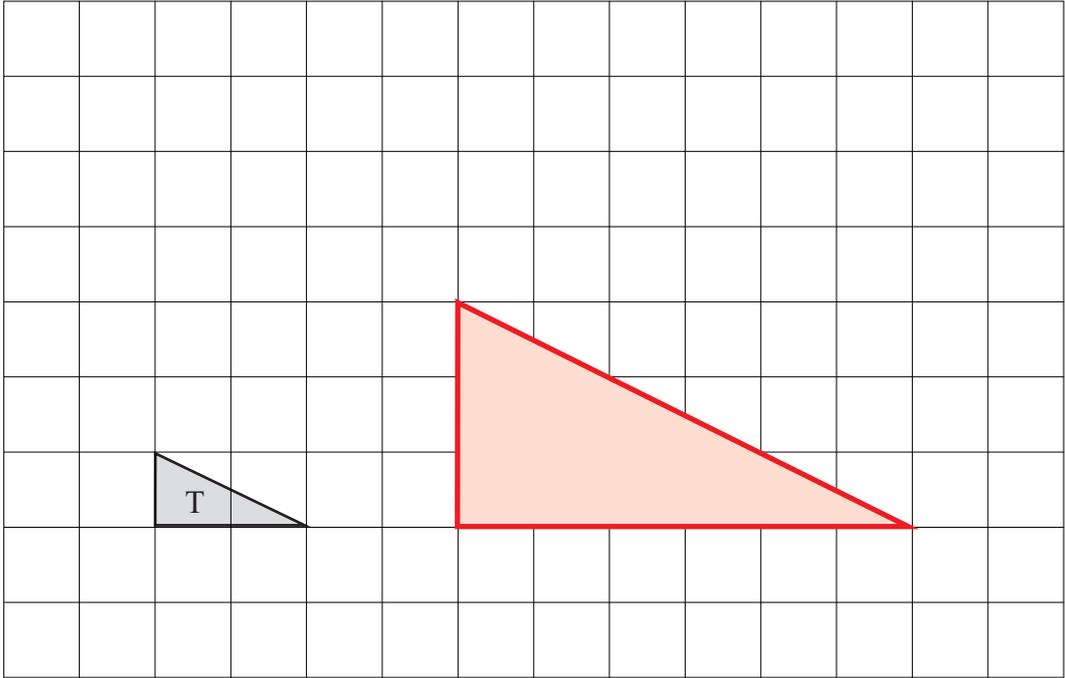
Triangle T has been drawn on a grid.

a) On the grid, draw an enlargement of the triangle T with scale factor 3.
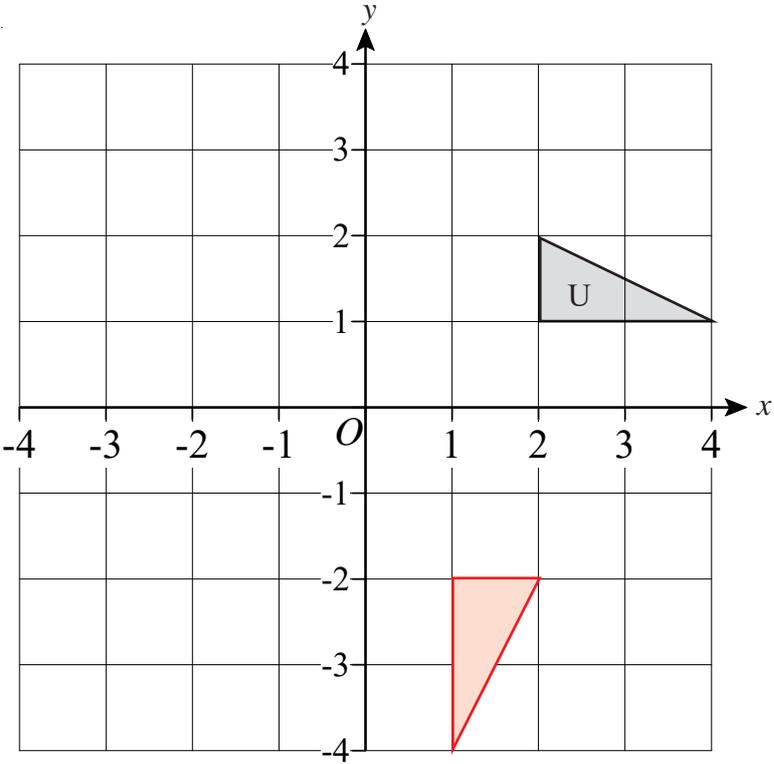
Triangle U has been drawn on a grid.

b) On the grid, rotate triangle U 90° clockwise about the centre O.

1)
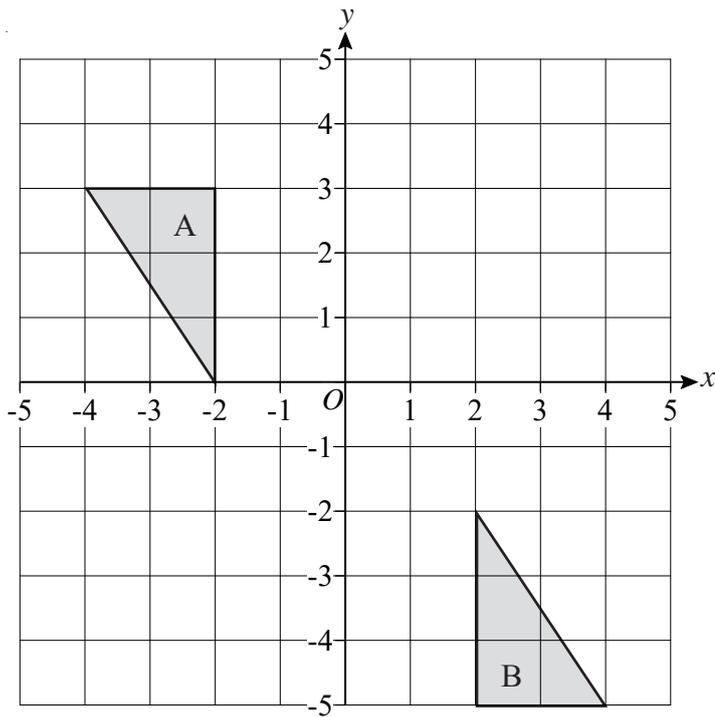
Describe fully the single transformation that maps triangle A onto triangle B.

2)
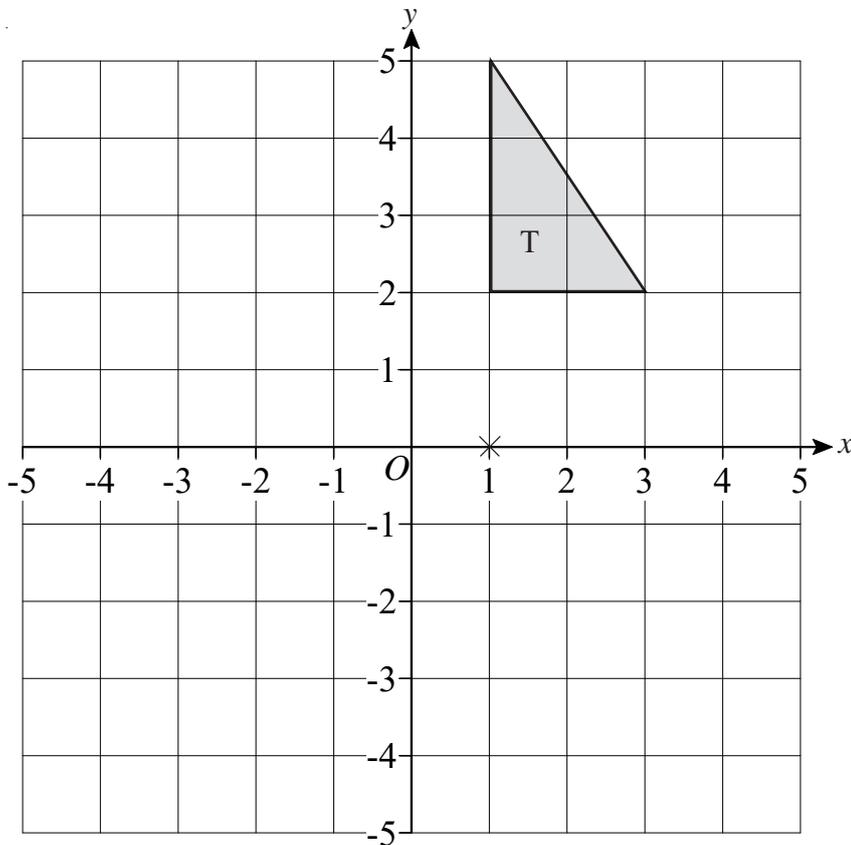
Triangle T has been drawn on the grid.

Rotate triangle T 180° about the point (1, 0)

Label the new triangle A.

1)
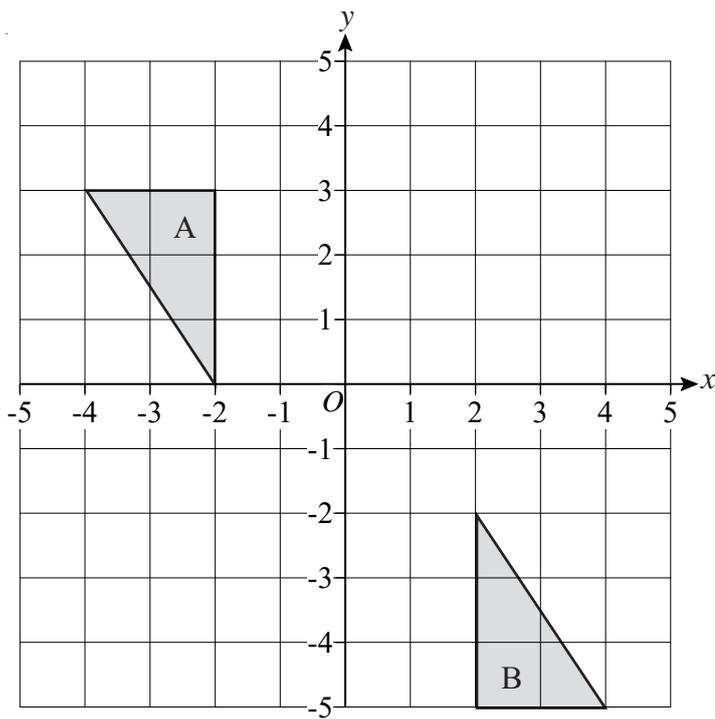
Describe fully the single transformation that maps triangle A onto triangle B.

Rotation of 180° about the point (0, -1)

2)
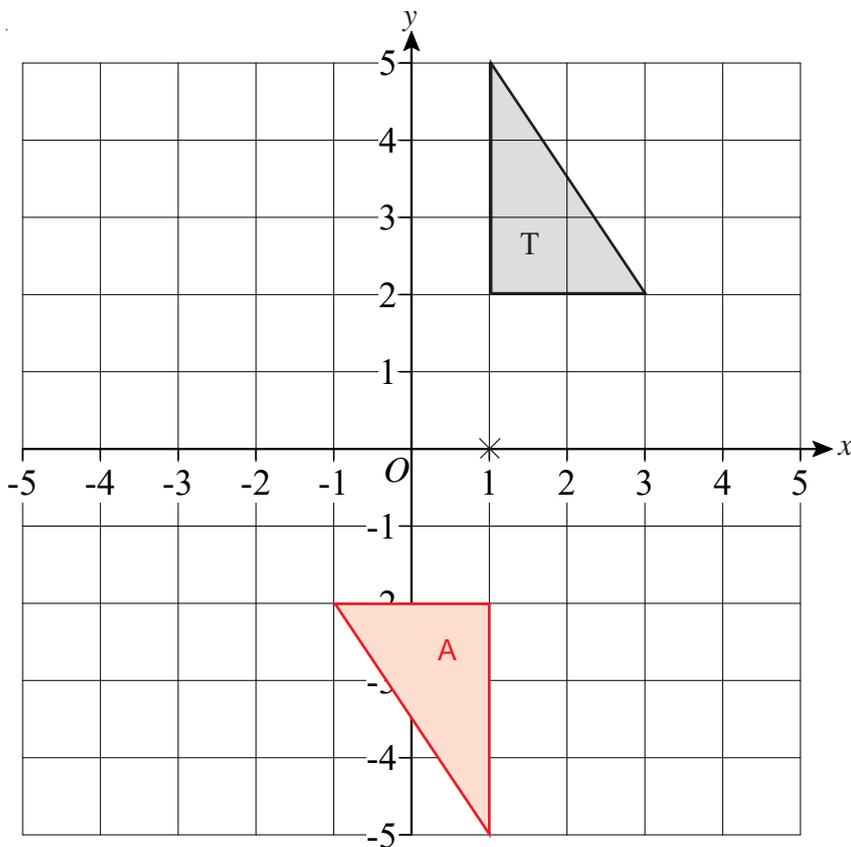
Triangle T has been drawn on the grid.

Rotate triangle T 180° about the point (1, 0)

Label the new triangle A.

Combinations of Transformations

1)

Describe fully the single transformation which maps shape S onto shape T.

2)
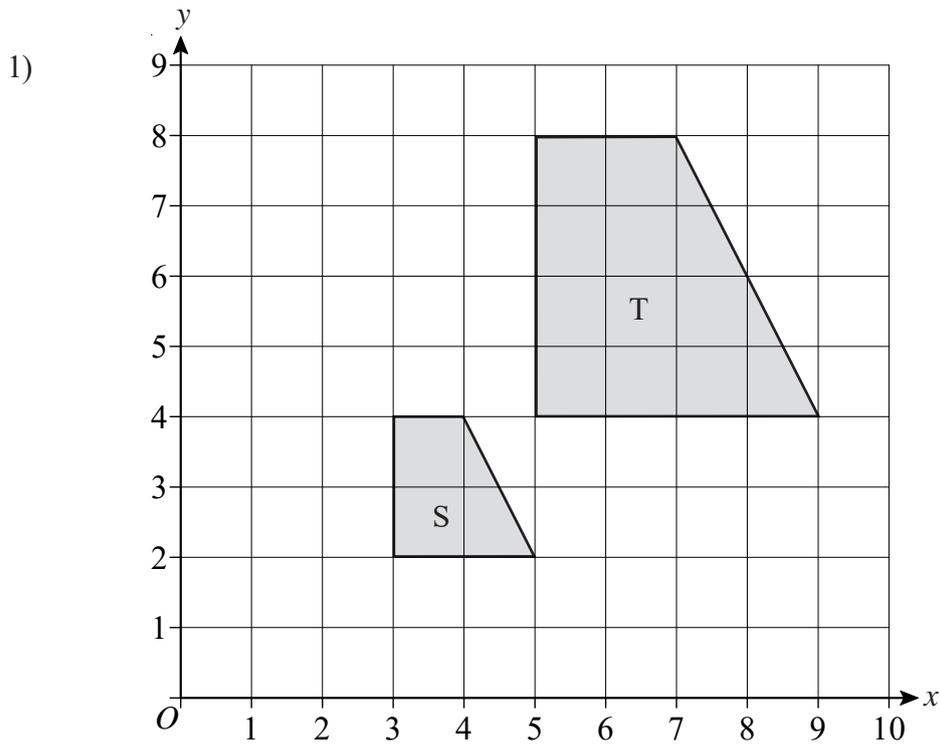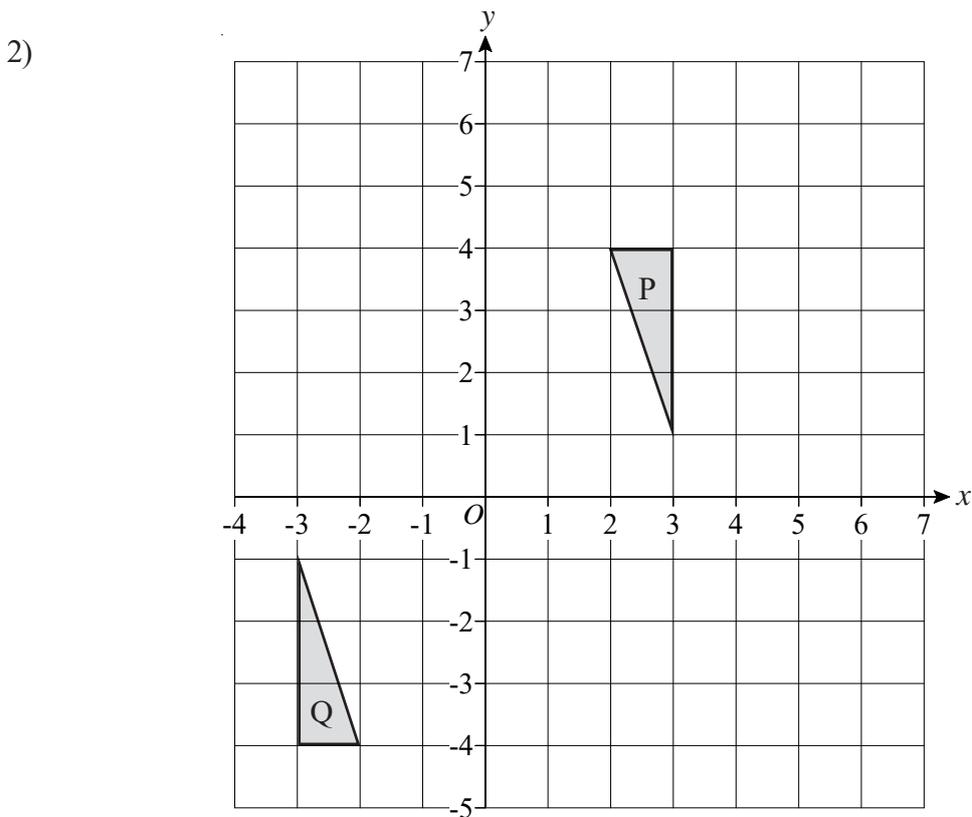
Triangle P and triangle Q are drawn on the grid.

a) Describe fully the single transformation which maps triangle P onto triangle Q.

b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
Label the new triangle R.

1)
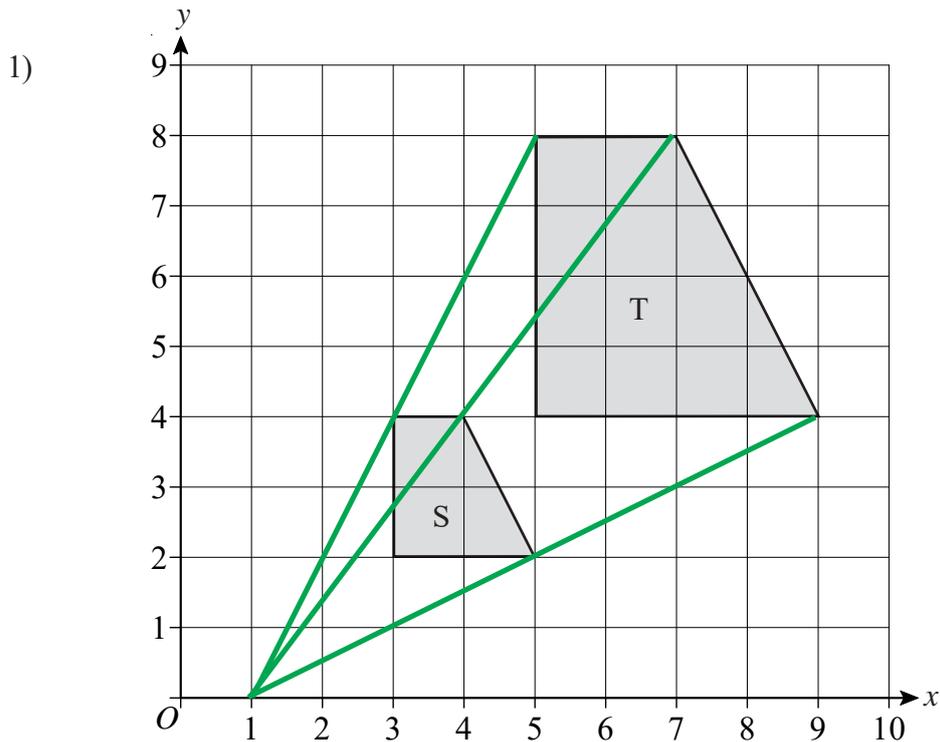
Describe fully the single transformation which maps shape S onto shape T.
Enlargement scale factor 2 with (1, 0) as the centre of enlargement.
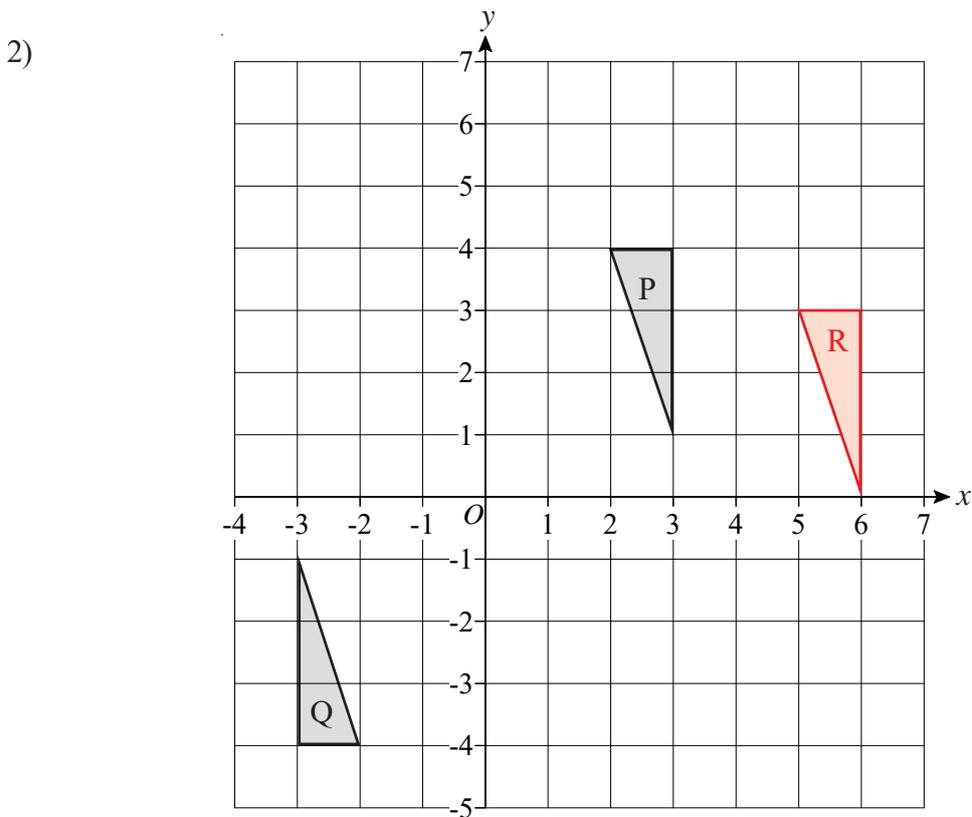
2)

Triangle P and triangle Q are drawn on the grid.

a) Describe fully the single transformation which maps triangle P onto triangle Q.
Rotation of 180° about the point (0, 0)

b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
Label the new triangle R.
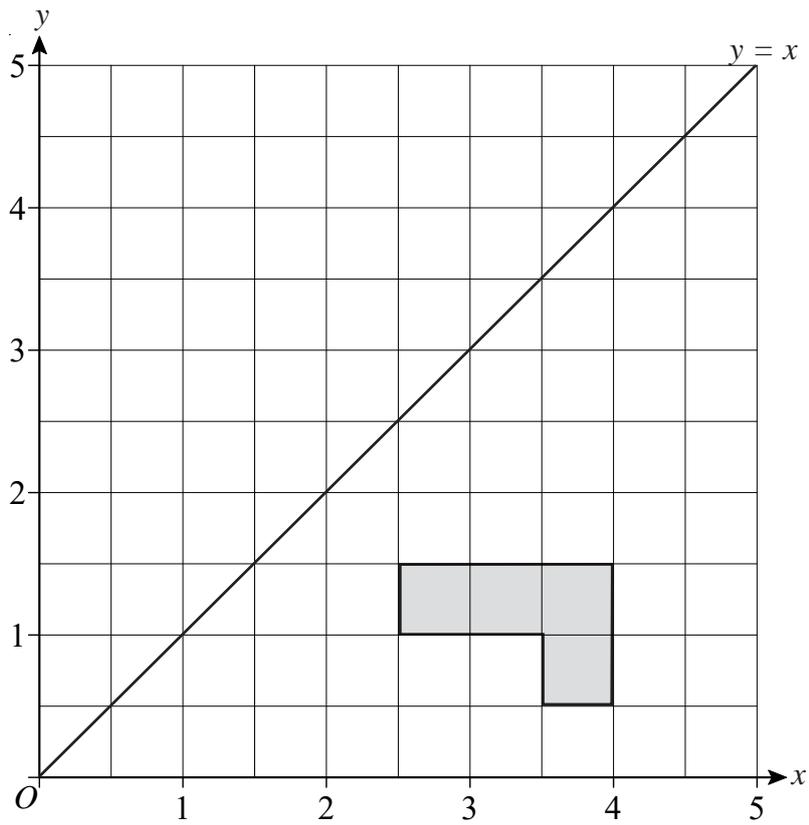
a) Reflect the shaded shape in the line $y = x$.
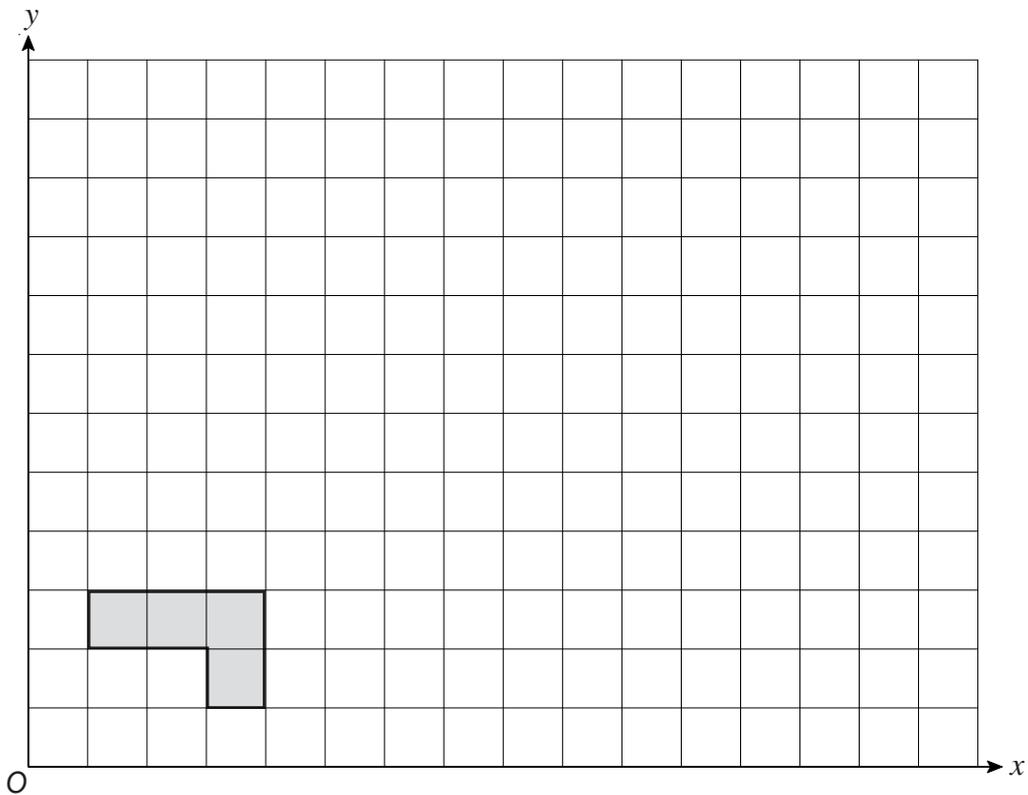
b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

a)   Reflect the shaded shape in the line $y = x$.
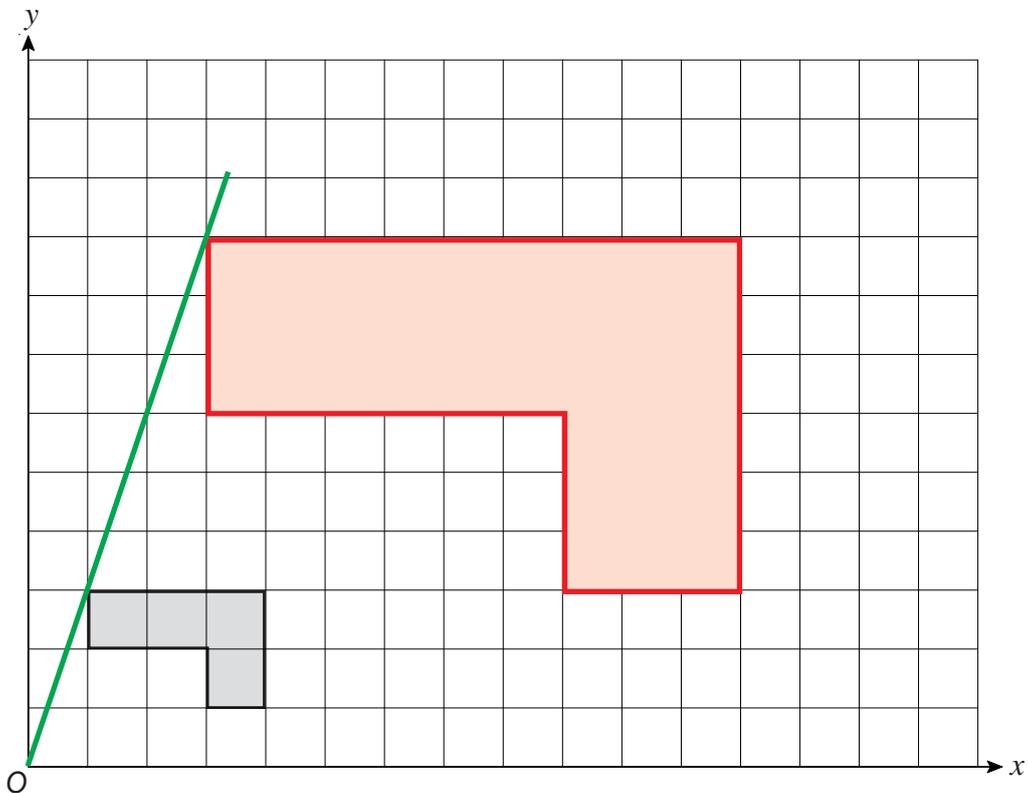
b)   On the grid, enlarge the shaded shape by a scale factor of 3, centre O.
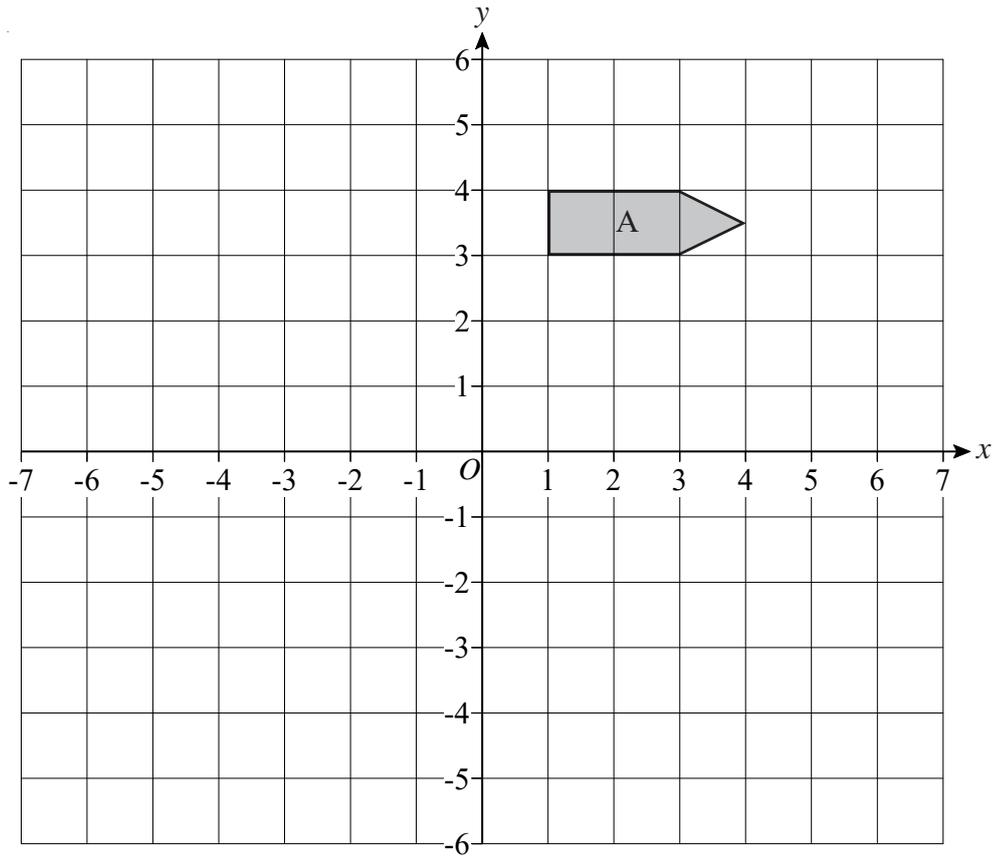
a) On the grid above, reflect shape A in the line $x = -1$

b) Describe fully the single transformation that will map shape P onto shape Q.

Combinations of Transformations
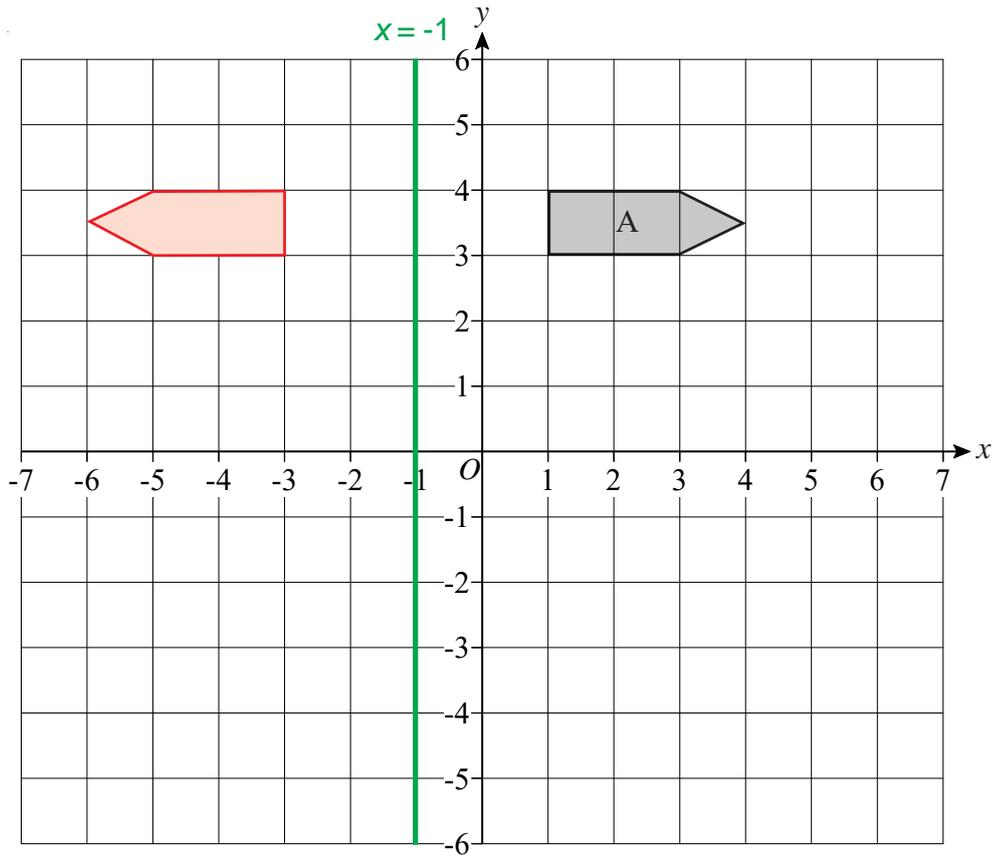
a)   On the grid above, reflect shape A in the line *x* = -1
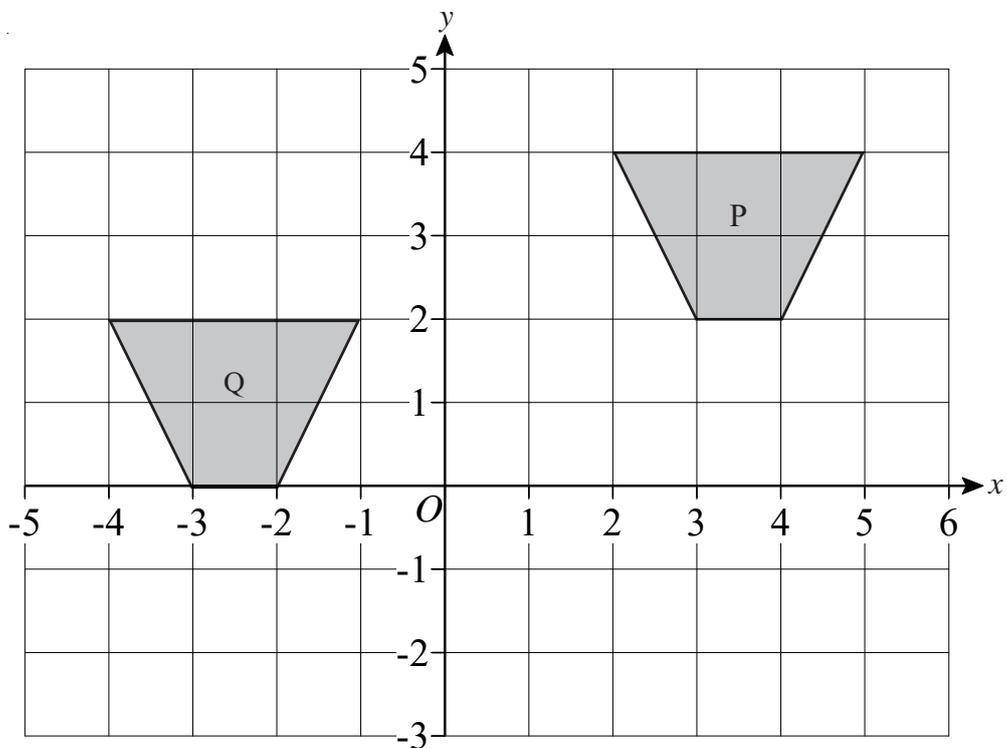
b)   Describe fully the single transformation that will map shape P onto shape Q.

Translation by vector $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$
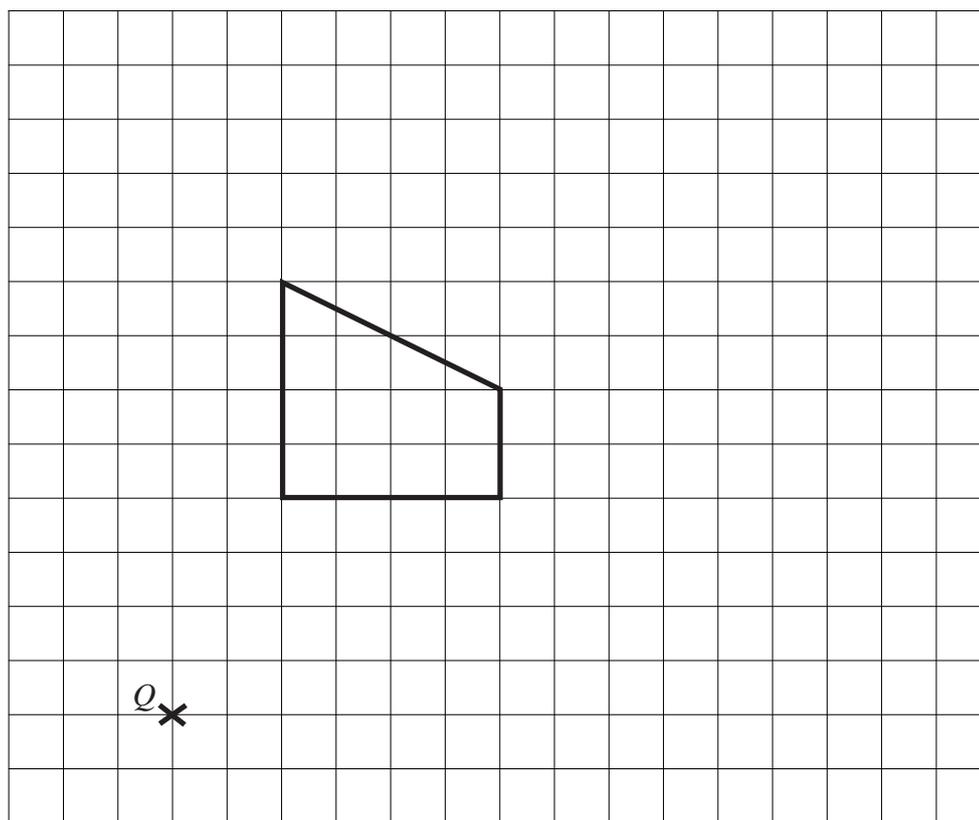
Page 162 I

a)   On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.
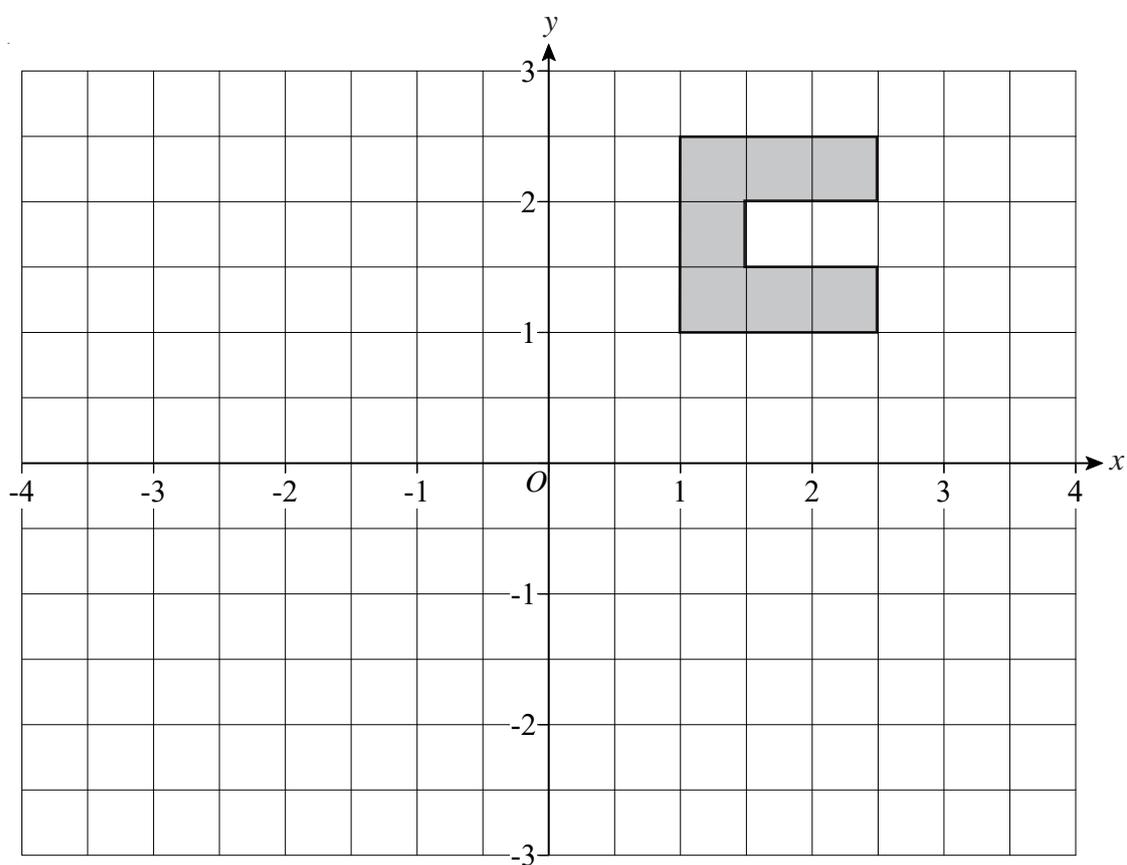
b)   Rotate the shape 90° clockwise, centre O.
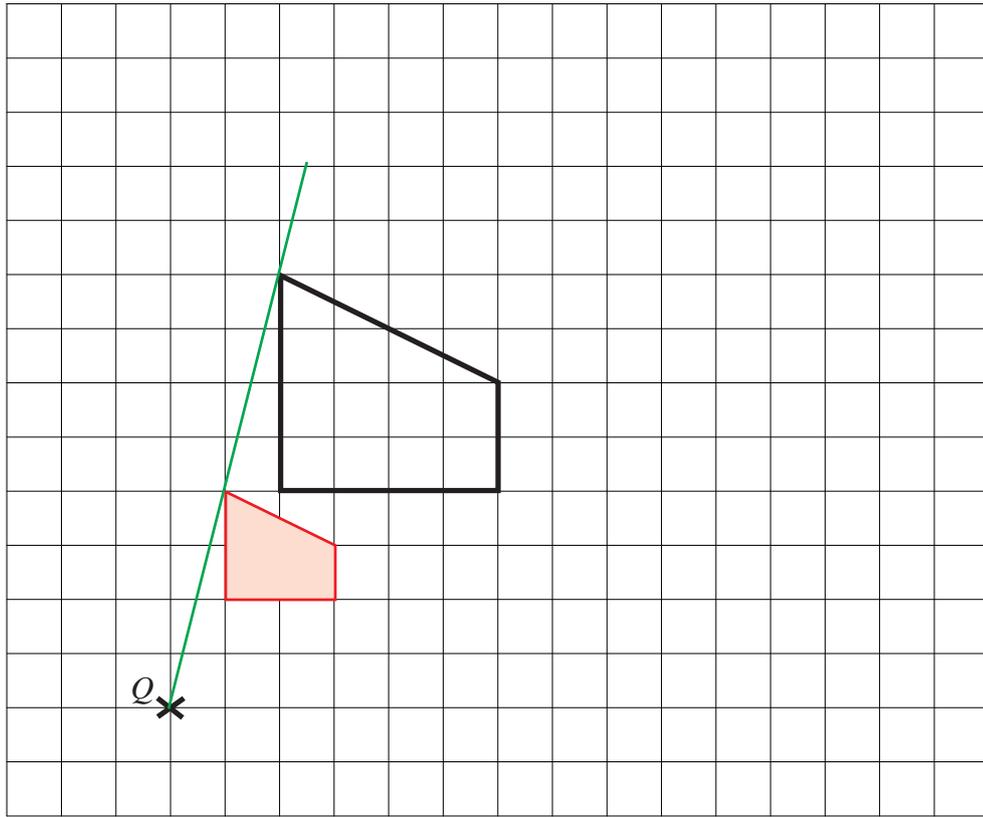
a)   On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.
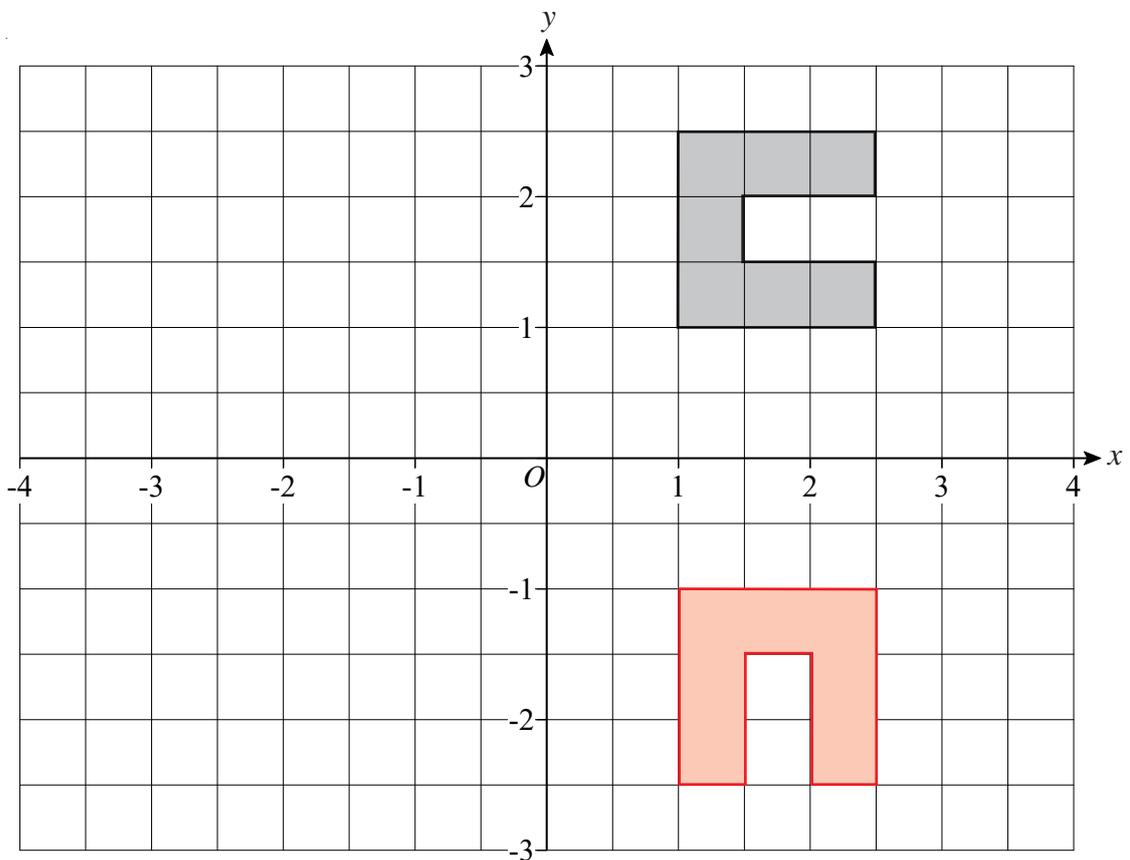
b)   Rotate the shape 90° clockwise, centre O.

1) Richard wants to select every 6th person on a list using systematic sampling.
   The first person selected is the 5th person on the list.

   Which of these people will **not** be selected?
   Circle your answer.

11th	16th	20th	26th
A	**B**	**C**	**D**

2) There are 480 employees in a company.
   8 of them are to be selected as members of an employees' committee.

   The CEO of the company produces a spreadsheet containing the names of the 480 employees.
   The list of employees has 480 rows, with an employee's details on each row.

   The CEO plans to use a systematic sampling method to select the committee members.
   The first employee selected appears on the 21st row of the list.

   Give the row numbers of the other 7 employees to be selected.

3) A pen-manufacturing company produces an average of 30 000 pens each day.
   They want to randomly sample their daily production of 30 000 pens for quality control.

   Use the following list of random numbers to select the first 5 pens for the sample.
   You must start with the first number in the list.
   Explain clearly how you are using the numbers to select the sample.

55812	00214	47441	75812
59836	61601	47922	07155
84664	40945	00214	70925
04818	10318	15772	34520
77814	13700	01780	27552

Sampling Methods - Systematic and Random

1) Richard wants to select every 6th person on a list using systematic sampling.
The first person selected is the 5th person on the list.

Which of these people will **not** be selected?
Circle your answer.

11th	16th	20th	26th
A	**B**	**C**	**D**

2) There are 480 employees in a company.
8 of them are to be selected as members of an employees' committee.

The CEO of the company produces a spreadsheet containing the names of the 480 employees.
The list of employees has 480 rows, with an employee's details on each row.

The CEO plans to use a systematic sampling method to select the committee members.
The first employee selected appears on the 21st row of the list.

Give the row numbers of the other 7 employees to be selected.   81, 141, 201, 261, 321, 381, 441

3) A pen-manufacturing company produces an average of 30 000 pens each day.
They want to randomly sample their daily production of 30 000 pens for quality control.

Use the following list of random numbers to select the first 5 pens for the sample.
You must start with the first number in the list.
Explain clearly how you are using the numbers to select the sample.

55812	00214	47441	75812
59836	61601	47922	07155
84664	40945	00214	70925
04818	10318	15772	34520
77814	13700	01780	27552

Number the pens 00001 to 30000

Work from the first number in rows and consider
successive 5-digit numbers.

Make sure we only use numbers in the range 1 to
30000 and that we ignore repeats.

00214, 07155, 04818, 10318, 15772

(if working in columns instead of rows:
04818, 00214, 10318, 13700, 15772)

Page 163 A

1) Ellen wants to do a survey with Years 9, 10 and 11 at her school.
The table shows the number of students in each of these year groups.

Year 11	Year 10	Year 9
750	700	900

Ellen takes a sample of 50 students stratified by year group.

Work out the number of students from Year 10 in the sample.

2) The table shows information about the year groups of 1000 students in a school.

Year group	7	8	9	10	11	12	13
Number in year	157	180	166	140	132	114	111

Tony takes a sample of 50 of these students, stratified by year group.

Calculate the number of Year 8 students he should have in his sample.

3) The table shows information about Ben's collection of 652 coins.

Country	France	Spain	Germany	Italy	Total
Number of coins	240	182	133	97	652

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample.

4)

	Male	Female
Lower sixth	399	602
Upper sixth	252	198

The table gives information about the number of students in the two years of a sixth form.

Amy wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the lower sixth.

1) Ellen wants to do a survey with Years 9, 10 and 11 at her school.
The table shows the number of students in each of these year groups.

Year 11	Year 10	Year 9
750	700	900

Ellen takes a sample of 50 students stratified by year group.

Work out the number of students from Year 10 in the sample. 15

2) The table shows information about the year groups of 1000 students in a school.

Year group	7	8	9	10	11	12	13
Number in year	157	180	166	140	132	114	111

Tony takes a sample of 50 of these students, stratified by year group.

Calculate the number of Year 8 students he should have in his sample. 9

3) The table shows information about Ben's collection of 652 coins.

Country	France	Spain	Germany	Italy	Total
Number of coins	240	182	133	97	652

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample. 7

4)

	Male	Female
Lower sixth	399	602
Upper sixth	252	198

The table gives information about the number of students in the two years of a sixth form.

Amy wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the lower sixth. 19

1) The table below shows the number of employees in each section of a company.

Department	Managerial	Sales	Technical	Production
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

a) Explain why a simple random sample of employees is unsuitable.

b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	Managerial	Sales	Technical	Production
Number of employees in sample				

2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	Boys	Girls
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	Boys in Sample	Girls in Sample
7		
8		
9		
10		
11		

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	Boys in Sample who answered YES	Girls in Sample who answered YES
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.

1) The table below shows the number of employees in each section of a company.

Department	Managerial	Sales	Technical	Production
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

a) Explain why a simple random sample of employees is unsuitable. The numbers in the different types of jobs vary greatly.

b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	Managerial	Sales	Technical	Production
Number of employees in sample	2	5	32	61

2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	Boys	Girls
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	Boys in Sample	Girls in Sample
7	8	7
8	7	8
9	7	7
10	9	11
11	9	7

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	Boys in Sample who answered YES	Girls in Sample who answered YES
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question. 27.5%

Data Distribution - Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	
$0 < h \leqslant 30$	
$0 < h \leqslant 40$	
$0 < h \leqslant 50$	
$0 < h \leqslant 60$	
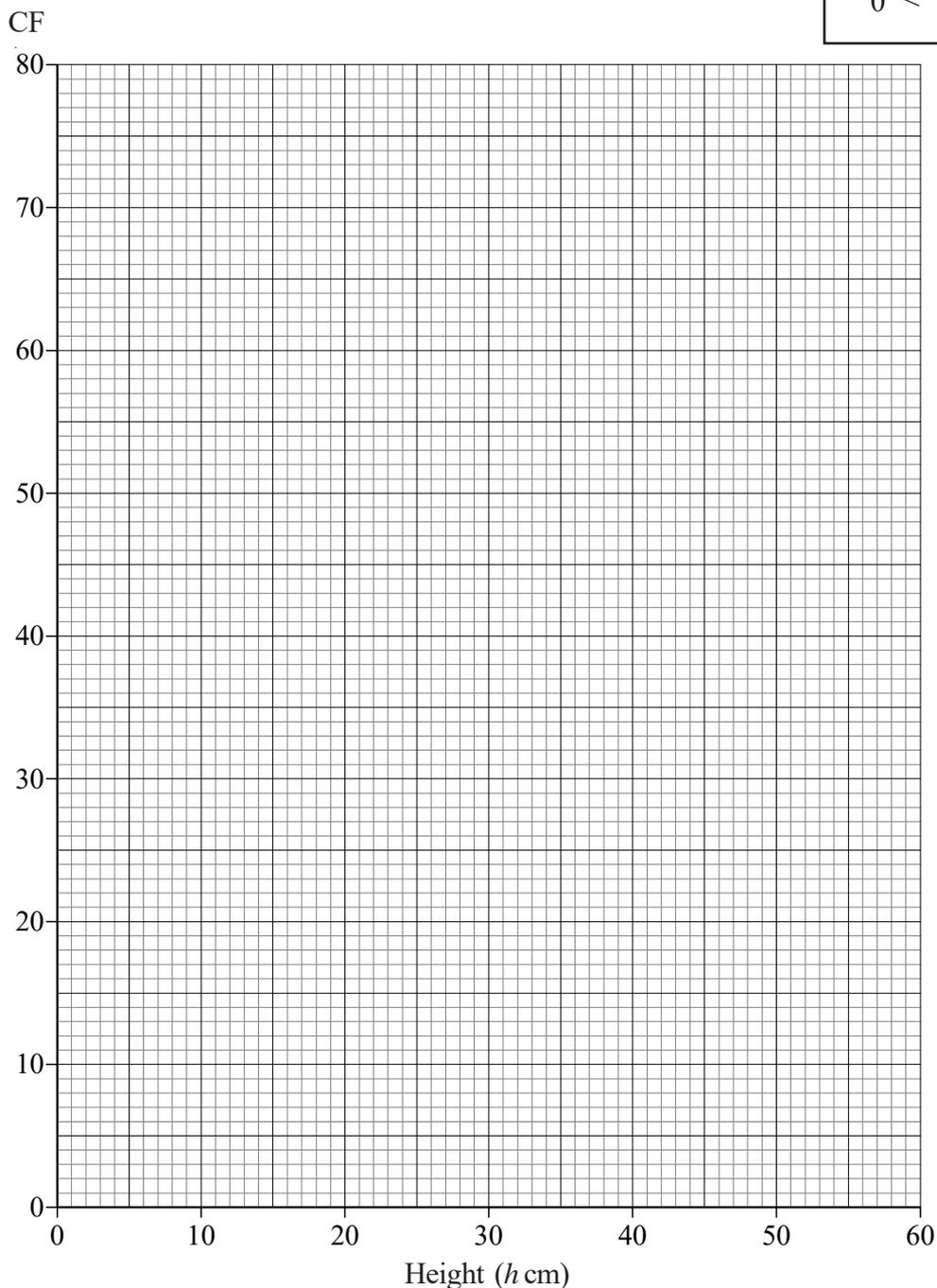
CF

Height (h cm)

b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.

(ii) the interquartile range of the heights of the plants.

d) Use your graph to estimate how many plants had a height that was greater than 45cm.

Data Distribution - Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	7
$0 < h \leqslant 30$	26
$0 < h \leqslant 40$	64
$0 < h \leqslant 50$	77
$0 < h \leqslant 60$	80
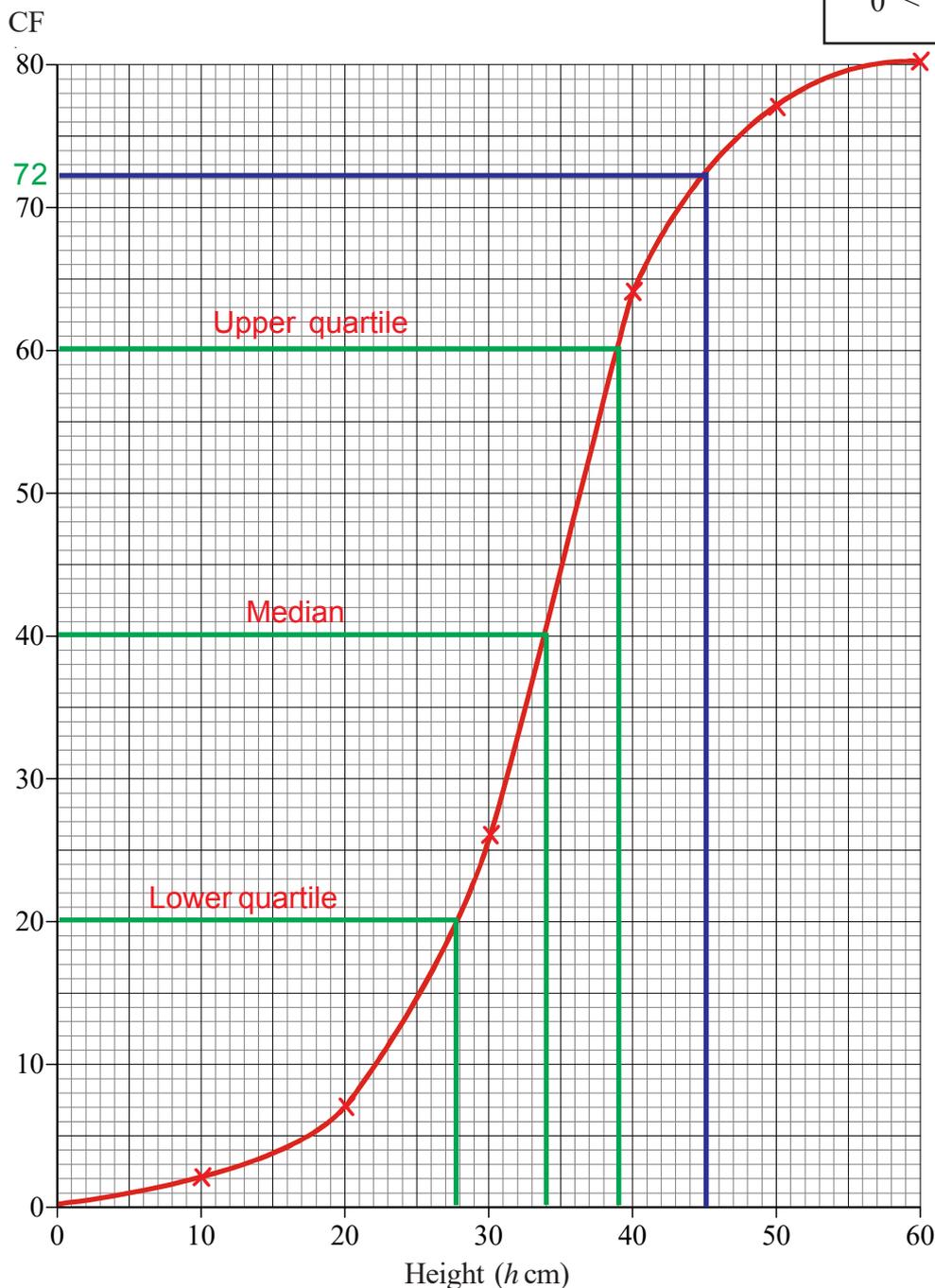
b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

   (i) the median height of a plant.
                    34 cm
   (ii) the interquartile range of the heights of the plants.
       39 – 27.7 = **11.3 cm**

d) Use your graph to estimate how many plants had a height that was greater than 45cm.
       80 – 72 = **8 plants**

CF

Upper quartile

Median

Lower quartile

Height (h cm)

Page 164 A

Data Distribution - Cumulative Frequency

The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n < 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n < 40$	
$0 < n < 60$	
$0 < n \leqslant 80$	
$0 < n < 100$	
$0 < n < 120$	

b) On the grid, draw a cumulative frequency graph for your table.
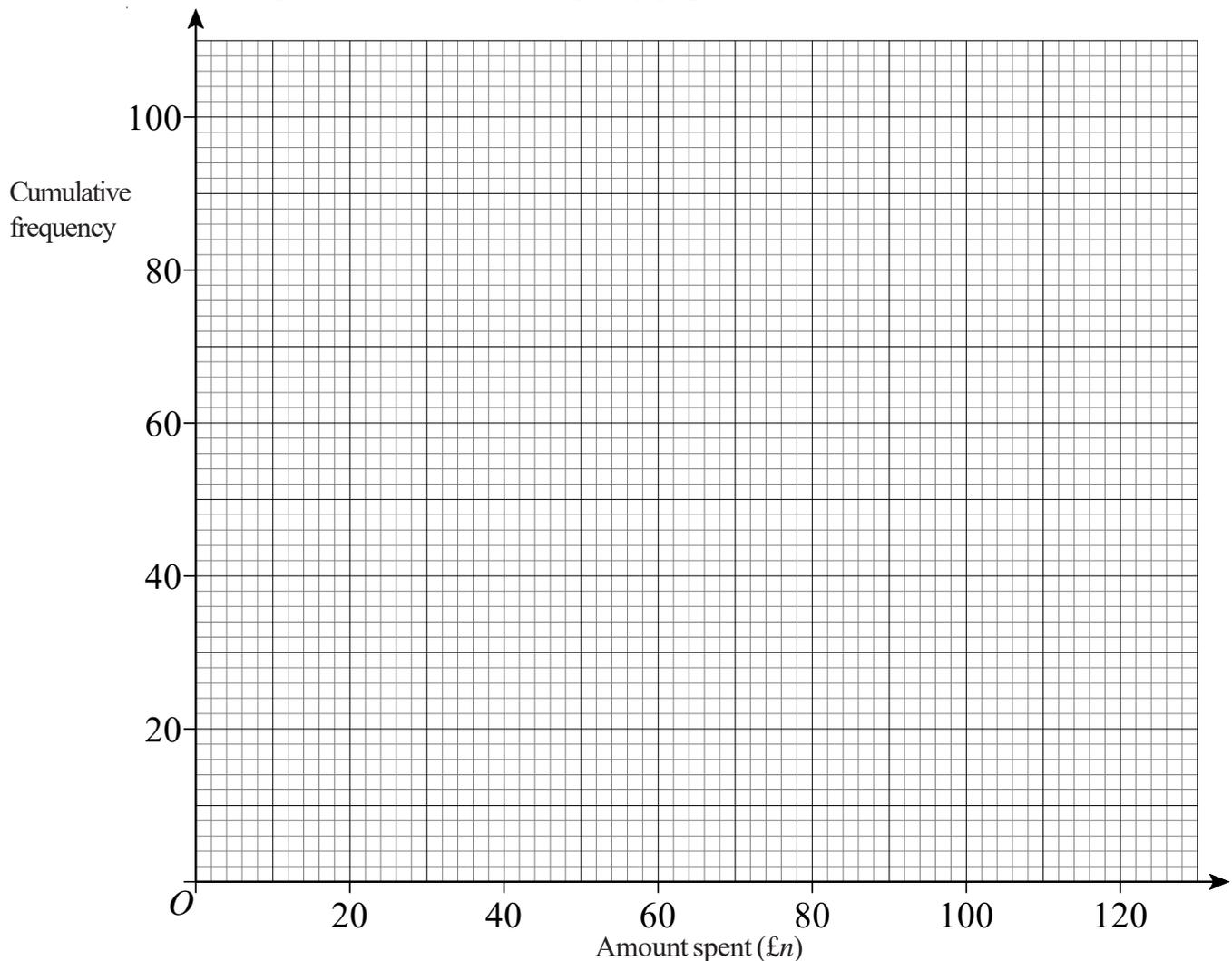
c) Use your graph to find an estimate for the median amount spent.

d) Use your graph to find an estimate for the interquartile range of the amount of money spent.

Data Distribution - Cumulative Frequency

The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n < 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n < 40$	40
$0 < n < 60$	76
$0 < n \leqslant 80$	90
$0 < n < 100$	98
$0 < n < 120$	100

b) On the grid, draw a cumulative frequency graph for your table.
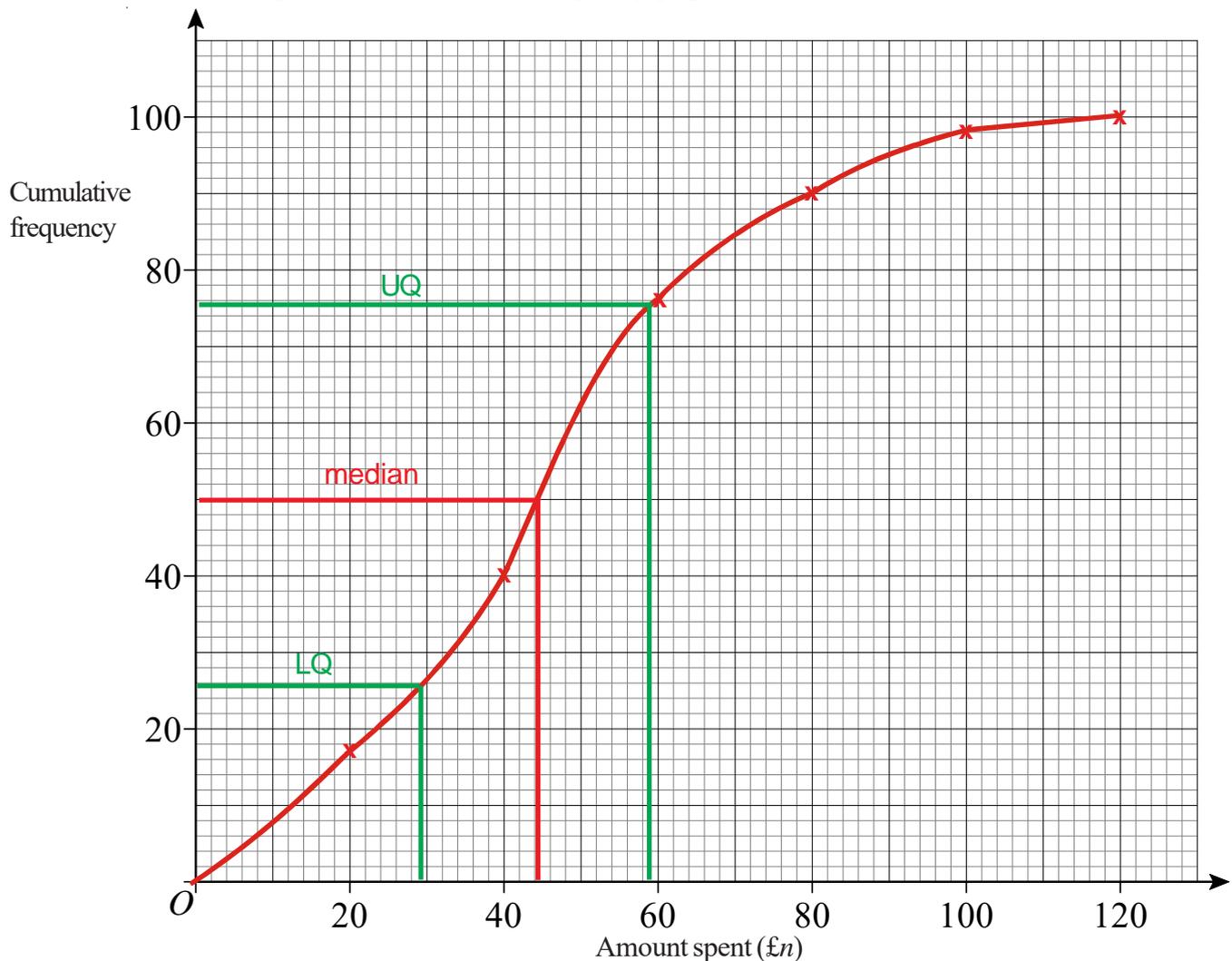
c) Use your graph to find an estimate for the median amount spent. £44

d) Use your graph to find an estimate for the interquartile range of the amount of money spent. £59 − £29 = £30

Data Distribution - Cumulative Frequency

Fred did a survey about the amount of money spent by 120 men at Christmas.

The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
0 < A < 100	12
0 < A < 150	26
0 < A < 200	42
0 < A < 250	64
0 < A < 300	93
0 < A < 350	112
0 < A < 400	120

a) On the grid, draw a cumulative frequency diagram.

Cumulative frequency

b) Use your cumulative frequency diagram to estimate the median.

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent.

d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.

Amount spent (£)

Page 164 C

Data Distribution - Cumulative Frequency

Fred did a survey about the amount of money spent by 120 men at Christmas.

The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
0 < A < 100	12
0 < A < 150	26
0 < A < 200	42
0 < A < 250	64
0 < A < 300	93
0 < A < 350	112
0 < A < 400	120

a) On the grid, draw a cumulative frequency diagram.

Cumulative frequency

b) Use your cumulative frequency diagram to estimate the median.
    £240

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent. £295 – £160 = £135

d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.
    14

Amount spent (£)

Data Distribution - Cumulative Frequency

The table gives some information about the delay, in minutes, of 80 trains.

a) Complete the cumulative frequency table.

Delay (*n* minutes)	Frequency
$0 < n < 20$	16
$20 < n \leqslant 30$	27
$30 < n < 40$	22
$40 < n \leqslant 50$	10
$50 < n < 60$	5

Delay (*n* minutes)	Cumulative Frequency
$0 < n < 20$	
$0 < n < 30$	
$0 < n < 40$	
$0 < n < 50$	
$0 < n < 60$	

b) On the grid below, draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for
   (i) the median delay.
   (ii) the interquartile range of the delays.
   (iii) the number of trains delayed for more than 53 minutes.

Page 164 D

Data Distribution - Cumulative Frequency

The table gives some information about the delay, in minutes, of 80 trains.

a)   Complete the cumulative frequency table.

Delay (*n* minutes)	Frequency
0 < *n* < 20	16
20 < *n* ≤ 30	27
30 < *n* ≤ 40	22
40 < *n* ≤ 50	10
50 < *n* < 60	5

Delay (*n* minutes)	Cumulative Frequency
0 < *n* < 20	16
0 < *n* < 30	43
0 < *n* < 40	65
0 < *n* < 50	75
0 < *n* < 60	80

b)   On the grid below, draw a cumulative frequency graph for your table.
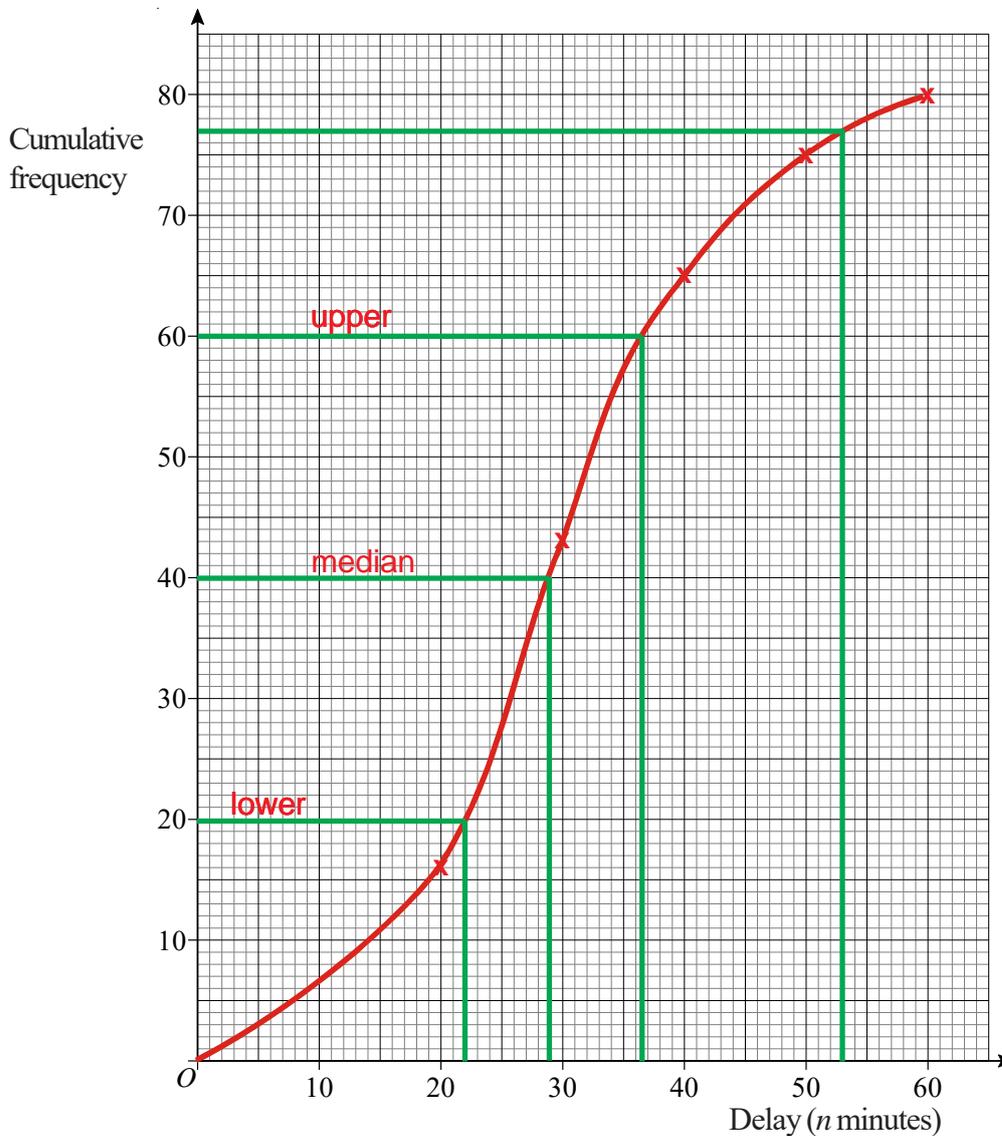
c)   Use your graph to find an estimate for

(i)   the median delay.   29 minutes

(ii)   the interquartile range of the delays.   36.5 – 22 = 14.5 minutes

(iii)   the number of trains delayed for more than 53 minutes.   3
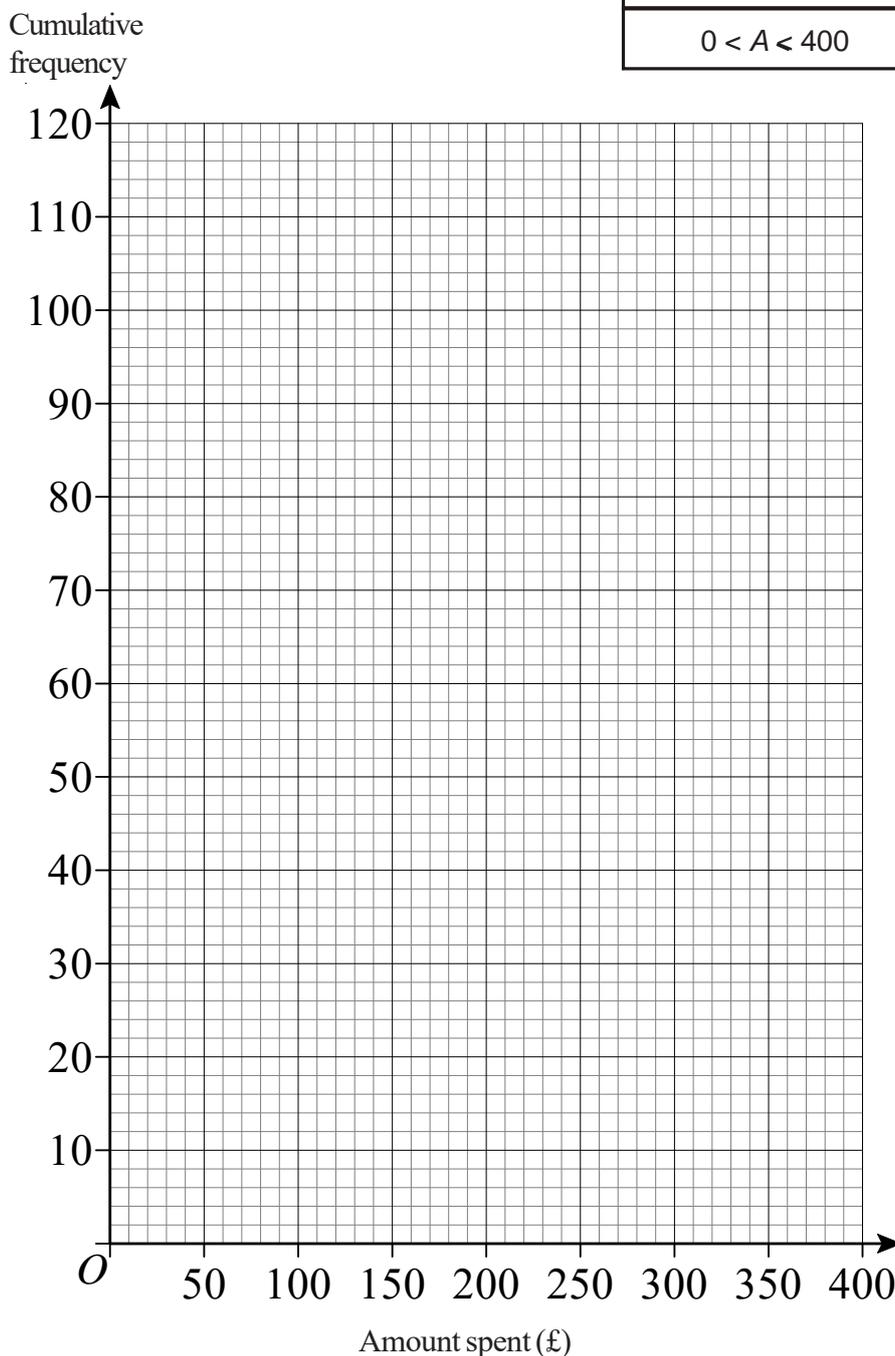
Page 164 D

Data Distribution - Cumulative Frequency

There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results.   a) Complete the cumulative frequency table

Age (*A* years)	Frequency
20 < *A* < 30	25
30 < *A* < 40	36
40 < *A* < 50	22
50 < *A* < 60	11
60 < *A* < 70	6

Age (*A* years)	Cumulative Frequency
20 < *A* < 30	25
20 < *A* < 40	
20 < *A* < 50	
20 < *A* < 60	
20 < *A* < 70	

b)   On the grid, draw a cumulative frequency graph for your table.

Cumulative frequency

Age (*A* years)
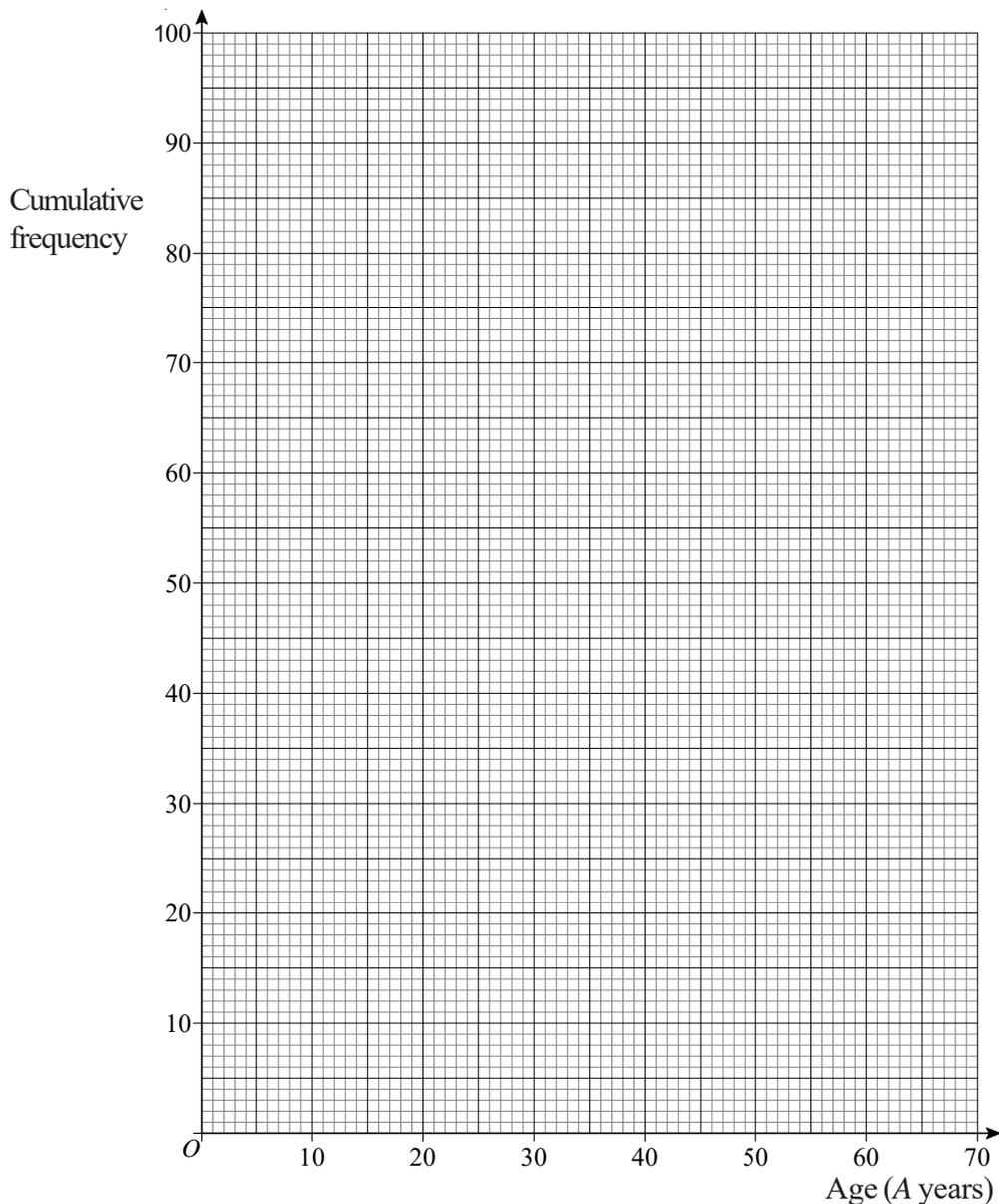
c)   Use your graph to find an estimate for the median age.

d)   Use your graph to find an estimate for the number of these teachers
     who are **older** than 56 years old.

Data Distribution - Cumulative Frequency

There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results. a) Complete the cumulative frequency table

Age (A years)	Frequency
20 < A < 30	25
30 < A < 40	36
40 < A < 50	22
50 < A < 60	11
60 < A < 70	6

Age (A years)	Cumulative Frequency
20 < A < 30	25
20 < A < 40	61
20 < A < 50	83
20 < A < 60	94
20 < A < 70	100

b) On the grid, draw a cumulative frequency graph for your table.
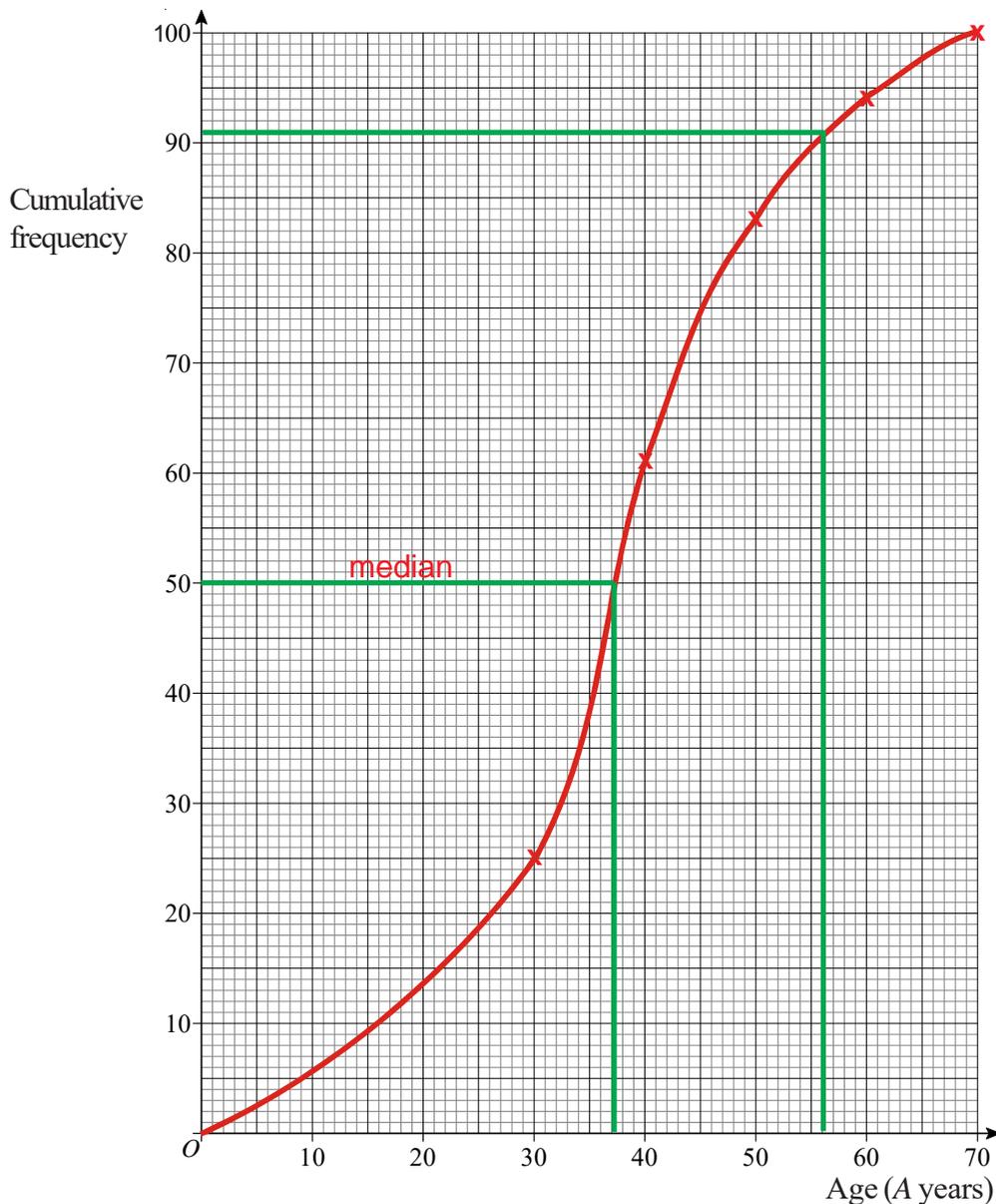
c) Use your graph to find an estimate for the median age. 37 years
d) Use your graph to find an estimate for the number of these teachers
    who are **older** than 56 years old. 9

Data Distribution - Cumulative Frequency

This table shows information about the time, *m* minutes, it takes to show each of 120 films.

Time (*m* minutes)	Frequency
70 < *m* ⩽ 80	3
80 < *m* ⩽ 90	13
90 < *m* ⩽ 100	34
100 < *m* ⩽ 110	32
110 < *m* ⩽ 120	26
120 < *m* ⩽ 130	12

a) Write down the modal class interval.

b) Complete this cumulative frequency table.

Time (*m* minutes)	Cumulative frequency
70 < *m* ⩽ 80	3
70 < *m* ⩽ 90	
70 < *m* ⩽ 100	
70 < *m* ⩽ 110	
70 < *m* ⩽ 120	
70 < *m* ⩽ 130	

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.
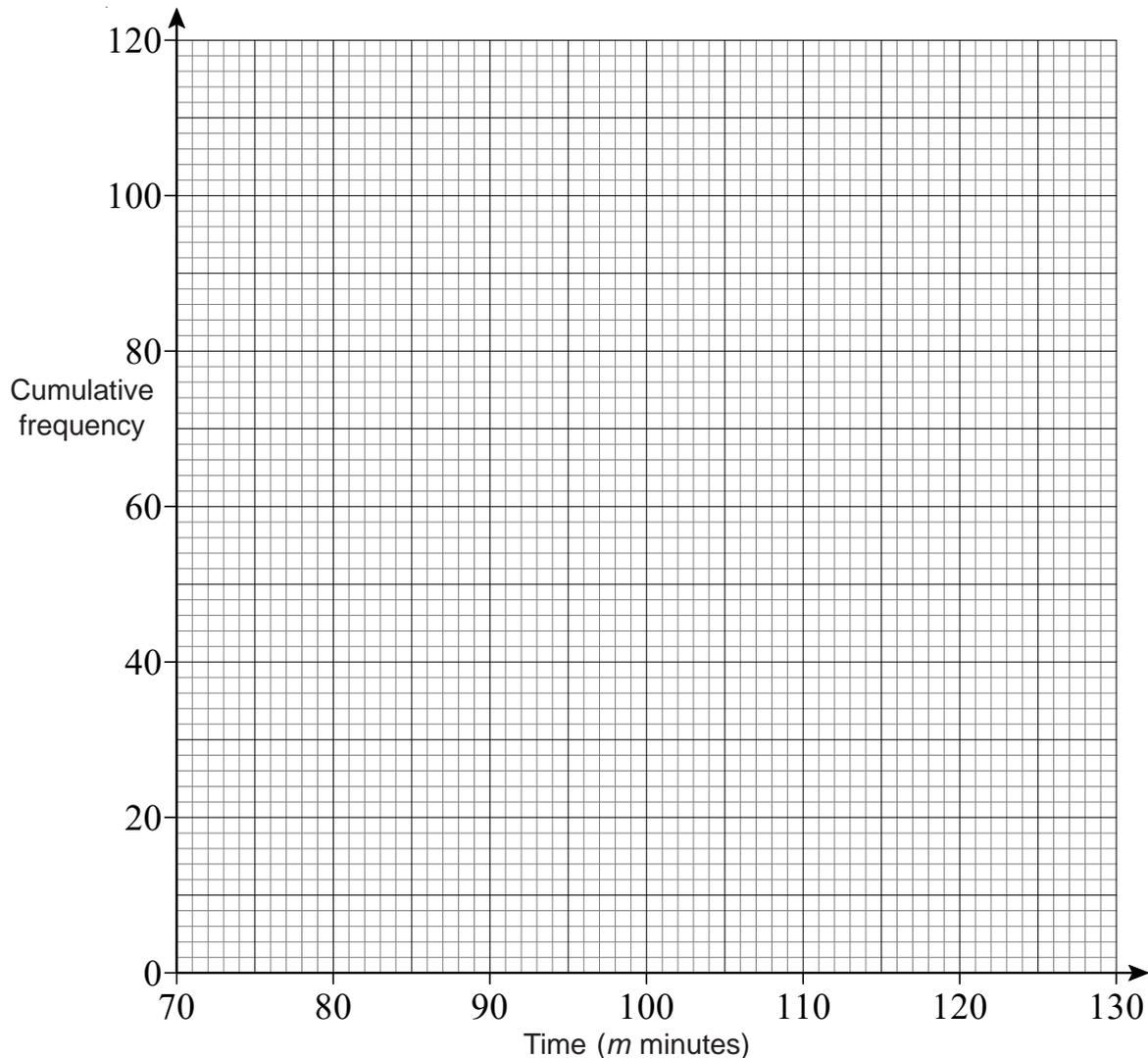
d) Use your graph to find an estimate for the median.

e) Use your graph to find an estimate for the interquartile range of times.

f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show.

Page 164 F

Data Distribution - Cumulative Frequency

This table shows information about the time, *m* minutes, it takes to show each of 120 films.

Time (*m* minutes)	Frequency
70 < *m* ⩽ 80	3
80 < *m* ⩽ 90	13
90 < *m* ⩽ 100	34
100 < *m* ⩽ 110	32
110 < *m* ⩽ 120	26
120 < *m* ⩽ 130	12

a) Write down the modal class interval.

$90 < m \leqslant 100$

b) Complete this cumulative frequency table.

Time (*m* minutes)	Cumulative frequency
70 < *m* ⩽ 80	3
70 < *m* ⩽ 90	16
70 < *m* ⩽ 100	50
70 < *m* ⩽ 110	82
70 < *m* ⩽ 120	108
70 < *m* ⩽ 130	120

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.
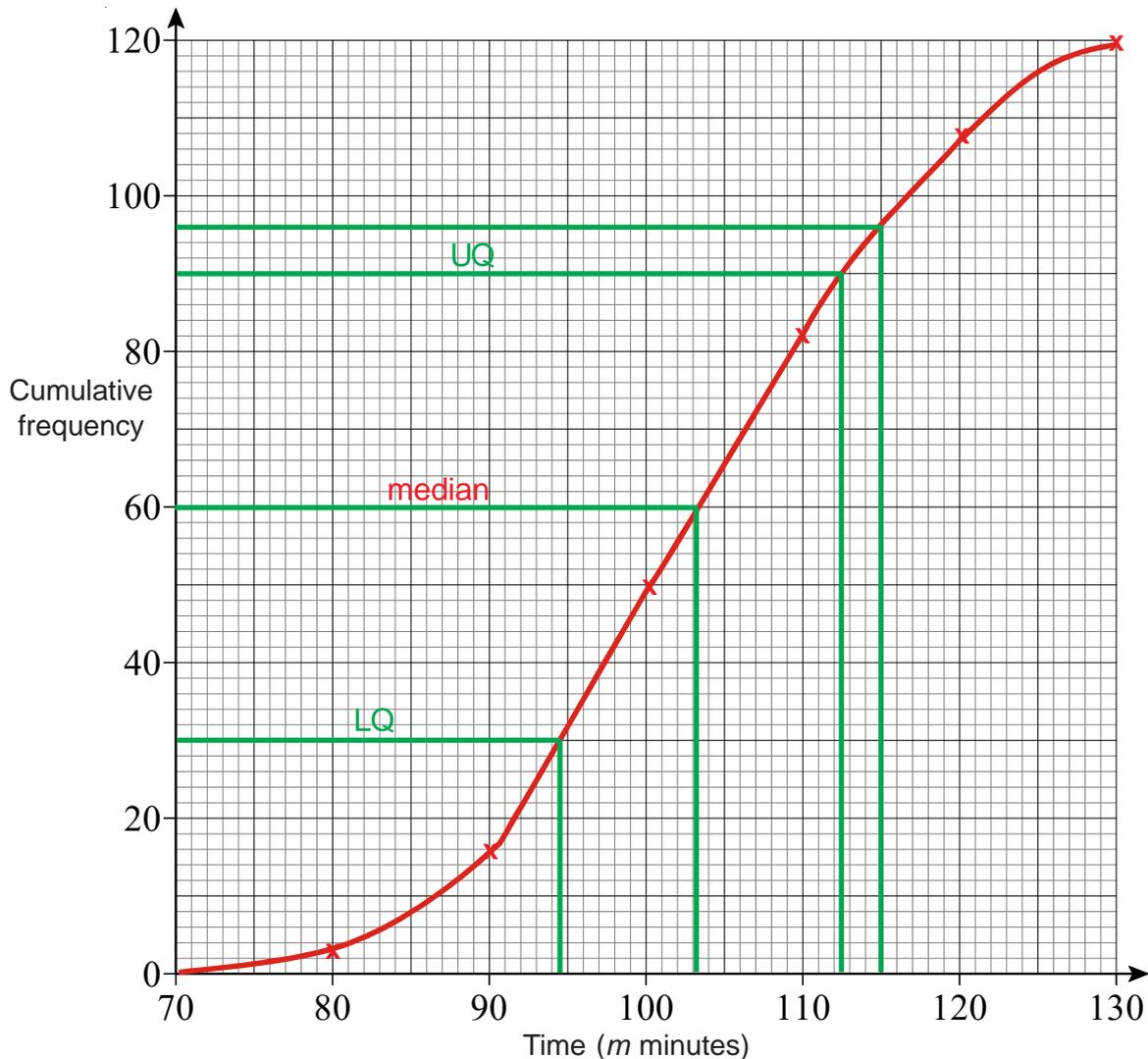
d) Use your graph to find an estimate for the median. 103 minutes

e) Use your graph to find an estimate for the interquartile range of times. 112.5 – 94.5 = 18 minutes

f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show. 24 films

Page 164 F

1) The ages of 20 teachers are listed below.

   22, 22, 24, 25, 27, 27, 28, 29, 29, 29, 34, 35, 41, 43, 44, 49, 55, 57, 58, 58

   a) On the grid below, draw a box plot to show the information about the teachers.

10   20   30   40   50   60   70
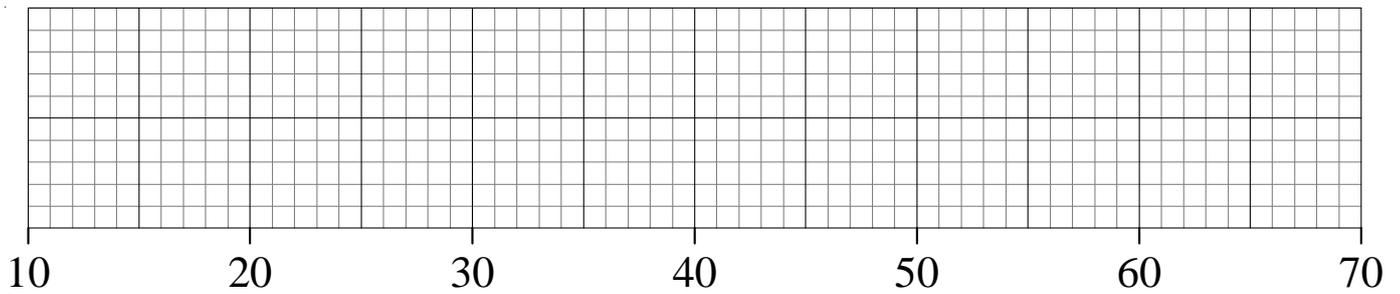
   b) What is the interquartile range of the ages of the teachers?

2) A warehouse has 60 employees working in it.

   The age of the youngest employee is 16 years.
   The age of the oldest employee is 55 years.

   The median age is 37 years.
   The lower quartile age is 29 years.
   The upper quartile age is 43 years.

   On the grid below, draw a box plot to show information about the ages of the employees.

10   20   30   40   50   60

1) The ages of 20 teachers are listed below.

27   31.5   46.5

22, 22, 24, 25, 27, 27, 28, 29, 29, 29, 34, 35, 41, 43, 44, 49, 55, 57, 58, 58

a) On the grid below, draw a box plot to show the information about the teachers.

b) What is the interquartile range of the ages of the teachers?   19.5 years

2) A warehouse has 60 employees working in it.

The age of the youngest employee is 16 years.
The age of the oldest employee is 55 years.

The median age is 37 years.
The lower quartile age is 29 years.
The upper quartile age is 43 years.

On the grid below, draw a box plot to show information about the ages of the employees.

Terry drew a line of length 60 cm.
He asked some children to estimate the length of the line he had drawn.
He recorded their estimates.
The box plot gives some information about these estimates.

Children's estimates

Size of estimate in cm

Adults' estimates

a)   Write down the median of the children's estimates.

b)   Write down the interquartile range of the children's estimates.

Terry then asked some adults to estimate the length of the line he had drawn.
The table gives some information about the adults' estimates.

	Length
Lowest estimate	20 cm
Lower quartile	45 cm
Median	62 cm
Upper quartile	75 cm
Highest estimate	95 cm

c)   On the grid above, draw a box plot to show this information.

d)   Use the two box plots to compare the distribution of the children's estimates
        with the distribution of the adults' estimates.

Data Distribution - Boxplots (Box and Whisker)

Terry drew a line of length 60 cm.
He asked some children to estimate the length of the line he had drawn.
He recorded their estimates.
The box plot gives some information about these estimates.

Children's estimates

Size of estimate in cm

Adults' estimates

a)   Write down the median of the children's estimates.   55 cm

b)   Write down the interquartile range of the children's estimates.   74 – 47 = 27 cm

Terry then asked some adults to estimate the length of the line he had drawn.
The table gives some information about the adults' estimates.

	Length
Lowest estimate	20 cm
Lower quartile	45 cm
Median	62 cm
Upper quartile	75 cm
Highest estimate	95 cm

c)   On the grid above, draw a box plot to show this information.

d)   Use the two box plots to compare the distribution of the children's estimates
       with the distribution of the adults' estimates.
              The median estimate is bigger for adults
              or The interquartile range is bigger for adults
              or The range is bigger for adults

Page 164 H

1) The box plot gives information about the distribution of the weights of bags on a plane.

a) Claude says that the heaviest bag weighs 24 kg.
   He is **wrong**.
   Explain why.

b) Write down the median weight.

c) Work out the interquartile range of the weights.

There are 240 bags on the plane.

d) Work out the number of bags with a weight of 10 kg or less.

2) The box plots show the distribution of marks in a Science and Maths test for a group of students.
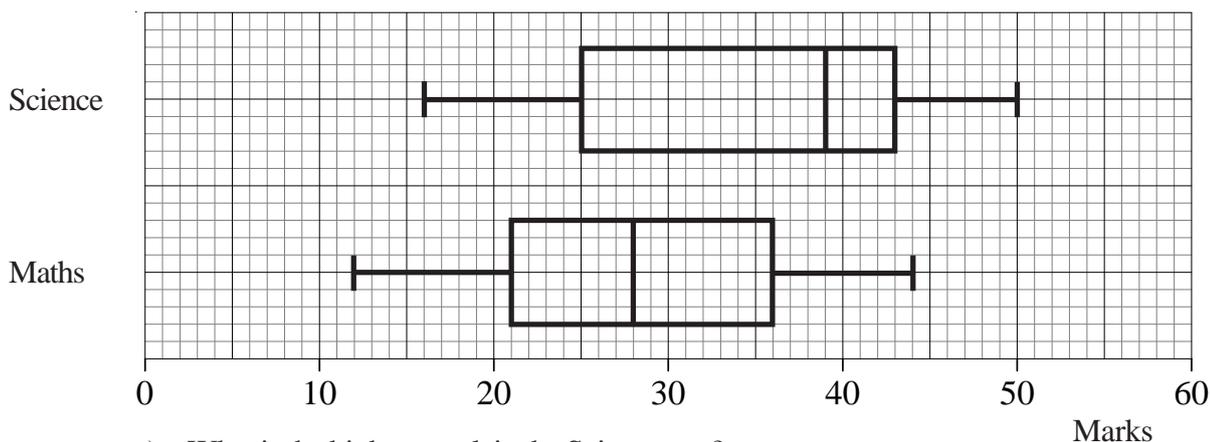
a) What is the highest mark in the Science test?

b) Compare the distribution of the marks in the Science test and marks in the Maths test.
   1 ....
   ....
   2 ....
   ....

Data Distribution - Boxplots (Box and Whisker)

1) The box plot gives information about the distribution of the weights of bags on a plane.
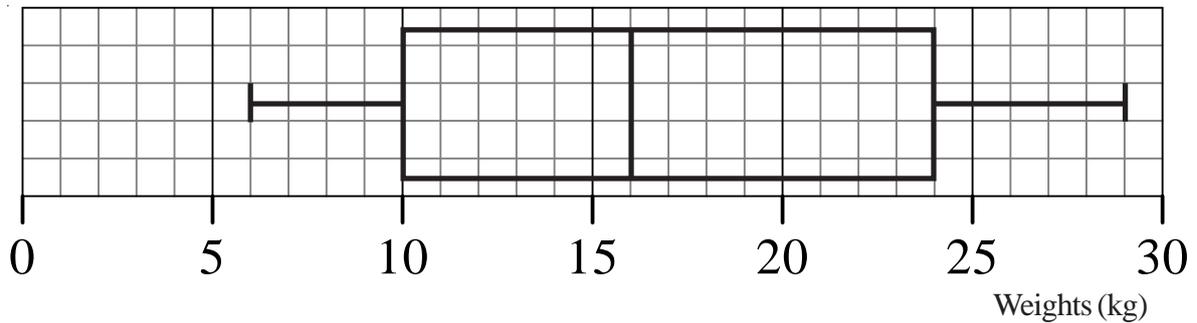
Weights (kg)

a) Claude says that the heaviest bag weighs 24 kg.

He is **wrong**.
Explain why.   The heaviest bag is 29 kg

b) Write down the median weight.   16 kg

c) Work out the interquartile range of the weights.   24 – 10 = 14 kg

There are 240 bags on the plane.

d) Work out the number of bags with a weight of 10 kg or less.   60 bags
10 kg is the lower quartile which means a quarter of
240 bags are 10 kg or less. A quarter of 240 is 60.

2) The box plots show the distribution of marks in a Science and Maths test for a group of students.
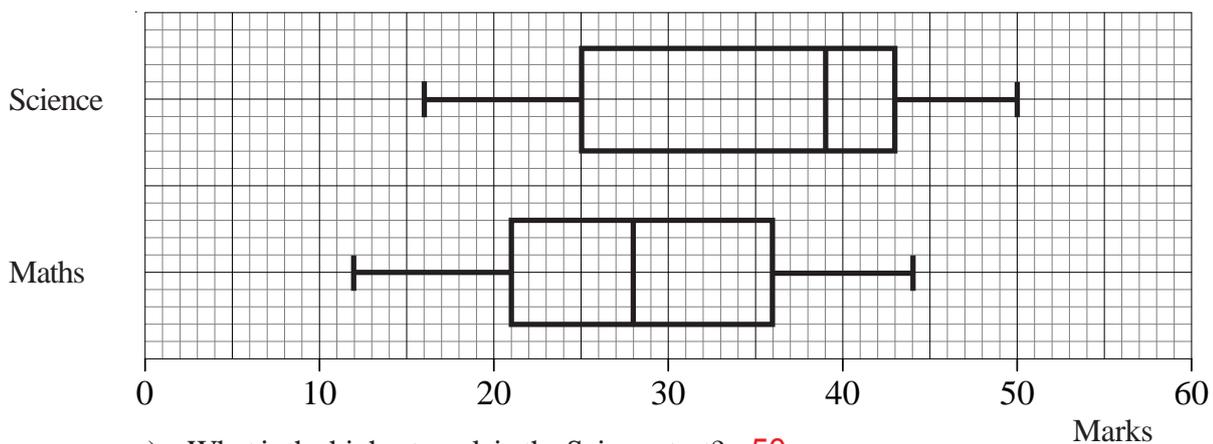
Marks

a) What is the highest mark in the Science test?   50

b) Compare the distribution of the marks in the Science test and marks in the Maths test.
1 ...The interquartile range for Science is bigger than for Maths.........
....
2 ...The median Science mark is bigger than the median Maths mark.
....

Data Distribution - Boxplots (Box and Whisker)

1) The incomplete box plot and table show some information about some marks.
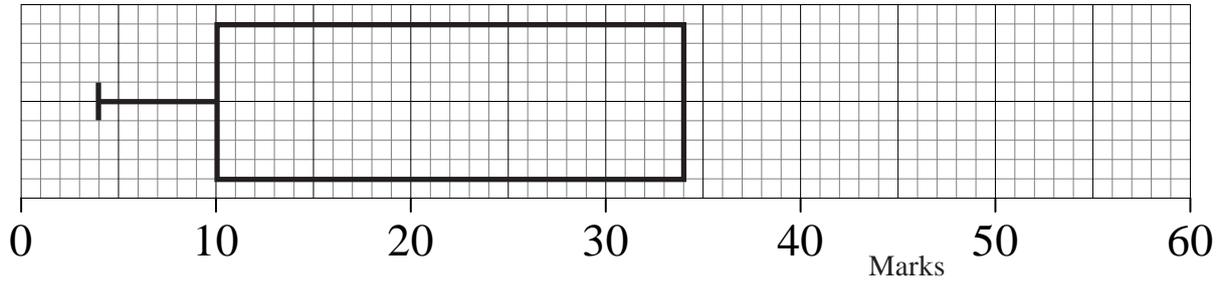
	Marks
Lowest mark	4
Lower quartile	
Median	30
Upper quartile	34
Highest mark	55

a) Use the information in the table to complete the box plot.

b) Use the information in the box plot to complete the table.

2) Kim measured the height, in cm, of each tomato plant in her greenhouse.
   She used the results to draw the box plot shown below.

a) Write down the median height.

b) Work out the interquartile range.

c) Explain why the interquartile range may be a better measure of
   spread than the range.

Data Distribution - Boxplots (Box and Whisker)

1) The incomplete box plot and table show some information about some marks.

0   10   20   30   40   50   60
Marks
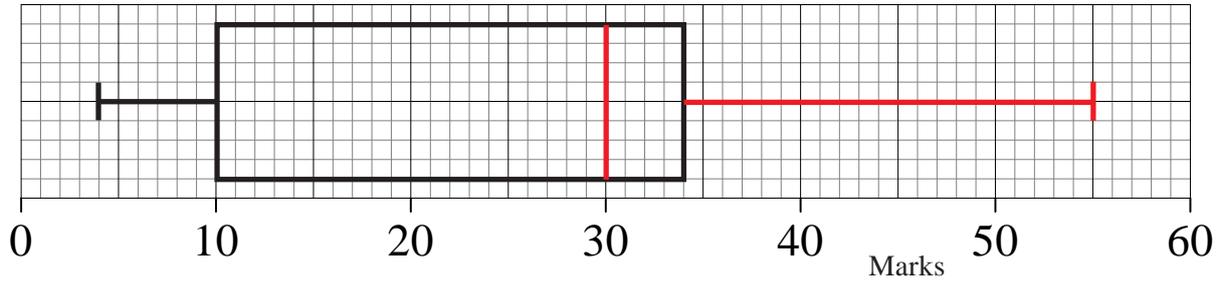
	Marks
Lowest mark	4
Lower quartile	10
Median	30
Upper quartile	34
Highest mark	55

a) Use the information in the table to complete the box plot.

b) Use the information in the box plot to complete the table.

2) Kim measured the height, in cm, of each tomato plant in her greenhouse.
   She used the results to draw the box plot shown below.

10   11   12   13   14   15   16   17
Height (cm)
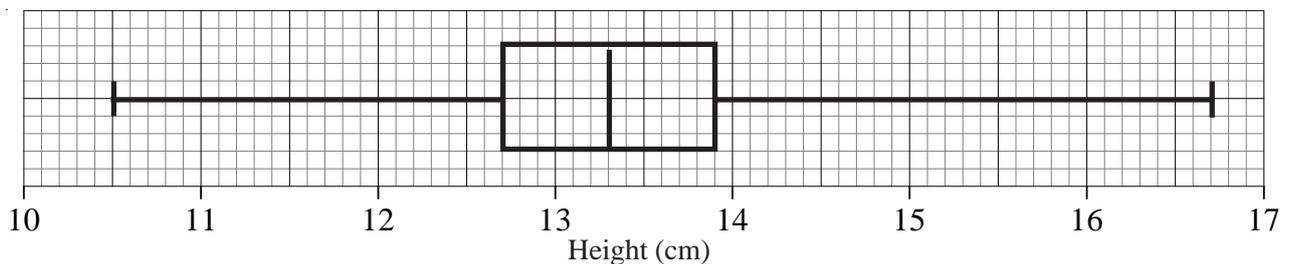
a) Write down the median height.   13.3 cm

b) Work out the interquartile range.   13.9 – 12.7 = 1.2 cm

c) Explain why the interquartile range may be a better measure of
   spread than the range.   It avoids the outlandishly tall and short plants.

1)   The cumulative frequency diagram shows the test scores for class X
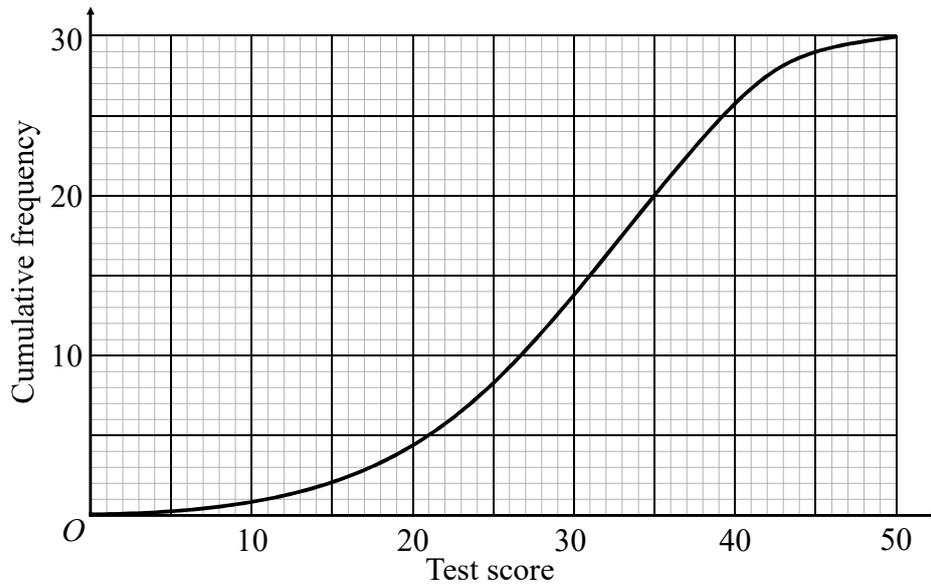
a) Find the median

b) Calculate the interquartile range

The box-and-whisker diagram shows the test scores for class Y
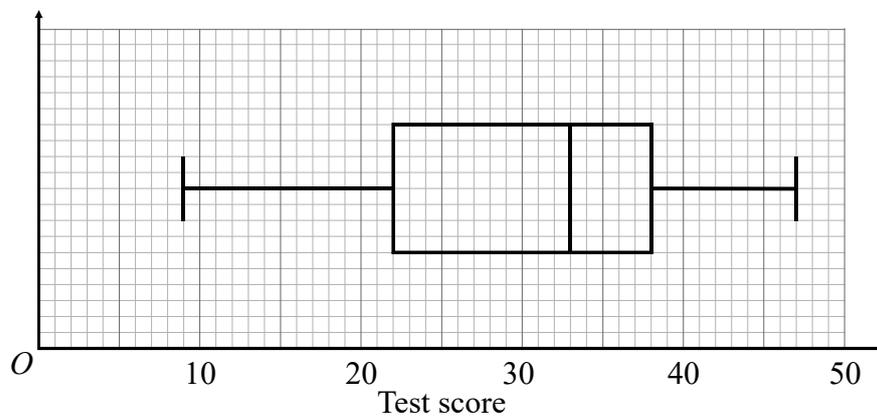
c) Find the median

d) Find the interquartile range

e) Compare the test scores between class X and class Y

1) The cumulative frequency diagram shows the test scores for class X
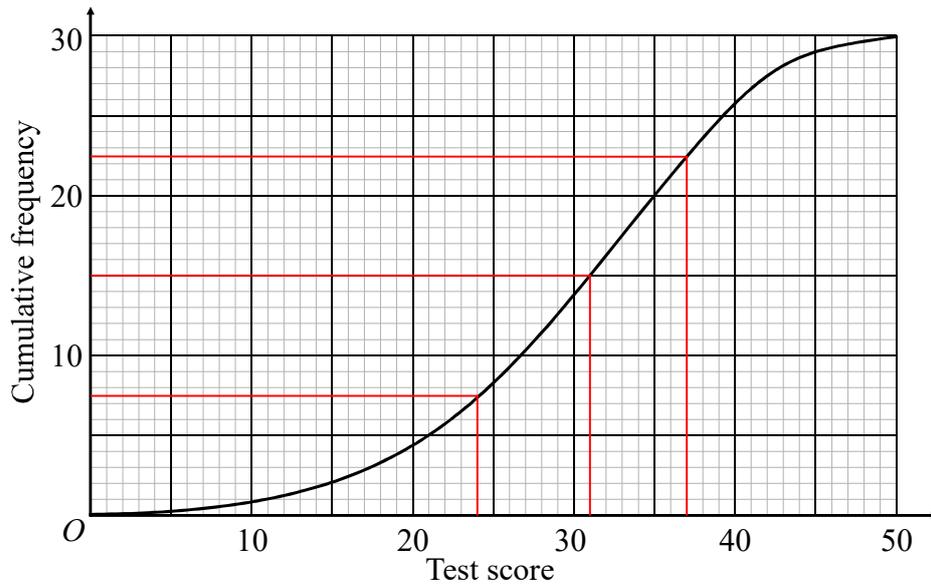
a) Find the median
31

b) Calculate the interquartile range
37 – 24 = 13

The box-and-whisker diagram shows the test scores for class Y
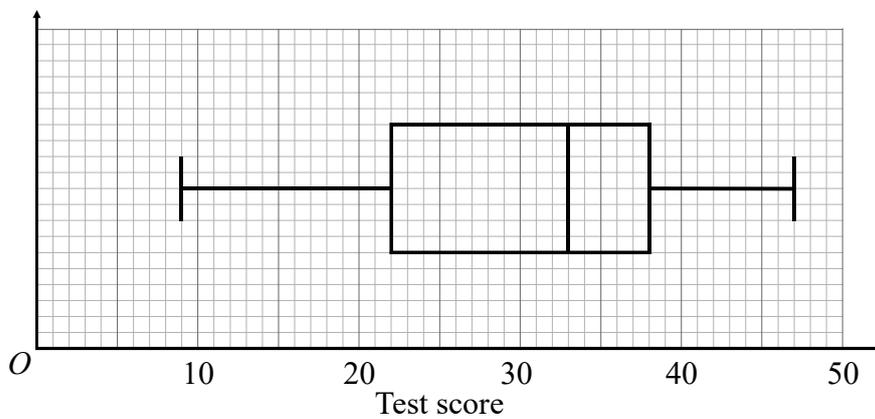
c) Find the median
33

d) Find the interquartile range
38 – 22 = 16

e) Compare the test scores between class X and class Y
On average, class Y achieved higher test scores.
However class X showed greater consistency in their results.

2) The cumulative frequency graph shows the times (in minutes) taken by 80 workers to travel to work at Company A.
The box plot shows the times (in minutes) taken by 50 workers to travel to work at Company B.
Compare the travel times of the workers at the two companies.
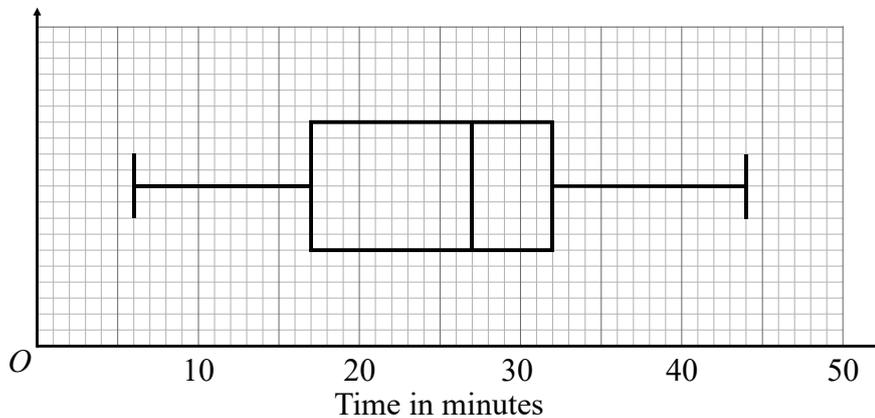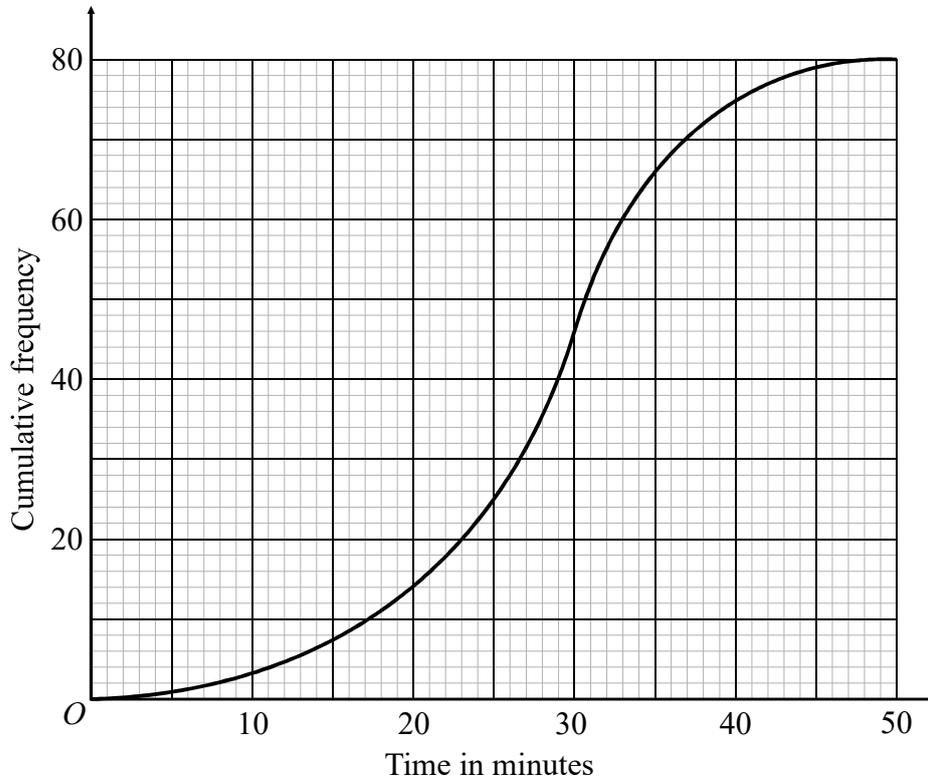
2) The cumulative frequency graph shows the times (in minutes) taken by 80 workers to travel to work at Company A.
The box plot shows the times (in minutes) taken by 50 workers to travel to work at Company B.
Compare the travel times of the workers at the two companies.
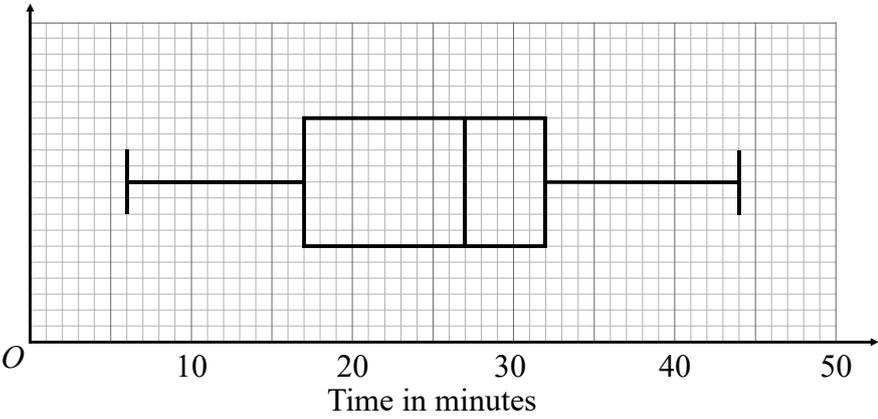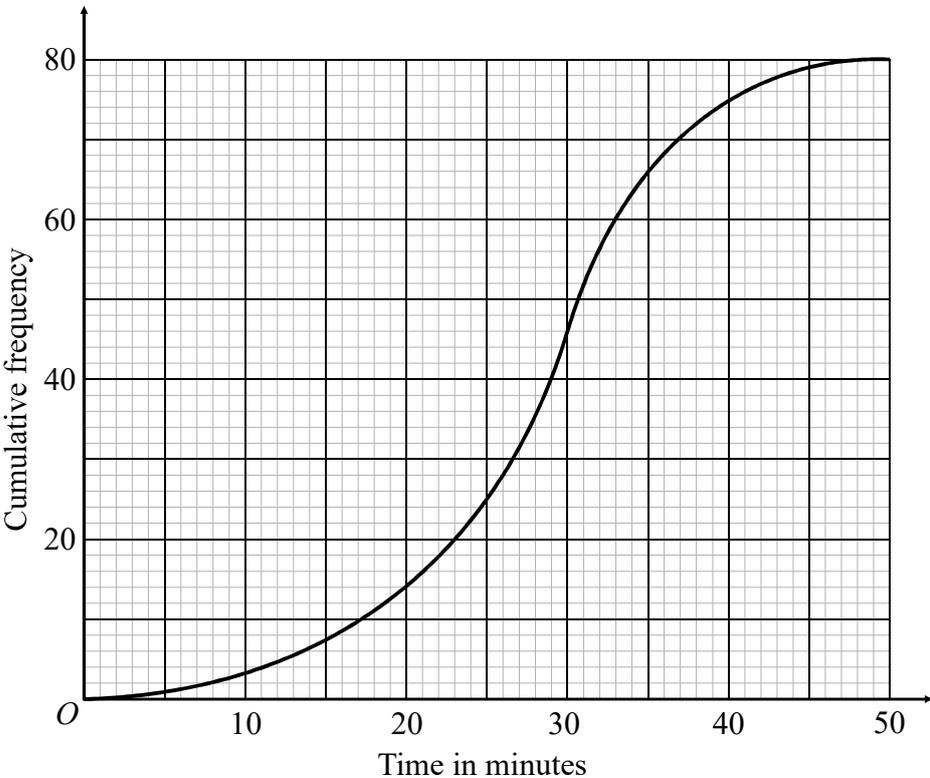
Company A:
Median = 29   IQR = 33 – 23 = 10

Company B:
Median = 27   IQR = 32 – 17 = 15

On average, workers at company A took longer to travel to work.
Company A were also more consistent with their travel times.

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
   Jerry takes at random a pen from the box and gives the pen to his friend.
   Jerry then takes at random another pen from the box.
   Work out the probability that both pens are the same colour.

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
   Jack takes a sweet at random.
   He eats the sweet.
   He then takes another sweet at random.

   Work out the probability that both sweets are the same colour.

3) There are 13 buttons in a bag.
           9 buttons are white.
           4 buttons are black.
   Carol takes a button at random from the bag, and keeps it.
   She now takes another button from the bag.

   Work out the probability that Carol takes a button of each colour.

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
   Jerry takes at random a pen from the box and gives the pen to his friend.
   Jerry then takes at random another pen from the box.
   Work out the probability that both pens are the same colour. $\frac{28}{90}$

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
   Jack takes a sweet at random.
   He eats the sweet.
   He then takes another sweet at random.

   Work out the probability that both sweets are the same colour. $\frac{20}{72}$

3) There are 13 buttons in a bag.
          9 buttons are white.
          4 buttons are black.
   Carol takes a button at random from the bag, and keeps it.
   She now takes another button from the bag.

   Work out the probability that Carol takes a button of each colour. $\frac{72}{156}$

1)   A bag contains 7 green and 3 yellow balls.
     A ball is taken from the bag at random and not replaced.
     Another ball is taken from the bag at random.

     a)   Draw a tree diagram to show all the possibilities.
     b)   What is the probability that both balls are different colours?

2)   A box contains 5 red counters and 3 blue counters.
     A counter is taken from the box at random and not replaced.
     Another counter is taken at random.

     a)   Draw a tree diagram to show all the possibilities.
     b)   What is the probability of choosing at least one blue counter?
     c)   What is the probability of choosing two counters of the
          same colour?
     d)   What is the probability of choosing two counters of
          different colours?

3)   A box contains 4 red counters and 3 blue counters.
     A counter is taken from the box at random and not replaced.
     A second counter is taken from the box at random and not replaced.
     A third counter is taken from the box.

     a)   Draw a tree diagram to show all the possibilities.
     b)   What is the probability that all three counters are the same colour?
     c)   What is the probability that exactly two of the counters are red?

Tree Diagrams - Advanced

1) A bag contains 7 green and 3 yellow balls.

a)

A ball is taken from the bag at random and not replaced.

Another ball is taken from the bag at random.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that both balls are different colours?
$\frac{42}{90}$
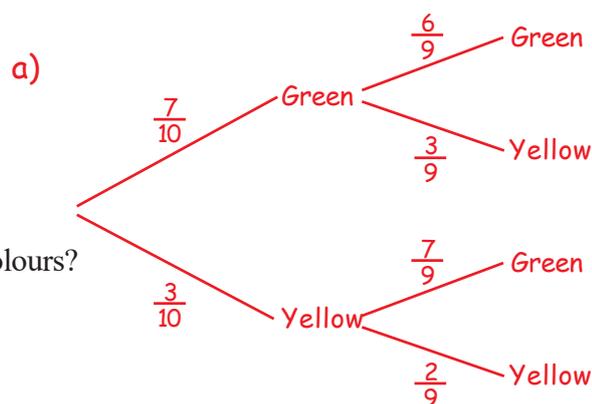
Tree diagram:
- $\frac{7}{10}$ Green → $\frac{6}{9}$ Green, $\frac{3}{9}$ Yellow
- $\frac{3}{10}$ Yellow → $\frac{7}{9}$ Green, $\frac{2}{9}$ Yellow

2) A box contains 5 red counters and 3 blue counters.

A counter is taken from the box at random and not replaced.

Another counter is taken at random.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability of choosing at least one blue counter? $\frac{36}{56}$

c) What is the probability of choosing two counters of the same colour? $\frac{26}{56}$

d) What is the probability of choosing two counters of different colours? $\frac{30}{56}$
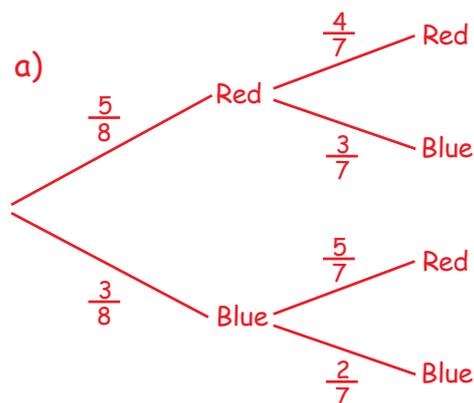
a)

Tree diagram:
- $\frac{5}{8}$ Red → $\frac{4}{7}$ Red, $\frac{3}{7}$ Blue
- $\frac{3}{8}$ Blue → $\frac{5}{7}$ Red, $\frac{2}{7}$ Blue

3) A box contains 4 red counters and 3 blue counters.

A counter is taken from the box at random and not replaced.

A second counter is taken from the box at random and not replaced.

A third counter is taken from the box.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that all three counters are the same colour? $\frac{30}{210}$

c) What is the probability that exactly two of the counters are red? $\frac{108}{210}$
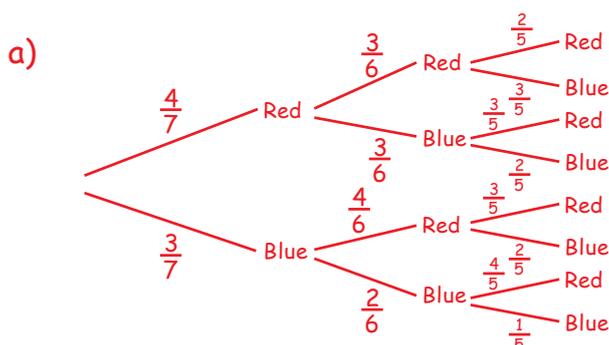
a)

Tree diagram:
- $\frac{4}{7}$ Red
  - $\frac{3}{6}$ Red → $\frac{2}{5}$ Red, $\frac{3}{5}$ Blue
  - $\frac{3}{6}$ Blue → $\frac{3}{5}$ Red, $\frac{2}{5}$ Blue
- $\frac{3}{7}$ Blue
  - $\frac{4}{6}$ Red → $\frac{3}{5}$ Red, $\frac{2}{5}$ Blue
  - $\frac{2}{6}$ Blue → $\frac{4}{5}$ Red, $\frac{1}{5}$ Blue

1) Sara has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Sara takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

a) Complete the probability tree diagram.

From A to B   From B to A

. . . .   Black

. . . . Black

                                 White
                   . . . .
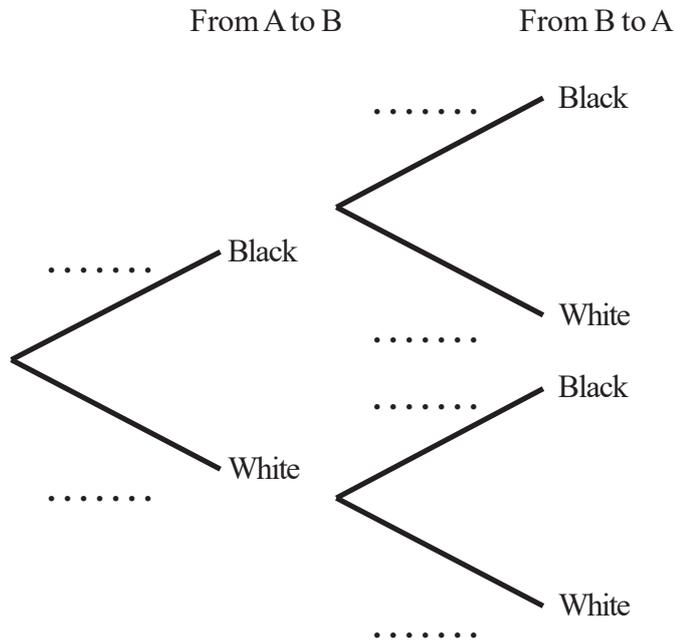
                   . . . . Black

. . . . White

                                 White
                   . . . .

b) Find the probability that after Sara has put the counters from box B into box A
there will still be 6 black counters and 4 white counters in box A.

1) Sara has two boxes.
   There are 6 black and 4 white counters in box A.
   There are 7 black and 3 white counters in box B.

   Sara takes at random a counter from box A and puts it in box B.
   She then takes at random a counter from box B and puts it in box A.

   a) Complete the probability tree diagram.

   From A to B   From B to A

   $\frac{8}{11}$ ...... Black

   $\frac{6}{10}$ ...... Black

   $\frac{3}{11}$ ...... White

   $\frac{7}{11}$ ...... Black

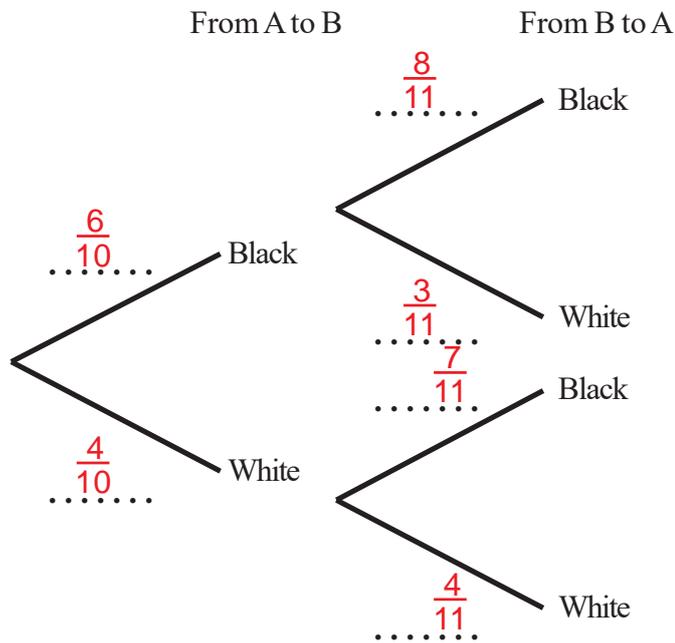 $\frac{4}{10}$ ...... White

   $\frac{4}{11}$ ...... White

   b) Find the probability that after Sara has put the counters from box B into box A
      there will still be 6 black counters and 4 white counters in box A. $\frac{64}{110}$

1)   In a class of 30 students, all of them have brothers or sisters or both.

19 have a brother.

16 have a sister.

a) Complete the Venn diagram.
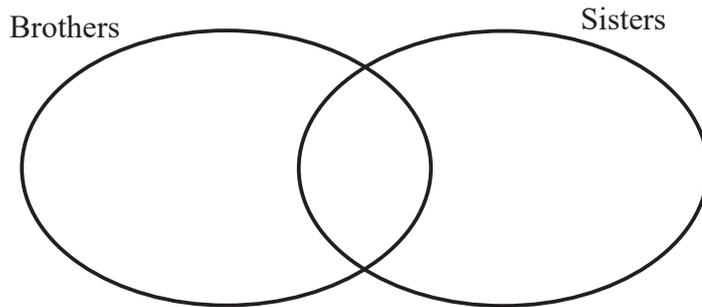
b) Find the probability that a student in the class has a brother and a sister.

c) If it is known that a student has a sister, what is the probability that they
     also have a brother?

2)   A cafeteria serves only main courses and desserts. Some people just have a main,
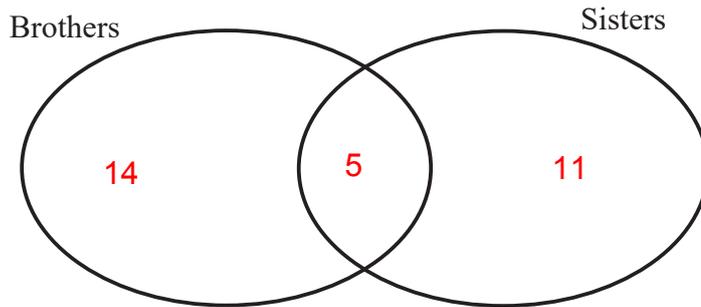   some have just a dessert and some have both.
       One day, 65% of the customers had a main course and 90% had a dessert.

a) Show this information on a Venn diagram.

b) What is the probability that a customer had a main course and a dessert?

c) If it is known that a customer had a dessert, what is the probability that
     they also had a main course?

1) In a class of 30 students, all of them have brothers or sisters or both.

19 have a brother.

16 have a sister.

a) Complete the Venn diagram.

b) Find the probability that a student in the class has a brother and a sister. $\dfrac{5}{30}$

c) If it is known that a student has a sister, what is the probability that they also have a brother? $\dfrac{5}{16}$

2) A cafeteria serves only main courses and desserts. Some people just have a main, some have just a dessert and some have both.

One day, 65% of the customers had a main course and 90% had a dessert.

a) Show this information on a Venn diagram.
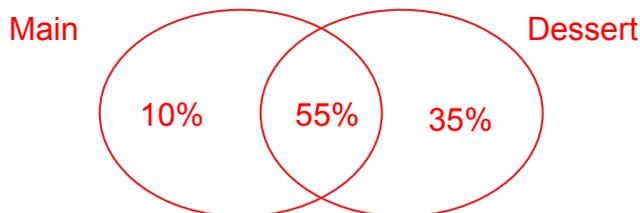
b) What is the probability that a customer had a main course and a dessert? $\dfrac{55}{100}$

c) If it is known that a customer had a dessert, what is the probability that they also had a main course? $\dfrac{55}{90}$

Fractional Indices

1) Simplify the following:

   a) $y^4 \times y^5$

   b) $x^2 \times x^6$

   c) $(p^4)^5$

   d) $(x^3)^2$

   e) $(x^4)^{-2}$

   f) $(x^{-3})^{-5}$

   g) $x^7 \div x^2$

   h) $\dfrac{t^5}{t^3}$

2) Work out the value of the following, leaving your answer in fraction form when necessary

   a) 5^0

   b) 4^{-2}

   c) 5^{-3}

   d) $49^{\frac{1}{2}}$

   e) $8^{\frac{1}{3}}$

   f) $32^{\frac{2}{5}}$

   g) $16^{-\frac{1}{2}}$

   h) $27^{-\frac{1}{3}}$

   i) $64^{-\frac{2}{3}}$

3) $5\sqrt{5}$ can be written in the form 5^n.

   Calculate the value of n.

4) $2\sqrt{8}$ can be written in the form 2^n.

   Calculate the value of n.

5) $a = 2^x, \ b = 2^y$

   Express in terms of a and b

   (i) 2^{x+y}

   (ii) 2^{2x}

   (iii) 2^{x+2y}

1) Simplify the following:

   a) $y^4 \times y^5$ y^9

   b) $x^2 \times x^6$ x^8

   c) $(p^4)^5$ p^{20}

   d) $(x^3)^2$ x^6

   e) $(x^4)^{-2}$ x^{-8}

   f) $(x^{-3})^{-5}$ x^{15}

   g) $x^7 \div x^2$ x^5

   h) $\dfrac{t^5}{t^3}$ t^2

2) Work out the value of the following, leaving your answer in fraction form when necessary

   a) 5^0 1

   b) 4^{-2} $\dfrac{1}{16}$

   c) 5^{-3} $\dfrac{1}{125}$

   d) $49^{\frac{1}{2}}$ 7

   e) $8^{\frac{1}{3}}$ 2

   f) $32^{\frac{2}{5}}$ 4

   g) $16^{-\frac{1}{2}}$ $\dfrac{1}{4}$

   h) $27^{-\frac{1}{3}}$ $\dfrac{1}{3}$

   i) $64^{-\frac{2}{3}}$ $\dfrac{1}{16}$

3) $5\sqrt{5}$ can be written in the form 5^n.

   Calculate the value of n. $1\frac{1}{2}$

4) $2\sqrt{8}$ can be written in the form 2^n.

   Calculate the value of n. $2\frac{1}{2}$

5) $a = 2^x, \ b = 2^y$

   Express in terms of a and b
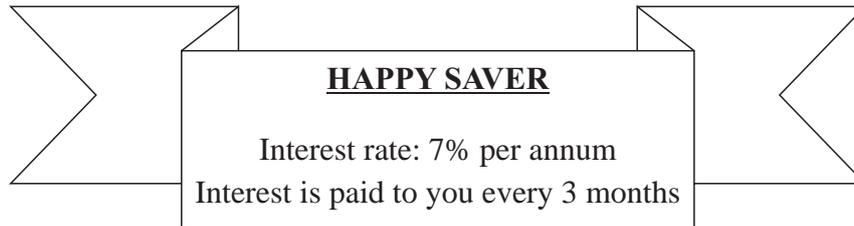
   (i) 2^{x+y} ab

   (ii) 2^{2x} a^2

   (iii) 2^{x+2y} ab^2

1) A bank is advertising the following savings account.

HAPPY SAVER

Interest rate: 7% per annum
Interest is paid to you every 3 months

Calculate the AER on this savings account.
Give your answer as a percentage correct to 2 decimal places.

2) Sandstone Building Society is advertising two different savings schemes.

Account	Nominal interest rate	AER to 2 d.p.
Marble Saver	5.8% p.a. paid quarterly	
Oak Saver	5.2% p.a. paid monthly	

a) Use the information given to work out the AER for both savings accounts.

b) Explain why AER is used.

3) Awstin opens a savings account with his local bank.
He invests £12 000 in an account that offers a nominal interest rate of 6.3% per annum, with interests paid every 4 months.
Awstin intends to keep the account for 5 years without any withdrawal or additional payment.

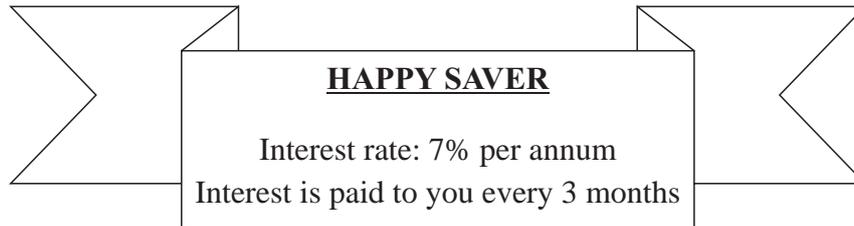Calculate the balance on Awstin's savings account at the end of the 5-year period.

Note:

$$\text{AER: } \left(1 + \frac{i}{n}\right)^n - 1$$

AER as a decimal, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1) A bank is advertising the following savings account.

HAPPY SAVER

Interest rate: 7% per annum
Interest is paid to you every 3 months

Calculate the AER on this savings account.
Give your answer as a percentage correct to 2 decimal places. 7.19%

2) Sandstone Building Society is advertising two different savings schemes.

Account	Nominal interest rate	AER to 2 d.p.
Marble Saver	5.8% p.a. paid quarterly	5.93%
Oak Saver	5.2% p.a. paid monthly	5.33%

a) Use the information given to work out the AER for both savings accounts.

b) Explain why AER is used.   It makes is easier to compare interest rates.

3) Awstin opens a savings account with his local bank.
He invests £12 000 in an account that offers a nominal interest rate of 6.3% per annum, with interests paid every 4 months.
Awstin intends to keep the account for 5 years without any withdrawal or additional payment.

Calculate the balance on Awstin's savings account at the end of the 5-year period. £16 389.56

Note:

$$\text{AER: } (1 + \frac{i}{n})^n - 1$$

AER as a decimal, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1) Here is a rectangle.
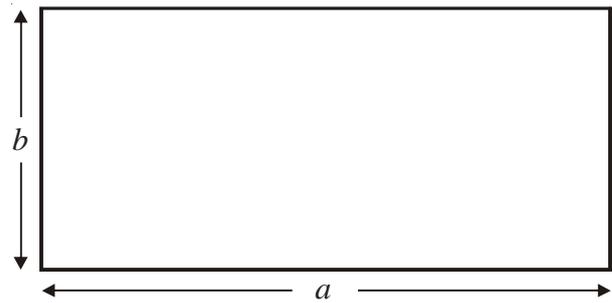
$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.

b

a

a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate
number of significant figures.

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle.

3) The voltage V of an electronic circuit is given by the formula

$$V = I R$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
$R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

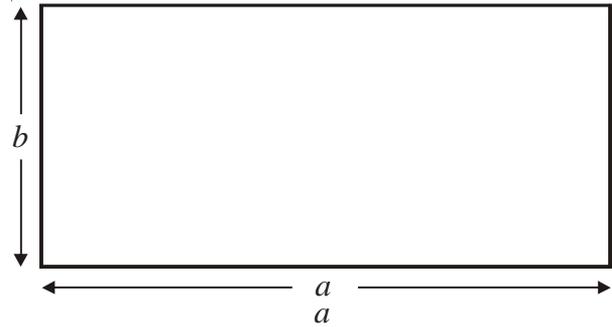$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
Give your answer correct to 2 decimal places.

Upper and Lower Bounds

1) Here is a rectangle.

a = 8.4 cm correct to 1 decimal place.
b = 3.6 cm correct to 1 decimal place.

b

a
a

a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

8.45 × 3.65 = 30.8425 cm²

b) Find the area of this rectangle correct to an appropriate
number of significant figures.

Lower bound for the area
is 29.6425 cm²

Area = 30 cm² correct to 1 significant figure

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

221000 mm²

b) Calculate the upper bound for the perimeter of the rectangle.

2100 mm

3) The voltage V of an electronic circuit is given by the formula

$$V = I R$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
             $R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

17.38955823 amps

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
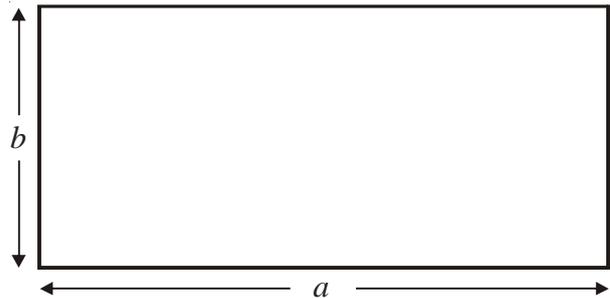Give your answer correct to 2 decimal places.

8.75 miles per litre

Upper and Lower Bounds

1)

The length of the rectangle, *a*,
is 45 cm correct to the nearest cm.

The width of the rectangle, *b*,
is 26 cm correct to the nearest cm.

Calculate the upper bound for the area of the rectangle.
Write down all the figures on your calculator display.

2) A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field.

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field.

3) A ball is thrown vertically upwards with a speed *V* metres per second.

The height, *H* metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where *g* m/s^2 is the acceleration due to gravity.

V = 24.4 correct to 3 significant figures.
g = 9.8 correct to 2 significant figures.

(i) Write down the lower bound of *g*.

(ii) Calculate the upper bound of *H*.
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\dfrac{a}{b}}$

a = 6.43 correct to 2 decimal places.
b = 5.514 correct to 3 decimal places.

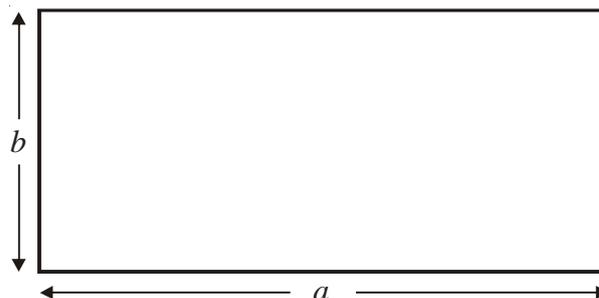By considering bounds, work out the value of *v* to a suitable degree of accuracy.

You must show all your working and give a reason for your final answer.

Page 169 B

Upper and Lower Bounds

1)

The length of the rectangle, *a*,
is 45 cm correct to the nearest cm.

The width of the rectangle, *b*,
is 26 cm correct to the nearest cm.

b (left side)

a (bottom)

Calculate the upper bound for the area of the rectangle.
Write down all the figures on your calculator display.   **1205.75 cm²**

2)   A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field.   **26.5 m**

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field.   **328 m**

3)   A ball is thrown vertically upwards with a speed *V* metres per second.

The height, *H* metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where *g* m/s² is the acceleration due to gravity.

V = 24.4 correct to 3 significant figures.
g = 9.8 correct to 2 significant figures.

(i)   Write down the lower bound of *g*.   **9.75 m/s**

(ii)   Calculate the upper bound of *H*.   **30.7 m**
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\dfrac{a}{b}}$

a = 6.43 correct to 2 decimal places.   **lower bound = 1.079402689**
b = 5.514 correct to 3 decimal places.   **upper bound = 1.080340323**

By considering bounds, work out the value of *v* to a suitable degree of accuracy.
v = 1.08 correct to two decimal places or three significant figures.
You must show all your working and give a reason for your final answer.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
   $B = 300$ correct to 1 significant figure
   $C = 9$ correct to the nearest integer

   a) Calculate the upper bound for $A + B$.

   b) Calculate the lower bound for $B \div C$.

   c) Calculate the least possible value of AC.

   d) Calculate the greatest possible value of $\dfrac{A + B}{B + C}$

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

   Using
   $T = 1.2$ correct to 1 decimal place
   $L = 4.50$ correct to 2 decimal places
   $x = 40$ correct to the nearest integer

   a) Calculate the lower bound for the value of g.
      Give your answer correct to 3 decimal places.

   b) Calculate the upper bound for the value of g.
      Give your answer correct to 3 decimal places.

3) The diagram shows a triangle ABC.

   $AB = 73$mm correct to 2 significant figures.
   $BC = 80$mm correct to 1 significant figure.
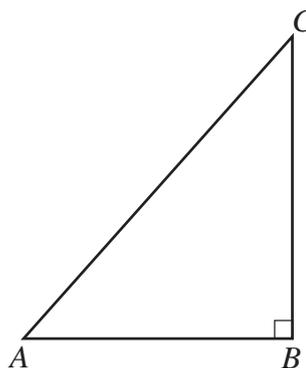
   Diagram **NOT**
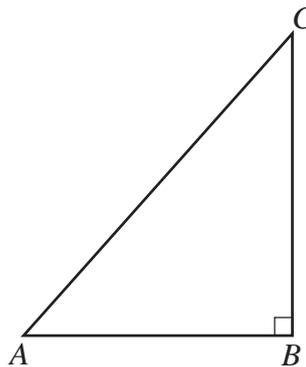   accurately drawn

   a) Write the upper and lower bounds of both AB and BC.

   $AB_{upper} = \ldots\ldots\ldots\ldots$ $BC_{upper} = \ldots\ldots\ldots\ldots$
   $AB_{lower} = \ldots\ldots\ldots\ldots$ $BC_{lower} = \ldots\ldots\ldots\ldots$

   b) Calculate the upper bound for the area of the triangle ABC.

   $\ldots\ldots\ldots\ldots$mm^2

   Angle $CAB = x°$

   c) Calculate the lower bound for the value of $\tan x°$.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
   $B = 300$ correct to 1 significant figure
   $C = 9$ correct to the nearest integer

   a) Calculate the upper bound for $A + B$.   **361.35**

   b) Calculate the lower bound for $B \div C$.   **26.3 (1dp)**

   c) Calculate the least possible value of AC.   **95.625**

   d) Calculate the greatest possible value of $\dfrac{A + B}{B + C}$ **1.4 (1dp)**

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

   Using
   $T = 1.2$ correct to 1 decimal place
   $L = 4.50$ correct to 2 decimal places
   $x = 40$ correct to the nearest integer

   a) Calculate the lower bound for the value of g.
      Give your answer correct to 3 decimal places.   **8.859**

   b) Calculate the upper bound for the value of g.
      Give your answer correct to 3 decimal places.   **10.711**

3) The diagram shows a triangle ABC.

   $AB = 73$mm correct to 2 significant figures.
   $BC = 80$mm correct to 1 significant figure.

   Diagram **NOT**
   accurately drawn

   a) Write the upper and lower bounds of both AB and BC.

   $AB_{upper} = $ ...**73.5**...... $BC_{upper} = $ ......**85**........
   $AB_{lower} = $ ...**72.5**..... $BC_{lower} = $ ......**75**......

   b) Calculate the upper bound for the area of the triangle ABC.

   ...**3123.75**.......mm^2

   Angle $CAB = x°$

   c) Calculate the lower bound for the value of $\tan x°$.   **1.02 (2dp)**

Surds - Introduction

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$

b) $\sqrt{3} \times \sqrt{3}$

c) $\sqrt{20}$

d) $\sqrt{24}$

e) $\sqrt{72}$

f) $\sqrt{200}$

g) $\sqrt{\dfrac{2}{25}}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$

b) $\sqrt{8} \times \sqrt{32}$

c) $\sqrt{99} \times \sqrt{22}$

d) $\sqrt{45} \times \sqrt{20}$

e) $\sqrt{18} \times \sqrt{128}$

f) $\sqrt{28} \times \sqrt{175}$

3) Expand and simplify where possible:

a) $\sqrt{3}\left(3 - \sqrt{3}\right)$

b) $\sqrt{2}\left(6 + 2\sqrt{2}\right)$

c) $\sqrt{7}\left(2 + 3\sqrt{7}\right)$

d) $\sqrt{2}\left(\sqrt{32} - \sqrt{8}\right)$

4) Expand and simplify where possible:

a) $\left(1 + \sqrt{2}\right)\left(1 - \sqrt{2}\right)$

b) $\left(3 + \sqrt{5}\right)\left(2 - \sqrt{5}\right)$

c) $\left(\sqrt{3} + 2\right)\left(\sqrt{3} + 4\right)$

d) $\left(\sqrt{5} - 3\right)\left(\sqrt{5} + 1\right)$

e) $\left(2 + \sqrt{7}\right)\left(2 - \sqrt{7}\right)$

f) $\left(\sqrt{6} - 3\right)^2$

5) Work out the following, giving your answer in its simplest form:

a) $\dfrac{(5 + \sqrt{3})(5 - \sqrt{3})}{\sqrt{22}}$

b) $\dfrac{(4 - \sqrt{5})(4 + \sqrt{5})}{\sqrt{11}}$

c) $\dfrac{(3 - \sqrt{2})(3 + \sqrt{2})}{\sqrt{14}}$

d) $\dfrac{\left(\sqrt{3} + 1\right)^2}{\sqrt{3}}$

e) $\dfrac{\left(\sqrt{5} + 3\right)^2}{\sqrt{20}}$

f) $\dfrac{\left(5 - \sqrt{5}\right)\left(2 + 2\sqrt{5}\right)}{\sqrt{20}}$

Surds - Introduction

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$ 7

b) $\sqrt{3} \times \sqrt{3}$ 3

c) $\sqrt{20}$ $2\sqrt{5}$

d) $\sqrt{24}$ $2\sqrt{6}$

e) $\sqrt{72}$ $6\sqrt{2}$

f) $\sqrt{200}$ $10\sqrt{2}$

g) $\sqrt{\dfrac{2}{25}}$ $\dfrac{\sqrt{2}}{5}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$ 6

b) $\sqrt{8} \times \sqrt{32}$ 16

c) $\sqrt{99} \times \sqrt{22}$ $33\sqrt{2}$

d) $\sqrt{45} \times \sqrt{20}$ 30

e) $\sqrt{18} \times \sqrt{128}$ 48

f) $\sqrt{28} \times \sqrt{175}$ 70

3) Expand and simplify where possible:

a) $\sqrt{3}\left(3 - \sqrt{3}\right)$ $3\sqrt{3} - 3$

b) $\sqrt{2}\left(6 + 2\sqrt{2}\right)$ $6\sqrt{2} + 4$

c) $\sqrt{7}\left(2 + 3\sqrt{7}\right)$ $2\sqrt{7} + 21$

d) $\sqrt{2}\left(\sqrt{32} - \sqrt{8}\right)$ 4

4) Expand and simplify where possible:

a) $\left(1 + \sqrt{2}\right)\left(1 - \sqrt{2}\right)$ -1

b) $\left(3 + \sqrt{5}\right)\left(2 - \sqrt{5}\right)$ $1 - \sqrt{5}$

c) $\left(\sqrt{3} + 2\right)\left(\sqrt{3} + 4\right)$ $11 + 6\sqrt{3}$

d) $\left(\sqrt{5} - 3\right)\left(\sqrt{5} + 1\right)$ $2 - 2\sqrt{5}$

e) $\left(2 + \sqrt{7}\right)\left(2 - \sqrt{7}\right)$ -3

f) $\left(\sqrt{6} - 3\right)^2$ $15 - 6\sqrt{6}$

5) Work out the following, giving your answer in its simplest form:

a) $\dfrac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$ $\sqrt{22}$

b) $\dfrac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$ $\sqrt{11}$

c) $\dfrac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$ $\dfrac{\sqrt{14}}{2}$

d) $\dfrac{\left(\sqrt{3}+1\right)^2}{\sqrt{3}}$ $\dfrac{4\sqrt{3}+6}{3}$

e) $\dfrac{\left(\sqrt{5}+3\right)^2}{\sqrt{20}}$ $\dfrac{7\sqrt{5}+15}{5}$

f) $\dfrac{\left(5-\sqrt{5}\right)\left(2+2\sqrt{5}\right)}{\sqrt{20}}$ 4

Surds - Expressions

1) $\sqrt{5} = 5^k$

     a)   Write down the value of k.

     b)   Expand and simplify $(2 + \sqrt{5})(1 + \sqrt{5})$

            Give your answer in the form $a + b\sqrt{c}$

            where a, b and c are integers.

2)   The diagram shows a right-angled triangle with lengths of sides as indicated.

The area of the triangle is A cm²

Show that $A = k\sqrt{2}$ giving the value of k.

6 cm

$2\sqrt{3}$
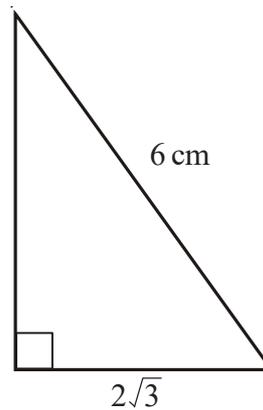
3)   Given that

$$\frac{8 - \sqrt{18}}{\sqrt{2}} = a + b\sqrt{2},$$ where a and b are integers,

find the value of a and the value of b.

4)   Work out $(2 + \sqrt{3})(2 - \sqrt{3})$

Give your answer in its simplest form.

1) $\sqrt{5} = 5^k$

    a)   Write down the value of k. $\dfrac{1}{2}$

    b)   Expand and simplify $(2 + \sqrt{5})(1 + \sqrt{5})$

        Give your answer in the form $a + b\sqrt{c}$ $7 + 3\sqrt{5}$

        where a, b and c are integers.

2)   The diagram shows a right-angled triangle
    with lengths of sides as indicated.

    The area of the triangle is A cm^2

    Show that $A = k\sqrt{2}$ giving the value of k.

$h^2 = 6^2 - (2\sqrt{3})^2$ Area $= \dfrac{2\sqrt{3} \times 2\sqrt{6}}{2}$
$\quad = 36 - 12$
$\quad = 24$
$\qquad\qquad\qquad\qquad = 2\sqrt{3}\sqrt{6}$
$h = \sqrt{24}$
$\qquad\qquad\qquad\qquad = 2\sqrt{18}$
$h = 2\sqrt{6}$
$\qquad\qquad\qquad\qquad = 6\sqrt{2}$ $k = 6$
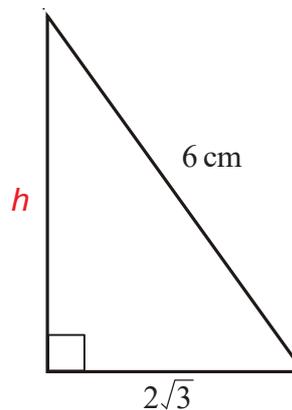
(diagram: right-angled triangle, hypotenuse 6 cm, vertical side h, base $2\sqrt{3}$)

3)   Given that

$$\dfrac{8 - \sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}\text{, where } a \text{ and } b \text{ are integers,}$$

    find the value of a and the value of b.

$\dfrac{8 - \sqrt{18}}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{8\sqrt{2} - \sqrt{36}}{2}$

$\qquad\qquad\qquad = \dfrac{8\sqrt{2} - 6}{2}$

$\qquad\qquad\qquad = 4\sqrt{2} - 3$

$\qquad\qquad\qquad = -3 + 4\sqrt{2}$

$\qquad\qquad a = -3$ and $b = 4$

4)   Work out $(2 + \sqrt{3})(2 - \sqrt{3})$ 1

    Give your answer in its simplest form.

1) Rationalise the denominator, simplifying where possible:

   a) $\dfrac{3}{\sqrt{2}}$

   b) $\dfrac{2}{\sqrt{2}}$

   c) $\dfrac{3\sqrt{2}}{\sqrt{7}}$

   d) $\dfrac{\sqrt{5}}{\sqrt{10}}$

   e) $\dfrac{1}{4\sqrt{8}}$

   f) $\dfrac{\sqrt{15}}{\sqrt{3}}$

   g) $\dfrac{1}{\sqrt{27}}$

2) Rationalise the denominator of $\dfrac{1}{\sqrt{3}}$

3) Rationalise the denominator of $\dfrac{1}{8\sqrt{8}}$ giving the answer in the form $\dfrac{\sqrt{2}}{p}$

1) Rationalise the denominator, simplifying where possible:

a) $\dfrac{3}{\sqrt{2}}$ $\dfrac{3\sqrt{2}}{2}$

b) $\dfrac{2}{\sqrt{2}}$ $\sqrt{2}$

c) $\dfrac{3\sqrt{2}}{\sqrt{7}}$ $\dfrac{3\sqrt{14}}{7}$

d) $\dfrac{\sqrt{5}}{\sqrt{10}}$ $\dfrac{\sqrt{2}}{2}$

e) $\dfrac{1}{4\sqrt{8}}$ $\dfrac{\sqrt{2}}{16}$

f) $\dfrac{\sqrt{15}}{\sqrt{3}}$ $\sqrt{5}$

g) $\dfrac{1}{\sqrt{27}}$ $\dfrac{\sqrt{3}}{9}$

2) Rationalise the denominator of $\dfrac{1}{\sqrt{3}}$ $\dfrac{\sqrt{3}}{3}$

3) Rationalise the denominator of $\dfrac{1}{8\sqrt{8}}$ giving the

answer in the form $\dfrac{\sqrt{2}}{p}$ $\dfrac{\sqrt{2}}{32}$

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x.

b) Calculate the value of y when $x = 350$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V.

b) Calculate the value of P when $V = 2$

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m², of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$.
Give your answer correct to 3 significant figures.

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$ $M = 540$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x. $y = \frac{x}{50}$ or $y = 0.02x$

b) Calculate the value of y when $x = 350$ $y = 7$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$ $D = 1406.25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V. $P = \frac{48}{V}$

b) Calculate the value of P when $V = 2$ 24

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$. $T = 23.2$ secs
Give your answer correct to 3 significant figures.

1) x is directly proportional to y.
   When $x = 21$, then $y = 3$.

   a) Express x in terms of y.

   b) Find the value of x when y is equal to 10.

2) a is inversely proportional to b.
   When $a = 12$, then $b = 4$.

   a) Find a formula for a in terms of b.

   b) Find the value of a when b is equal to 8.

   c) Find the value of b when a is equal to 4.

3) The variables u and v are in inverse proportion to one another.
   When $u = 3$, then $v = 8$.

   Find the value of u when $v = 12$.

4) p is directly proportional to the square of q.
   $p = 75$ when $q = 5$

   a) Express p in terms of q.

   b) Work out the value of p when $q = 7$.

   c) Work out the positive value of q when $p = 27$.

5) y is directly proportional to x^2.
   When $x = 3$, then $y = 36$.

   a) Express y in terms of x.

   z is inversely proportional to x.
   When $x = 4$, $z = 2$.

   b) Show that $z = c\, y^n$, where c and n are numbers and $c > 0$.
      You must find the values of c and n.

Direct and Inverse Proportion

1) x is directly proportional to y.
   When $x = 21$, then $y = 3$.

   a) Express x in terms of y. $x = 7y$

   b) Find the value of x when y is equal to 10.   70

2) a is inversely proportional to b.
   When $a = 12$, then $b = 4$.

   a) Find a formula for a in terms of b. $a = \dfrac{48}{b}$

   b) Find the value of a when b is equal to 8.   6

   c) Find the value of b when a is equal to 4.   12

3) The variables u and v are in inverse proportion to one another.
   When $u = 3$, then $v = 8$.

   Find the value of u when $v = 12$.

4) p is directly proportional to the square of q.
   $p = 75$ when $q = 5$

   a) Express p in terms of q. $p = 3q^2$

   b) Work out the value of p when $q = 7$. $p = 147$

   c) Work out the positive value of q when $p = 27$. $q = 3$

5) y is directly proportional to x^2.
   When $x = 3$, then $y = 36$.

   a) Express y in terms of x. $y = 4x^2$

   z is inversely proportional to x.
   When $x = 4$, $z = 2$.

   b) Show that $z = c\, y^n$, where c and n are numbers and $c > 0$. $z = 16y^{-0.5}$
      You must find the values of c and n.

   $c = 16$
   $n = -0.5$

1) Make c the subject of the formula.

$v = 2a + 3b + c$

2) Make t the subject of the formula.

$A = \pi t + 5t$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula.

b) Make m the subject of the formula.

5) $A = \dfrac{k(x + 5)}{3}$

Make x the subject of the formula.

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula.

7) $\dfrac{3x + 2}{5} = \dfrac{y}{10 + y}$

Make y the subject of the formula.

8) $\sqrt{\dfrac{a - 3}{5}} = 4b$

Rearrange this formula to give a in terms of b.

9) $S = 2\pi d \sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject.

Rearranging Difficult Formulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$ $c = v - 2a - 3b$

2) Make t the subject of the formula.

$A = \pi t + 5t$ $t = \dfrac{A}{\pi + 5}$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$ $s = \dfrac{R - 2t}{3 + \pi}$

4) $k = \dfrac{l}{m - l}$

   a) Make l the subject of the formula. $l = \dfrac{km}{1 + k}$

   b) Make m the subject of the formula. $m = \dfrac{l + kl}{k}$

5) $A = \dfrac{k(x + 5)}{3}$

   Make x the subject of the formula. $x = \dfrac{3A - 5k}{k}$

6) $R = \dfrac{u + v^2}{u + v}$

   Make u the subject of the formula. $u = \dfrac{v^2 - Rv}{R - 1}$

7) $\dfrac{3x + 2}{5} = \dfrac{y}{10 + y}$

   Make y the subject of the formula. $y = \dfrac{30x + 20}{3 - 3x}$

8) $\sqrt{\dfrac{a - 3}{5}} = 4b$

   Rearrange this formula to give a in terms of b. $a = 80b^2 + 3$

9) $S = 2\pi d\sqrt{h^2 + d^2}$

   Rearrange this formula to make h the subject. $h = \sqrt{\dfrac{S^2}{4\pi^2 d^2} - d^2}$

Solving Quadratics with the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$

   Give your answers correct to 3 decimal places.

2) Solve the equation $x^2 + 8x + 6 = 0$

   Give your answers correct to 3 significant figures.

3) Solve the equation $x^2 - 3x - 2 = 0$

   Give your answers correct to 3 significant figures.

4) Solve the equation $x^2 - 7x + 2 = 0$

   Give your answers correct to 3 significant figures.

5) Solve the equation $2x^2 + 6x - 1 = 0$

   Give your answers correct to 3 significant figures.

6) Solve the equation $3x^2 - 2x - 20 = 0$

   Give your answers correct to 3 significant figures.

7) Solve the equation $x^2 - 14x - 161.25 = 0$

8) Solve the equation $17x^2 - 92x - 206 = 0$

   Give your answers correct to 3 significant figures.

9) $x^2 + 10x = 300$

   Find the positive value of x.
   Give your answer correct to 3 significant figures.

10) $(x + 2)(x - 3) = 1$

    a) Show that $x^2 - x - 7 = 0$

    b) Solve the equation $x^2 - x - 7 = 0$

    Give your answers correct to 3 significant figures.

1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.
$x = -0.268$ or $x = -3.732$

2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.
$x = -0.838$ or $x = -7.16$

3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.
$x = -0.562$ or $x = 3.56$

4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.
$x = 0.298$ or $x = 6.70$

5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.
$x = -3.16$ or $x = 0.158$

6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.
$x = -2.27$ or $x = 2.94$

7) Solve the equation $x^2 - 14x - 161.25 = 0$
$x = -7.5$ or $x = 21.5$

8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.
$x = -1.70$ or $x = 7.11$

9) $x^2 + 10x = 300$
Find the positive value of x.
Give your answer correct to 3 significant figures.
$x = 13.0$

10) $(x + 2)(x - 3) = 1$

$x^2 - 3x + 2x - 6 = 1$
$x^2 - x - 6 = 1$
a) Show that $x^2 - x - 7 = 0$ $x^2 - x - 7 = 0$

b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.
$x = -2.19$ or $x = 3.19$

Factorising Hard Quadratics

1) Factorise the following:

    a) $2x^2 + 7x + 3$

    b) $3x^2 + 5x - 2$

    c) $6x^2 - 11x + 3$

    d) $8x^2 + 10x + 3$

    e) $6x^2 - 7x - 20$

    f) $4x^2 - 4x - 15$

2) Solve the following:

    a) $5x^2 + 9x - 2 = 0$

    b) $6x^2 + 5x - 6 = 0$

    c) $12x^2 + 25x + 7 = 0$

    d) $8x^2 - 14x - 15 = 0$

    e) $10x^2 - 43x - 30 = 5$

    f) $4x^2 - 8x + 2 = 7$

Factorising Hard Quadratics

1) Factorise the following:

a) $2x^2 + 7x + 3$ (2x + 1)(x + 3)

b) $3x^2 + 5x - 2$ (x + 2)(3x − 1)

c) $6x^2 - 11x + 3$ (2x − 3)(3x − 1)

d) $8x^2 + 10x + 3$ (2x + 1)(4x + 3)

e) $6x^2 - 7x - 20$ (2x − 5)(3x + 4)

f) $4x^2 - 4x - 15$ (2x − 5)(2x + 3)

2) Solve the following:

a) $5x^2 + 9x - 2 = 0$ x = -2, x = $\dfrac{1}{5}$

b) $6x^2 + 5x - 6 = 0$ x = $-\dfrac{3}{2}$, x = $\dfrac{2}{3}$

c) $12x^2 + 25x + 7 = 0$ x = $-\dfrac{1}{3}$, x = $-\dfrac{7}{4}$

d) $8x^2 - 14x - 15 = 0$ x = $\dfrac{5}{2}$, x = $-\dfrac{3}{4}$

e) $10x^2 - 43x - 30 = 5$ x = 5, x = $-\dfrac{7}{10}$

f) $4x^2 - 8x + 2 = 7$ x = $\dfrac{5}{2}$, x = $-\dfrac{1}{2}$

1)   The area of the rectangle below is 90 cm^2.

$(x - 5)$ cm

$(x + 4)$ cm
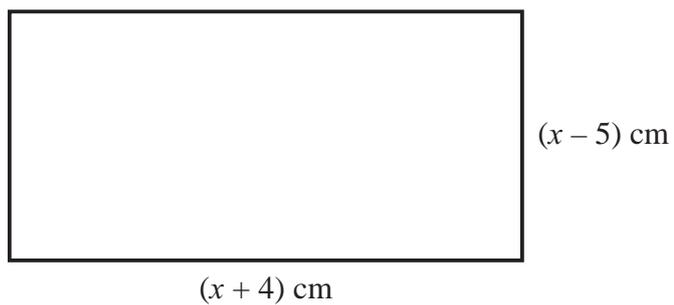
     Set up and solve a quadratic equation to work out the value of x.

2)   Work out the value of x.
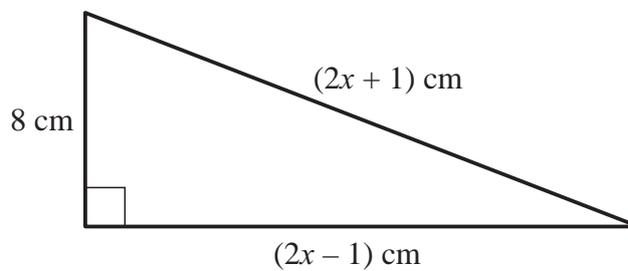
8 cm

$(2x + 1)$ cm

$(2x - 1)$ cm

     You must show your working.

Forming and Solving Quadratic Equations

1) The area of the rectangle below is 90 cm^2.

$(x – 5)$ cm

$(x + 4)$ cm
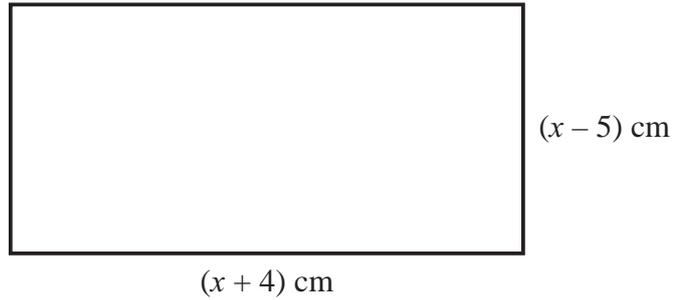
Set up and solve a quadratic equation to work out the value of x.

$(x + 4)(x – 5) = 90$
$x^2 – x – 20 = 90$
$x^2 – x – 110 = 0$
$(x + 10)(x – 11) = 0$
$x = 11$ (reject $x = –10$ as this would make both lengths negative)

2) Work out the value of x.

$(2x + 1)$ cm

8 cm

$(2x – 1)$ cm
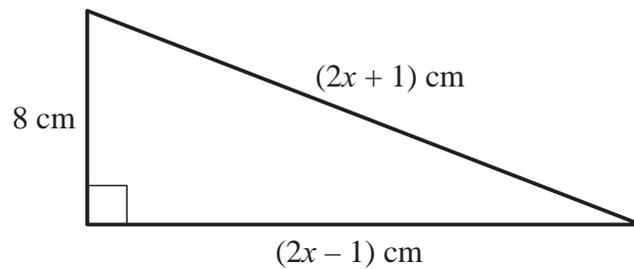
You must show your working.

$8^2 + (2x – 1)^2 = (2x + 1)^2$
$64 + 4x^2 – 4x + 1 = 4x^2 + 4x + 1$
$64 = 8x$
$x = 8$

1)
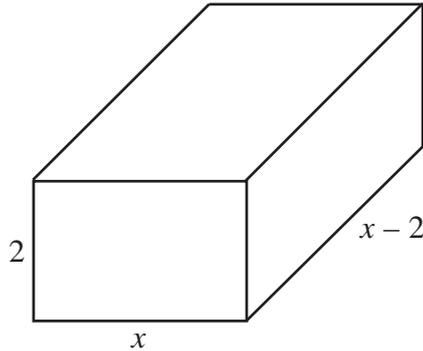
The diagram shows a cuboid.
All the measurements are in cm.

The volume of the cuboid is 52 cm³.

a) Show that $2x^2 - 4x - 52 = 0$ for $x > 2$

b) Solve the quadratic equation

$$2x^2 - 4x - 52 = 0$$

Give your solutions correct to 3 significant figures.
You must show your working.

2) The diagram below shows a large rectangle of length $(2x + 6)$ cm and width x cm.

A smaller rectangle of length x cm and width 3 cm is cut out and removed.

The area of the shape that is left is 100 cm².

a) Show that $x^2 + 3x - 100 = 0$

b) Calculate the length of the smaller rectangle.
Give your answer correct to 3 significant figures.

Forming and Solving Quadratic Equations

1)

The diagram shows a cuboid.
All the measurements are in cm.

The volume of the cuboid is 52 cm³.

a)   Show that $2x^2 - 4x - 52 = 0$ for $x > 2$

b)   Solve the quadratic equation

$$2x^2 - 4x - 52 = 0$$
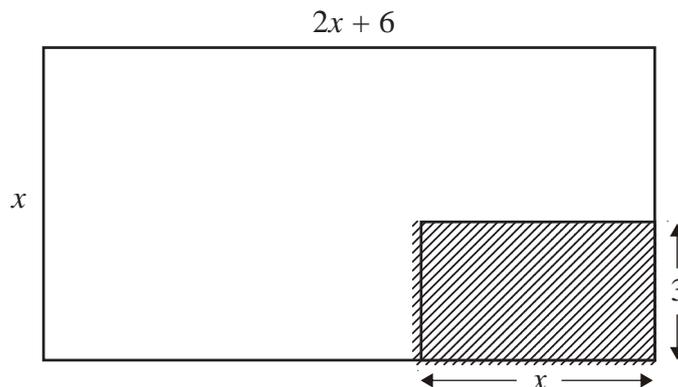
Give your solutions correct to 3 significant figures.
You must show your working.
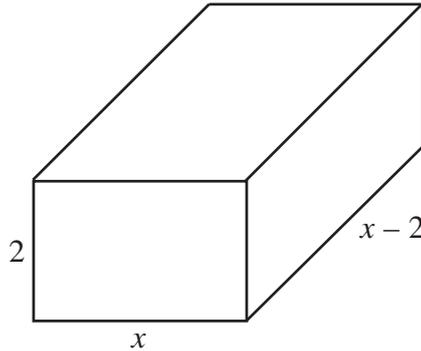
length × width × height = volume
$2x(x - 2) = 52$
$2x^2 - 4x = 52$
$2x^2 - 4x - 52 = 0$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{4 \pm \sqrt{(-4)^2 - 4 \times 2 \times (-52)}}{2 \times 2}$

$x = \dfrac{4 \pm \sqrt{432}}{4}$

$x = 6.20$ or -4.20

2)   The diagram below shows a large rectangle of length $(2x + 6)$ cm and width x cm.

A smaller rectangle of length x cm and width 3 cm is cut out and removed.

The area of the shape that is left is 100 cm².

a)   Show that $x^2 + 3x - 100 = 0$

b)   Calculate the length of the smaller rectangle.
       Give your answer correct to 3 significant figures.

Area of large rectangle is $(2x + 6) \times x$
Area of shaded rectangle is $3x$
Area of shape that is left is
$(2x + 6) \times x - 3x = 100$
$\therefore 2x^2 + 3x = 100$
$\therefore 2x^2 + 3x - 100 = 0$

$x = 6.36$ cm

Forming and Solving Quadratic Equations

1)

x

$2x + 1$

5

x
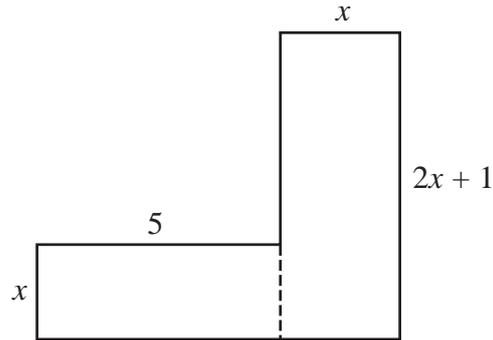
The diagram shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

The area of the shape is 94 cm^2.

a)   Show that $2x^2 + 6x - 94 = 0$

b)   Solve the equation

$$2x^2 + 6x - 94 = 0$$

Give your solutions correct to 3 significant figures.

2)   The diagram shows a 6-sided shape.
All the corners are right angles.
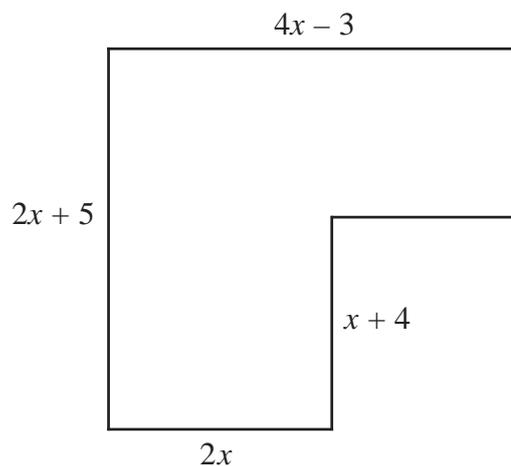
$4x - 3$

$2x + 5$

$x + 4$

$2x$

All the measurements are given in centimetres.

The area of the shape is 33 cm^2.

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.

Forming and Solving Quadratic Equations

1)

x

B $2x + 1$

5

x A

The diagram shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

The area of the shape is 94 cm².

a) Show that $2x^2 + 6x - 94 = 0$

b) Solve the equation

$$2x^2 + 6x - 94 = 0 \qquad x = 5.52 \text{ or } -8.52$$

Give your solutions correct to 3 significant figures.
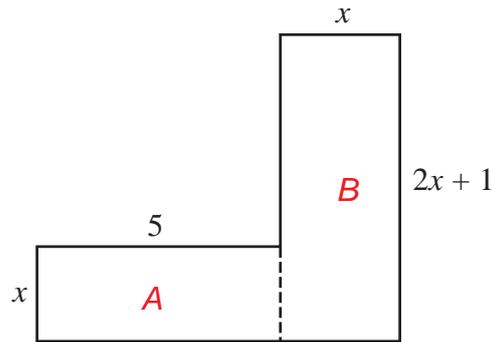
Area of the whole shape is the sum of rectangle *A* and rectangle *B*.
Area of $A = 5x$
Area of $B = x(2x + 1)$
Area of whole shape = $5x + x(2x + 1) = 94$
$5x + 2x^2 + x = 94$
$2x^2 + 6x - 94 = 0$

2) The diagram shows a 6-sided shape.
All the corners are right angles.

$4x - 3$

$2x^2 - x - 3$ $x + 1$

$2x + 5$ $4x^2 + 10x$

$2x - 3$

$x + 4$

$2x$

All the measurements are given in centimetres.

The area of the shape is 33 cm².

Work out the length of the longest side of the shape.
Give your answer correct to 2 significant figures.

$x = -3.3$ or 1.8
Using $x = 1.8$ the longest side is given by $2x + 5$
$2x + 5 = 8.6$ cm
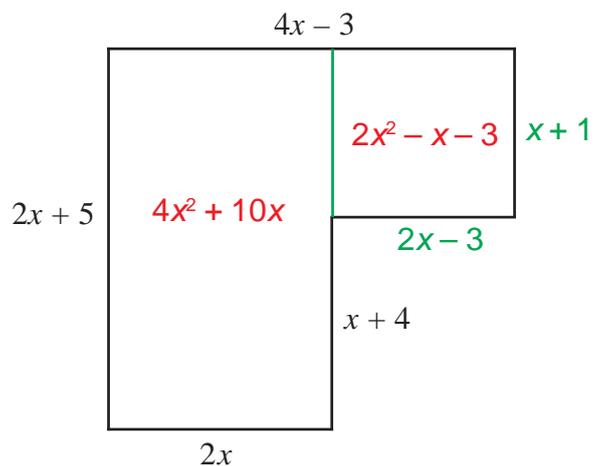
$4x^2 + 10x + 2x^2 - x - 3 = 33$
$6x^2 + 9x - 36 = 0$
$2x^2 + 3x - 12 = 0$

1) Simplify fully

   a) $\dfrac{9x^2}{21x^3}$

   b) $\dfrac{10xy^3}{5y^2}$

   c) $\dfrac{18a^3b^2}{2ab^2}$

   d) $\dfrac{4x^2+12x}{10x}$

   e) $\dfrac{2a^2b-14a^2b^3}{6a^3b^3}$

   f) $\dfrac{5x^2y+5xy^2}{10x^2y^2}$

2) Simplify fully

   a) $\dfrac{x^2+x}{x^2+6x+5}$

   b) $\dfrac{x^2-6x+8}{2x^2-8x}$

   c) $\dfrac{x^2+7x+10}{x^2+5x}$

3) a) Factorise $4x^2-12x+9$

   b) Simplify $\dfrac{6x^2-7x-3}{4x^2-12x+9}$

Algebraic Fractions - Simplifying

1) Simplify fully

   a) $\dfrac{9x^2}{21x^3}$ $\dfrac{3}{7x}$

   b) $\dfrac{10xy^3}{5y^2}$ $2xy$

   c) $\dfrac{18a^3b^2}{2ab^2}$ $9a^2$

   d) $\dfrac{4x^2+12x}{10x}$ $\dfrac{2(x+3)}{5}$

   e) $\dfrac{2a^2b-14a^2b^3}{6a^3b^3}$ $\dfrac{1-7b^2}{3ab^2}$

   f) $\dfrac{5x^2y+5xy^2}{10x^2y^2}$ $\dfrac{x+y}{2xy}$

2) Simplify fully

   a) $\dfrac{x^2+x}{x^2+6x+5}$ $\dfrac{x}{x+5}$

   b) $\dfrac{x^2-6x+8}{2x^2-8x}$ $\dfrac{x-2}{2x}$

   c) $\dfrac{x^2+7x+10}{x^2+5x}$ $\dfrac{x+2}{x}$

3) a) Factorise $4x^2-12x+9$ $(2x-3)^2$

   b) Simplify $\dfrac{6x^2-7x-3}{4x^2-12x+9}$ $\dfrac{3x+1}{2x-3}$

1) Write as single fractions in their simplest form

a) $\dfrac{3}{x} + \dfrac{3}{2x}$

b) $\dfrac{5}{3x} - \dfrac{3}{4x}$

c) $\dfrac{x+2}{5} + \dfrac{x-1}{2}$

d) $\dfrac{3}{x+2} - \dfrac{5}{2x+1}$

2) a) Factorise $\quad 2x^2 + 7x + 6$

b) Write as a single fraction in its simplest form $\quad \dfrac{3}{x+2} + \dfrac{4x}{2x^2 + 7x + 6}$

3) Solve

a) $\dfrac{1}{x} + \dfrac{1}{3x} = 2$

b) $\dfrac{1}{x-2} + \dfrac{3}{x+6} = \dfrac{1}{2}$

c) $\dfrac{1}{x-5} + \dfrac{6}{x} = 2$

d) $\dfrac{7}{x+2} + \dfrac{1}{x-1} = 4$

e) $\dfrac{3}{x+2} + \dfrac{1}{x-2} = \dfrac{7}{x^2 - 4}$

f) $\dfrac{x}{2x-1} + \dfrac{2}{x+2} = 1$

1) Write as single fractions in their simplest form

a) $\dfrac{3}{x} + \dfrac{3}{2x}$ $\dfrac{9}{2x}$

b) $\dfrac{5}{3x} - \dfrac{3}{4x}$ $\dfrac{11}{12x}$

c) $\dfrac{x+2}{5} + \dfrac{x-1}{2}$ $\dfrac{7x-1}{10}$

d) $\dfrac{3}{x+2} - \dfrac{5}{2x+1}$ $\dfrac{x-7}{(x+2)(2x+1)}$

2) a) Factorise $2x^2 + 7x + 6$ $(x+2)(2x+3)$

b) Write as a single fraction in its simplest form $\dfrac{3}{x+2} + \dfrac{4x}{2x^2+7x+6}$ $\dfrac{10x+9}{(x+2)(2x+3)}$

3) Solve

a) $\dfrac{1}{x} + \dfrac{1}{3x} = 2$ $x = \dfrac{2}{3}$

b) $\dfrac{1}{x-2} + \dfrac{3}{x+6} = \dfrac{1}{2}$ $x = -2$ or 6

c) $\dfrac{1}{x-5} + \dfrac{6}{x} = 2$ $x = 2.5$ or 6

d) $\dfrac{7}{x+2} + \dfrac{1}{x-1} = 4$ $x = -0.5$ or 1.5

e) $\dfrac{3}{x+2} + \dfrac{1}{x-2} = \dfrac{7}{x^2-4}$ $x = 2.75$

f) $\dfrac{x}{2x-1} + \dfrac{2}{x+2} = 1$ $x = 0$ or 3

Finding the *n*th Term of a Quadratic

1) Find a formula for the *n*th term of this quadratic sequence:

3, 8, 15, 24, . . .

2) Find a formula for the *n*th term of this quadratic sequence:

3, 5, 9, 15, . . .

3) Find a formula for the *n*th term of this quadratic sequence:

3, 7, 13, 21, . . .

4) Find a formula for the *n*th term of this quadratic sequence:

1, 4, 11, 22, . . .

5) Find a formula for the *n*th term of this quadratic sequence:

2, 7, 18, 35, . . .

1) Find a formula for the *n*th term of this quadratic sequence:

3, 8, 15, 24, . . .

$n^2 + 2n$

2) Find a formula for the *n*th term of this quadratic sequence:

3, 5, 9, 15, . . .

$n^2 - n + 3$

3) Find a formula for the *n*th term of this quadratic sequence:

3, 7, 13, 21, . . .

$n^2 + n + 1$

4) Find a formula for the *n*th term of this quadratic sequence:

1, 4, 11, 22, . . .

$2n^2 - 3n + 2$

5) Find a formula for the *n*th term of this quadratic sequence:

2, 7, 18, 35, . . .

$3n^2 - 4n + 3$

Simultaneous Equations Graphically - Advanced

1)   a) Complete the table of values for $y = x^2 + x - 2$

x	−4	−3	−2	−1	0	1	2	3
y		4				0		

b) On the grid, draw the graph of
   $y = x^2 + x - 2$

c) Use the graph to estimate the
   solutions of $x^2 + x - 10 = 0$
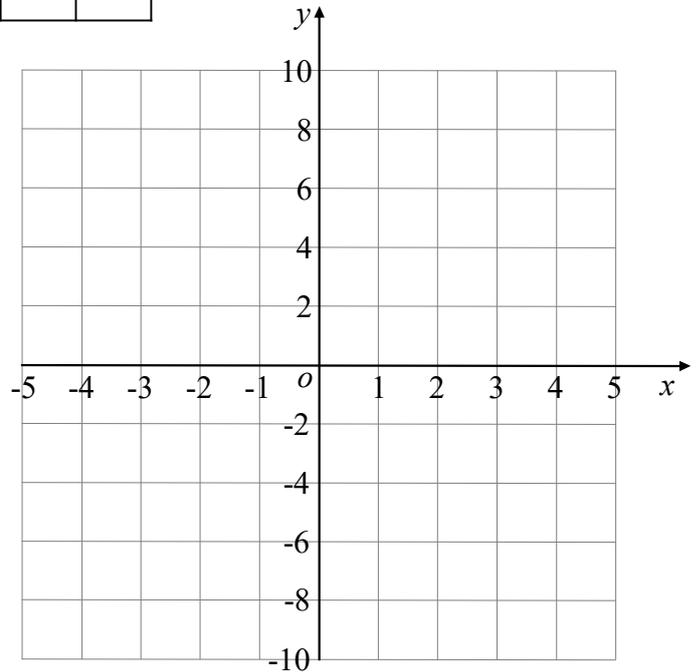
2)   a) Complete the table of values for $y = x^2 + 3x - 4$

x	−5	−4	−3	−2	−1	0	1	2
y		0			−6			

b) On the grid, draw the graph of
   $y = x^2 + 3x - 4$

c) Use the graph to solve
   $x^2 + x - 6 = 0$

Simultaneous Equations Graphically - Advanced
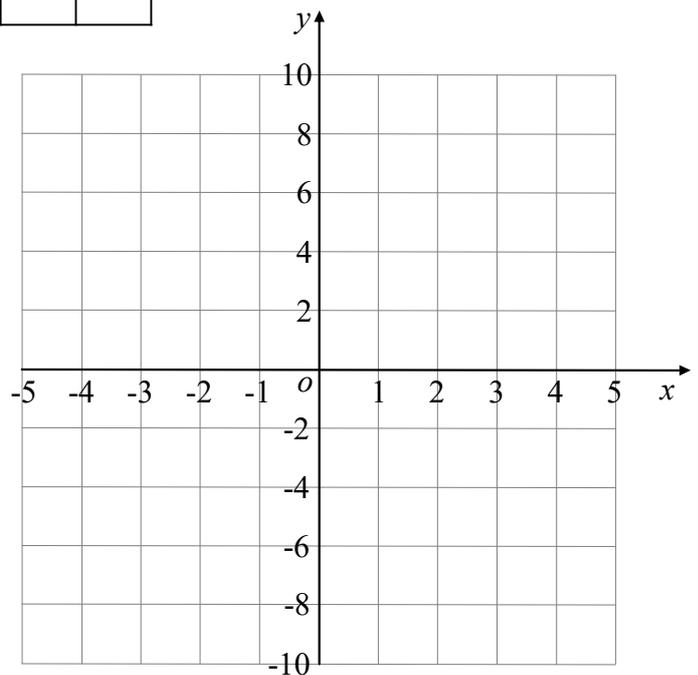
1) a) Complete the table of values for $y = x^2 + x - 2$

x	–4	–3	–2	–1	0	1	2	3
y	10	4	0	–2	–2	0	4	10

b) On the grid, draw the graph of
$y = x^2 + x - 2$

c) Use the graph to estimate the
solutions of $x^2 + x - 10 = 0$

$x^2 + x - 2 - 8 = 0$
$x^2 + x - 2 = 8$
$y = 8$

$x \approx -3.7$ or 2.7
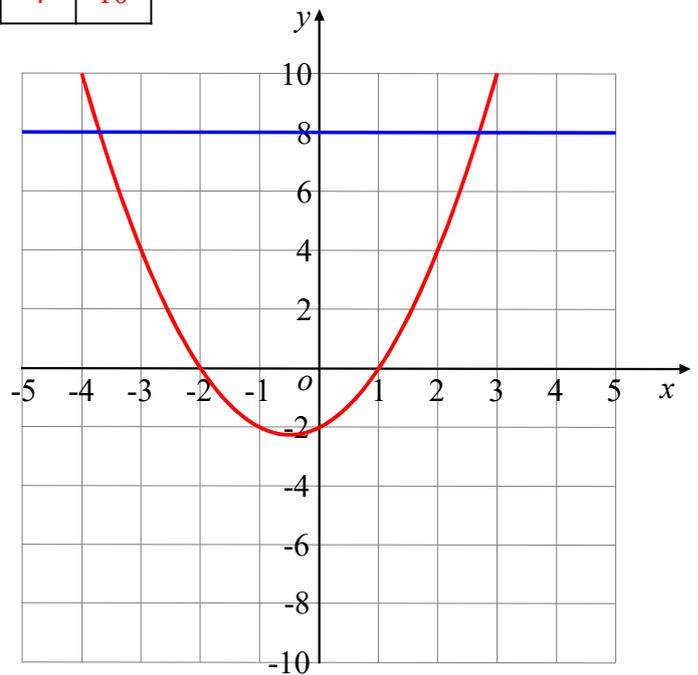
2) a) Complete the table of values for $y = x^2 + 3x - 4$

x	–5	–4	–3	–2	–1	0	1	2
y	6	0	–4	–6	–6	–4	0	6

b) On the grid, draw the graph of
$y = x^2 + 3x - 4$

c) Use the graph to solve
$x^2 + x - 6 = 0$

$x^2 + 3x - 4 - 2x - 2 = 0$
$x^2 + 3x - 4 = 2x + 2$
$y = 2x + 2$

$x = -3$ or 2
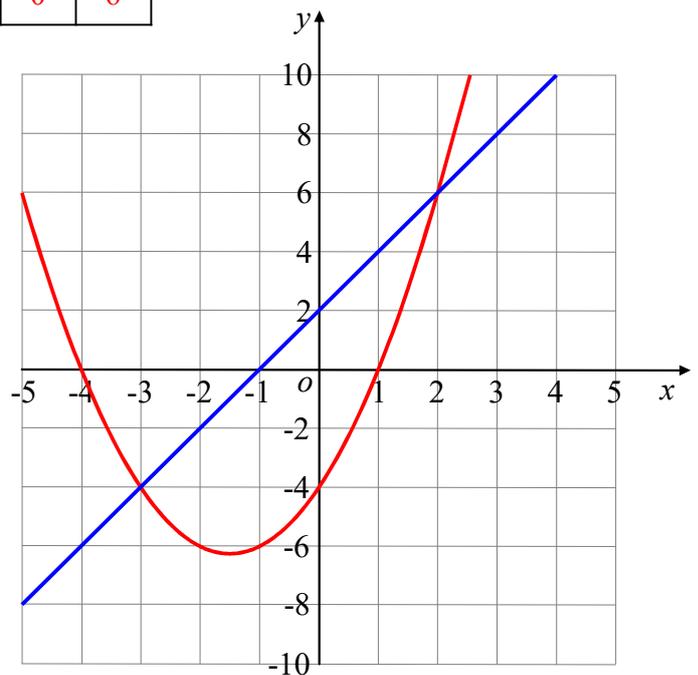
1) The graph shows the speed of a coach between two bus stations.
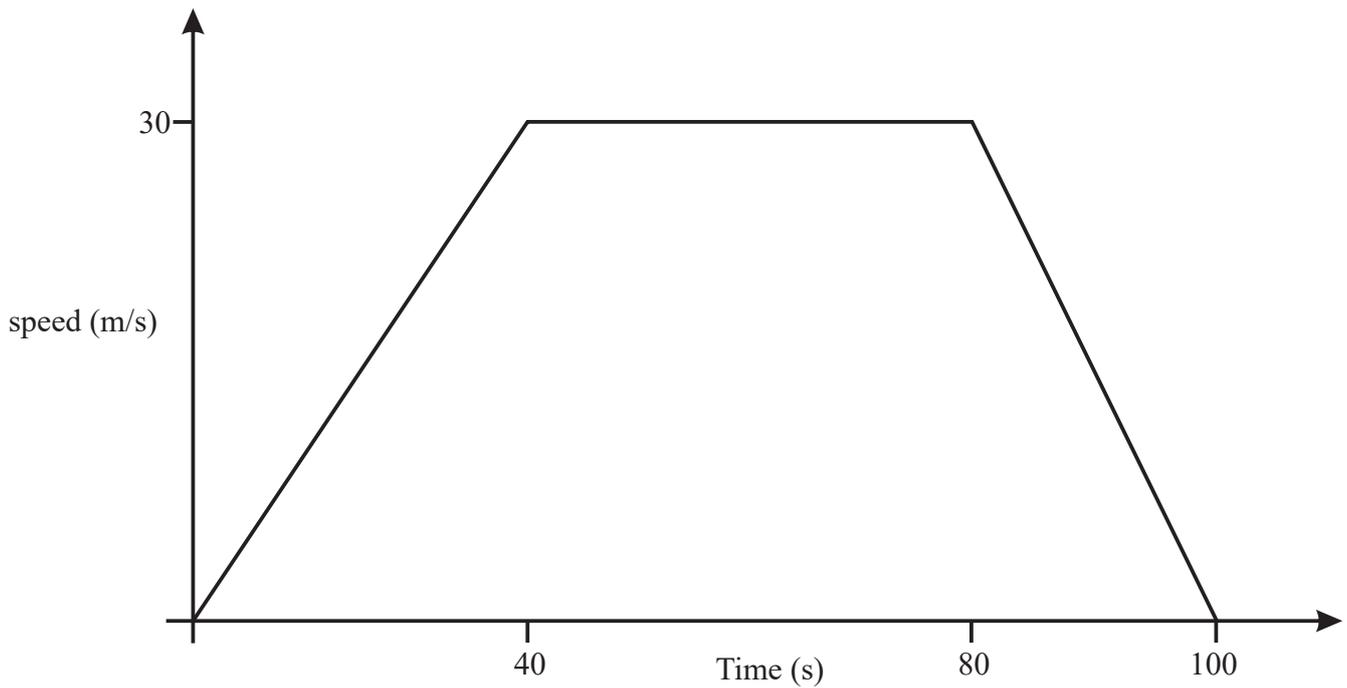
a) What was the acceleration of the coach in m/s² for the first 40 seconds?

b) What is the distance, in metres, between the two stations?

2) The velocity-time graph for a car is shown.
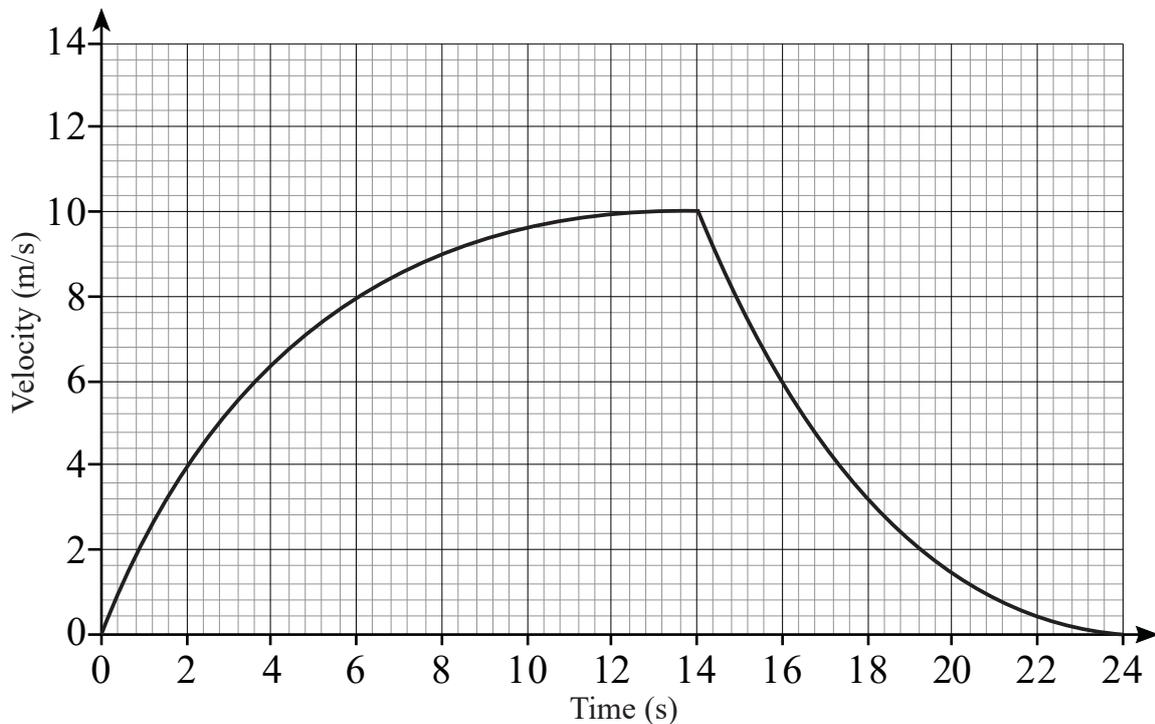
a) Estimate the acceleration of the car at 6 seconds.

b) Find an estimate for how far the car has travelled in the first 14 seconds.
Show all your working.

Interpreting Time Graphs - Introduction

1) The graph shows the speed of a coach between two bus stations.
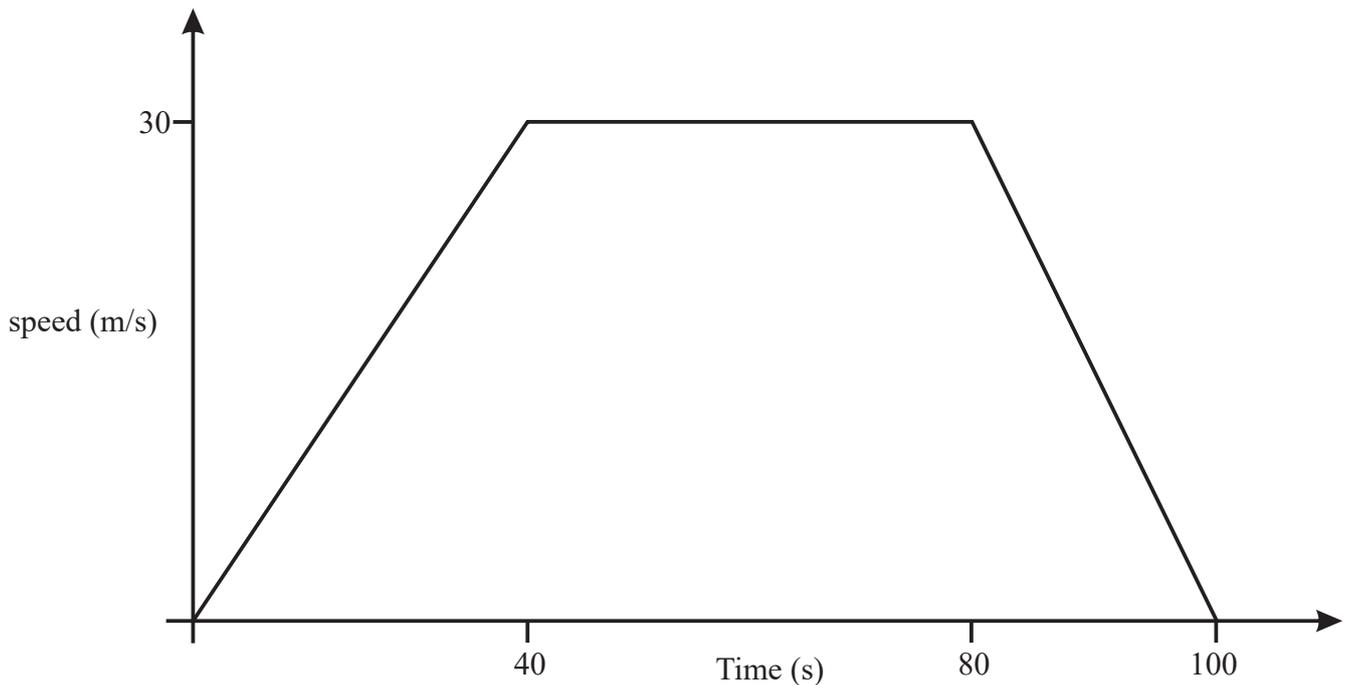
a) What was the acceleration of the coach in m/s² for the first 40 seconds? **0.75 m/s²**

b) What is the distance, in metres, between the two stations? **2100 m**

2) The velocity-time graph for a car is shown.

$A = 0.5(a + b)h$
$= 0.5 \times (8 + 10) \times 8$
$= 72$

$B = 0.5(a + b)h$
$= 0.5 \times (4 + 8) \times 4$
$=$

$C = 0.5 \times b \times h$
$= 0.5 \times 2 \times 4$
$=$
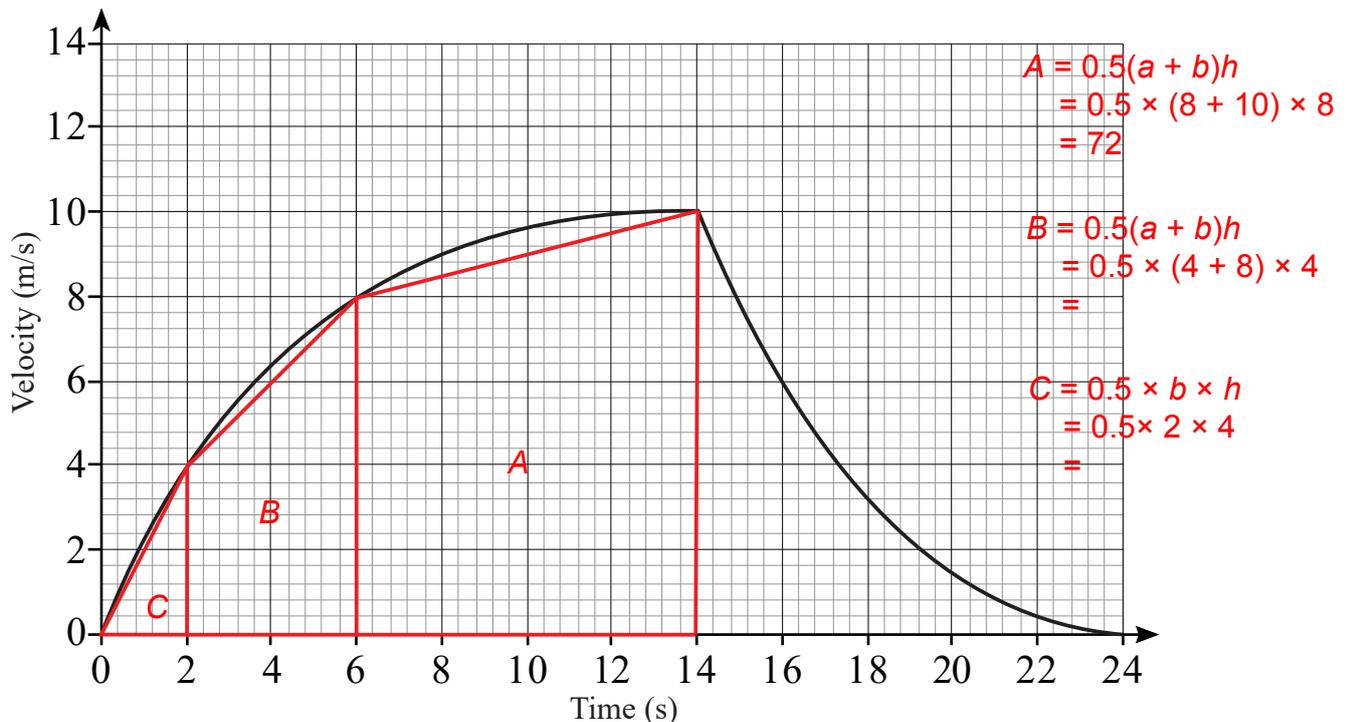
a) Estimate the acceleration of the car at 6 seconds. **0.6 m/s²**

b) Find an estimate for how far the car has travelled in the first 14 seconds.
Show all your working. **72 + 24 + 4 = 100 m**

1) Oil is leaking out from a tank.
The graph below shows the depth of oil in the tank over a period of time.
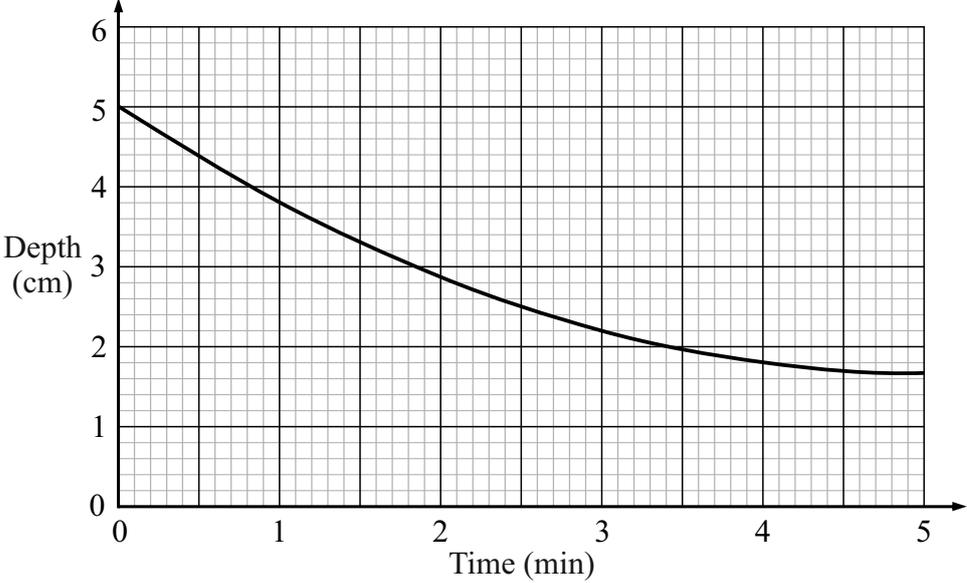
Use the graph to work out an estimate of the rate of decrease of depth at 3 minutes.

2) A football is kicked from the top of a 3-metre high platform.
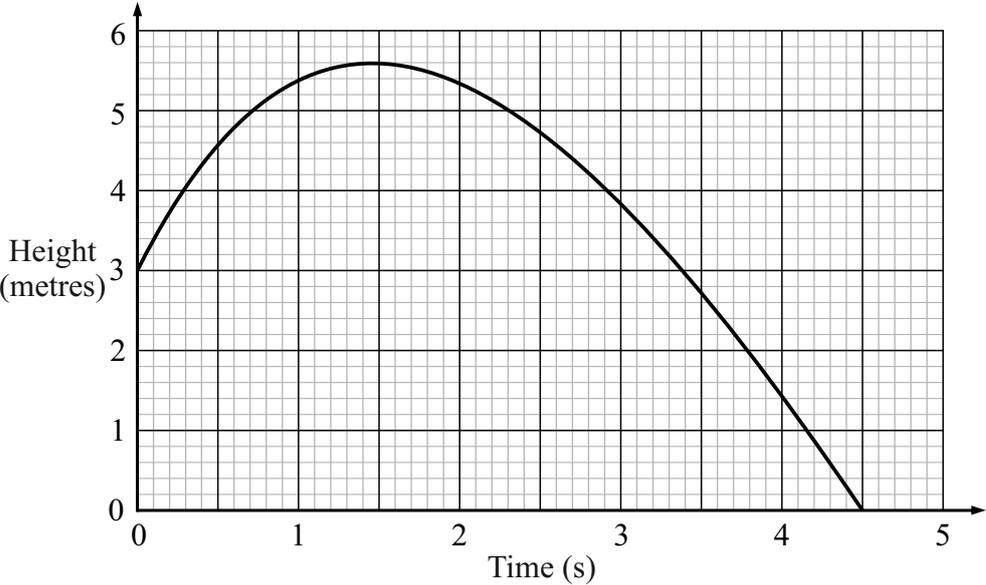
a) Estimate the speed of the ball, in m/s, after 4 seconds.

b) Give the exact time, within the 4.5 seconds motion of the ball, at which it has a speed of 0

1) Oil is leaking out from a tank.
    The graph below shows the depth of oil in the tank over a period of time.

Use the graph to work out an estimate of the rate of decrease of depth at 3 minutes.

$1.6 \div 3 = 0.53$ cm/min

Other answers accepted based on tangent drawn

2) A football is kicked from the top of a 3-metre high platform.
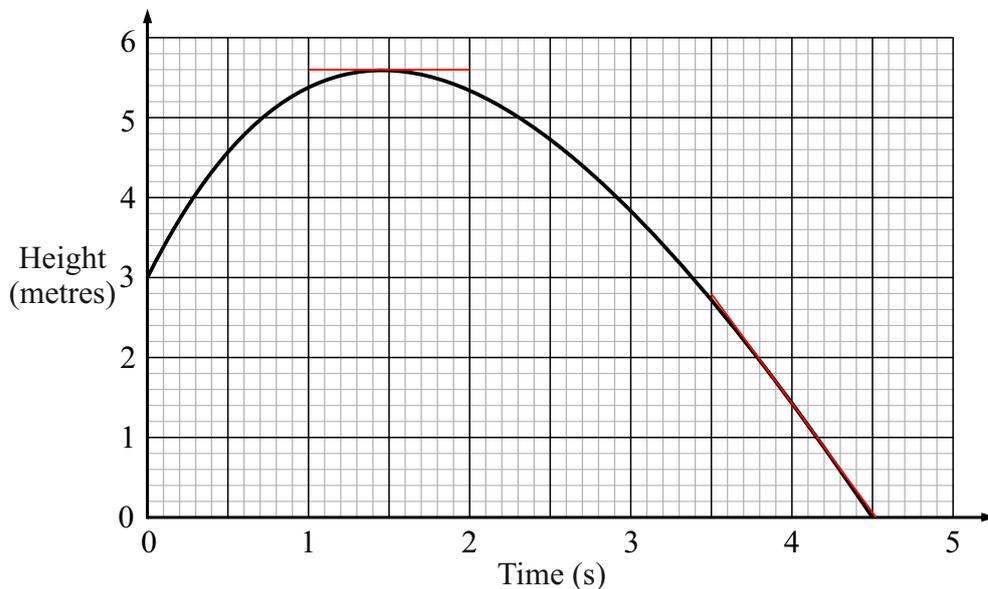
a) Estimate the speed of the ball, in m/s, after 4 seconds. $1.4 \div 1 = 1.8$ m/s

Other answers accepted based on tangent drawn

b) Give the exact time, within the 4.5 seconds motion of the ball, at which it has a speed of 0   1.5 s

1)   The graph of $y = 25 - x^2$ is shown below for values of x from $x = 0$ to $x = 5$

Use the trapezium rule, with ordinates $x = 0$, $x = 1$, $x = 2$, $x = 3$, $x = 4$ and $x = 5$,
to estimate the area of the shaded region.

2)   The velocity-time graph below shows the velocity of a vehicle over a 40-second period.

Calculate an estimate of the distance travelled by the vehicle during the 40-second period.
Use 5 strips of equal width.

1) The graph of $y = 25 - x^2$ is shown below for values of x from $x = 0$ to $x = 5$
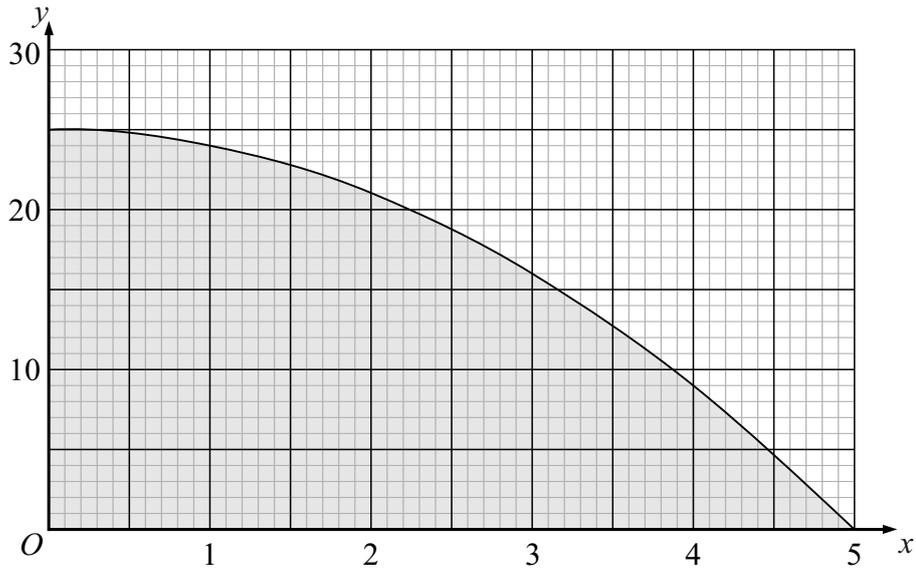
Use the trapezium rule, with ordinates $x = 0$, $x = 1$, $x = 2$, $x = 3$, $x = 4$ and $x = 5$, to estimate the area of the shaded region.

82.5

2) The velocity-time graph below shows the velocity of a vehicle over a 40-second period.
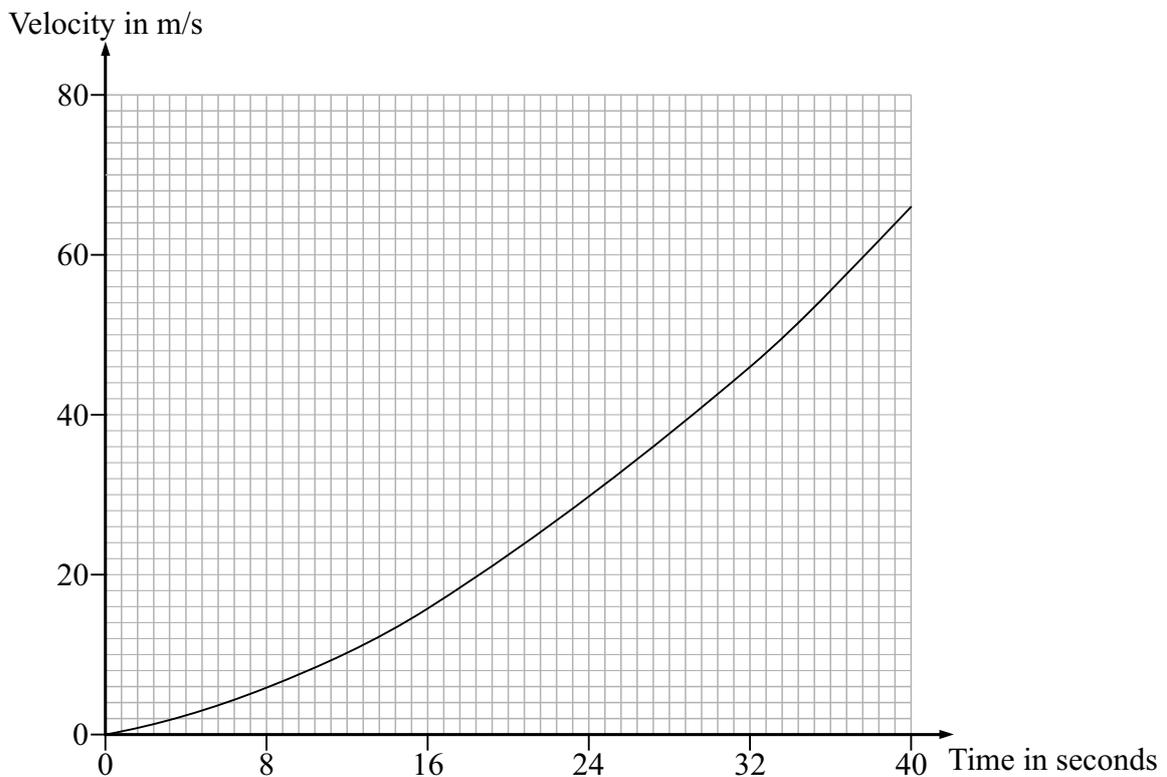
Calculate an estimate of the distance travelled by the vehicle during the 40-second period. Use 5 strips of equal width.

1048 m

Spheres

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

1) a) Work out the volume of the sphere.

    b) Work out the surface area of the sphere.
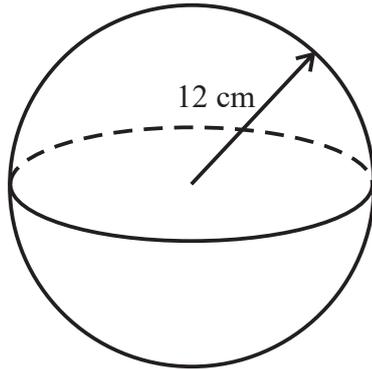
12 cm

2) a) Work out the volume of the sphere, leaving your answer in terms of π.

    b) Work out the surface area of the sphere, leaving your answer in terms of π.

10 cm
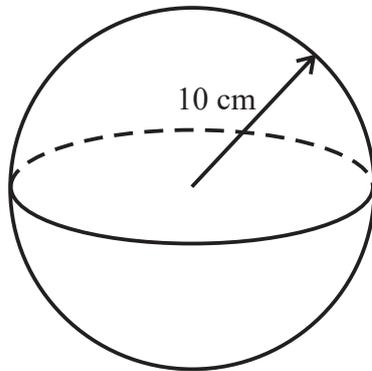
3) a) Work out the volume of the solid hemisphere.

    b) Work out the surface area of the solid hemisphere.

5.5 cm
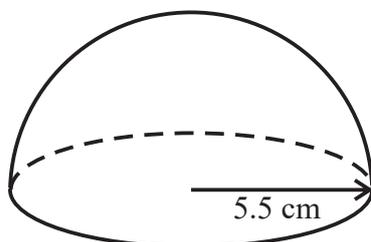
Spheres

> Volume of a sphere = $\frac{4}{3}\pi r^3$
>
> Surface area of a sphere = $4\pi r^2$

1)   a)   Work out the volume of the sphere.   **7239.168 cm³**

      b)   Work out the surface area of the sphere.   **1809.792 cm²**
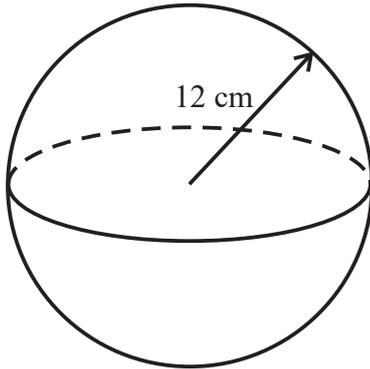
12 cm

2)   a)   Work out the volume of the sphere, leaving your answer in terms of π.   **$\frac{4000}{3}$ π cm³**

      b)   Work out the surface area of the sphere, leaving your answer in terms of π.   **400π cm²**

10 cm
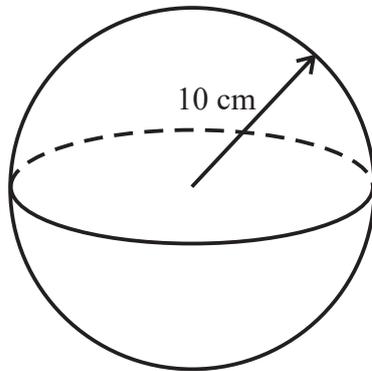
3)   a)   Work out the volume of the solid hemisphere.   **348.50 cm³**

      b)   Work out the surface area of the solid hemisphere.   **285.14 cm²**
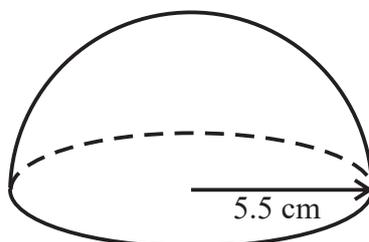
5.5 cm

Pyramids

$$\text{Volume of a pyramid} = \tfrac{1}{3} \times \text{base area} \times \text{height}$$

1)   The pyramid has a rectangular base and *E* is vertically above *A*.

E

10 cm

D

C

A

9 cm

B

6 cm
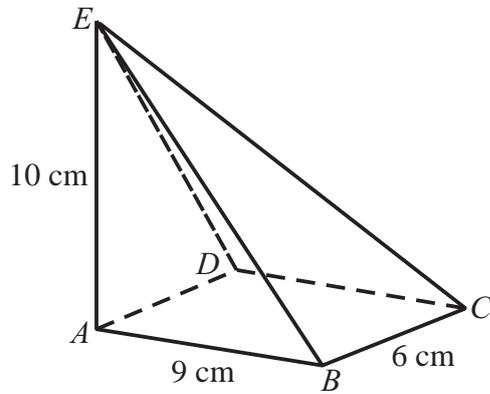
Find the volume of the pyramid.

2)   Find the volume of this pyramid.
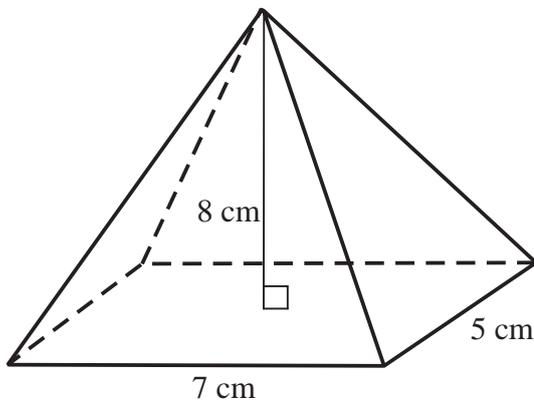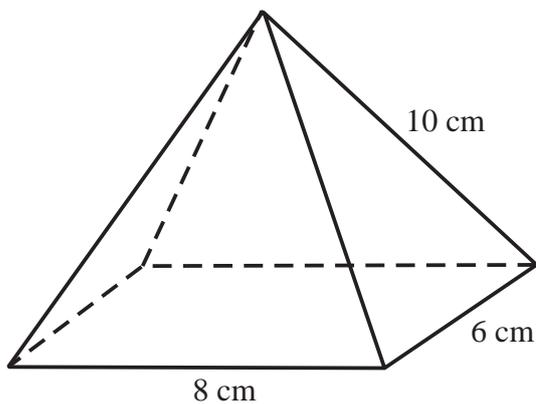
8 cm

5 cm

7 cm

3)   Find the volume of this pyramid.

10 cm

6 cm

8 cm

Pyramids

Volume of a pyramid $= \frac{1}{3} \times$ base area $\times$ height

1)   The pyramid has a rectangular base and E is vertically above A.

E

10 cm

D

A

9 cm

B

6 cm

C
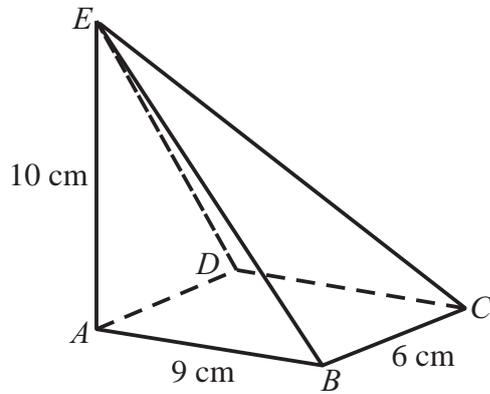
Find the volume of the pyramid.   180 cm³

2)   Find the volume of this pyramid.

93.33 cm³

8 cm

5 cm

7 cm
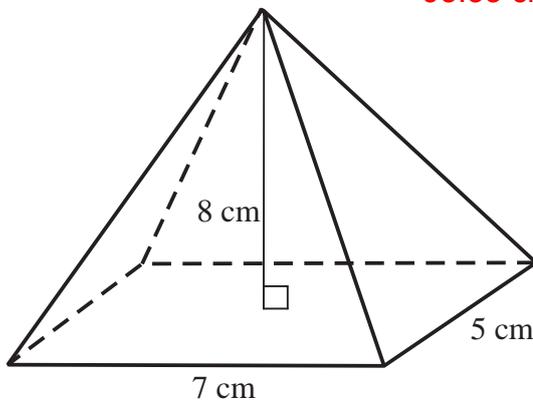
3)   Find the volume of this pyramid.   138.56 cm³

10 cm

6 cm

8 cm
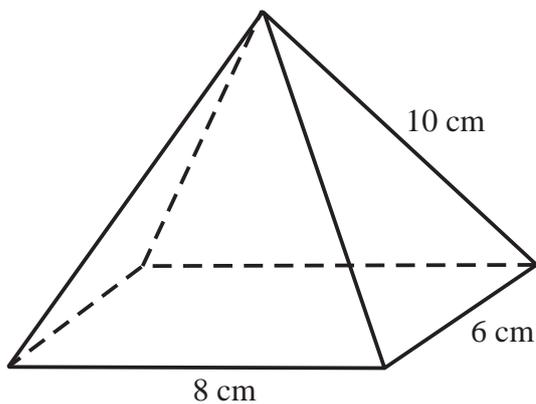
Volume of a cone = $\frac{1}{3}\pi r^2 h$

Curved surface area = $\pi r l$

1)   a) Work out the volume of the cone.

     b) Work out the curved surface area of the cone.

     c) The total surface area of the cone.
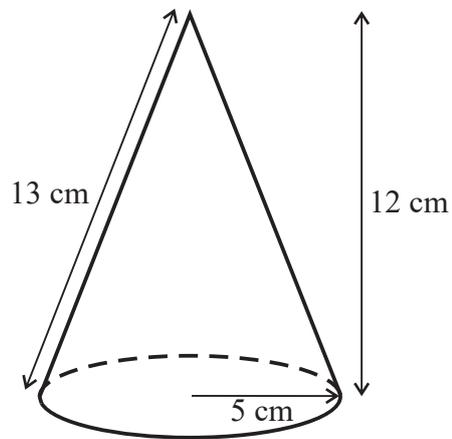
13 cm

12 cm

5 cm

2)   Work out the volume of the cone, leaving your answer in terms of π.

9 cm

4 cm

Cones
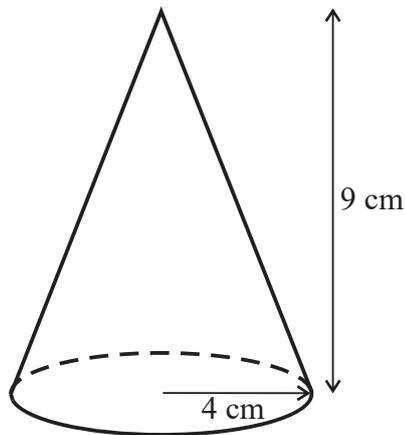
Volume of a cone = $\frac{1}{3}\pi r^2 h$

Curved surface area = $\pi r l$

1) a) Work out the volume of the cone. 314.2 cm³

    b) Work out the curved surface area of the cone. 204.23 cm²

    c) The total surface area of the cone. 282.78 cm²
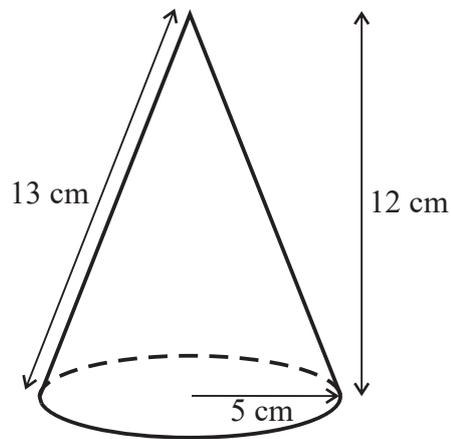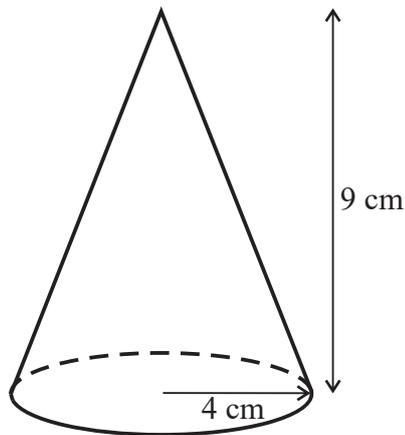
13 cm

12 cm

5 cm

2) Work out the volume of the cone, leaving your answer in terms of π. 48π cm³

9 cm

4 cm

Spheres and Cones

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

   a) Calculate the volume of the cone.
      Take π to be 3.142.
      Give your answer correct to 3 significant figures.

   b) Use Pythagoras' Theorem to find the slant height of the cone.
      Give your answer correct to 1 decimal place.

   c) Find the curved surface area of the cone.
      Take π to be 3.142.
      Give your answer correct to 3 significant figures.

8 cm

4 cm
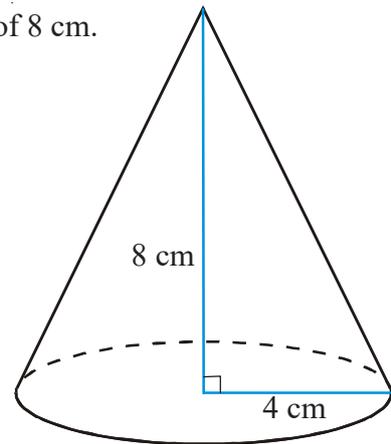
2) A sphere has a radius of 12cm.

   a) Calculate the volume of the sphere.
      Take π to be 3.142.
      Give your answer correct to 3 significant figures.

   b) Find the curved surface area of the sphere.
      Take π to be 3.142.
      Give your answer correct to 3 significant figures.

12 cm

3) A cone has a base radius of 8 cm and a slant height of 10 cm.

   Calculate the volume of the cone.
   Leave your answer in terms of π.

10 cm

8 cm

Spheres and Cones
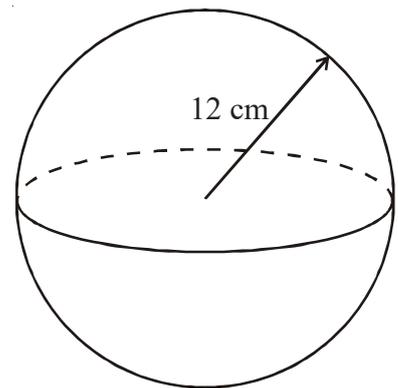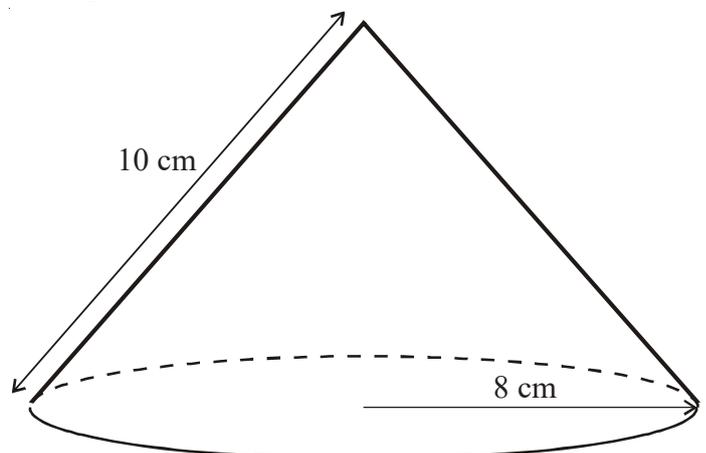
1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

a) Calculate the volume of the cone.
   Take π to be 3.142.
   Give your answer correct to 3 significant figures.

   134 cm³

b) Use Pythagoras' Theorem to find the slant height of the cone.
   Give your answer correct to 1 decimal place.

   8.9 cm

c) Find the curved surface area of the cone.
   Take π to be 3.142.
   Give your answer correct to 3 significant figures.

   112 cm²
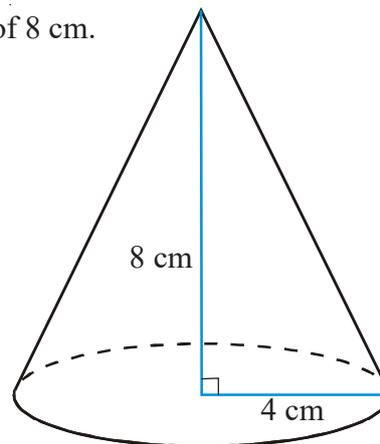
8 cm

4 cm

2) A sphere has a radius of 12cm.

a) Calculate the volume of the sphere.
   Take π to be 3.142.
   Give your answer correct to 3 significant figures.

   7240 cm³

b) Find the curved surface area of the sphere.
   Take π to be 3.142.
   Give your answer correct to 3 significant figures.

   1810 cm²
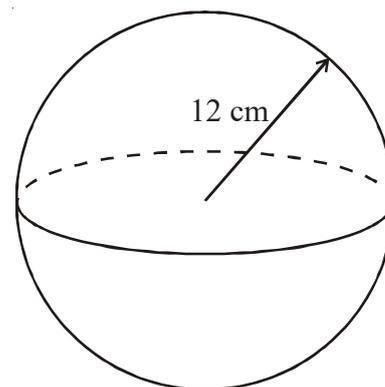
12 cm

3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone.
Leave your answer in terms of π.

   128π cm³

10 cm

8 cm

1)
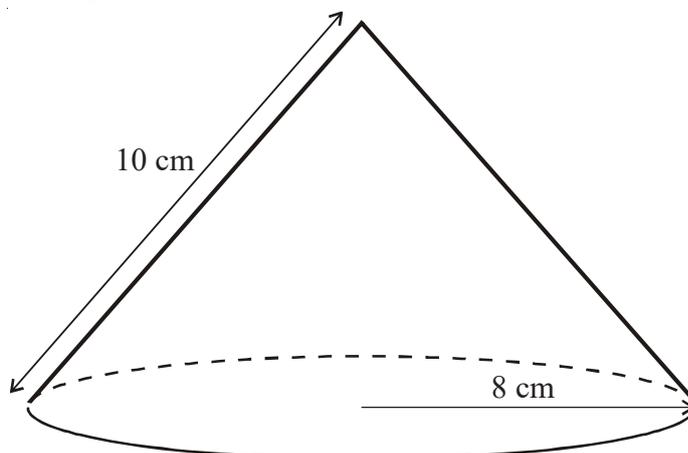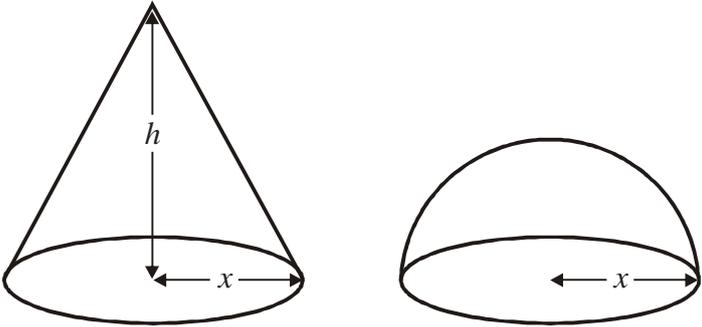
The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

2)
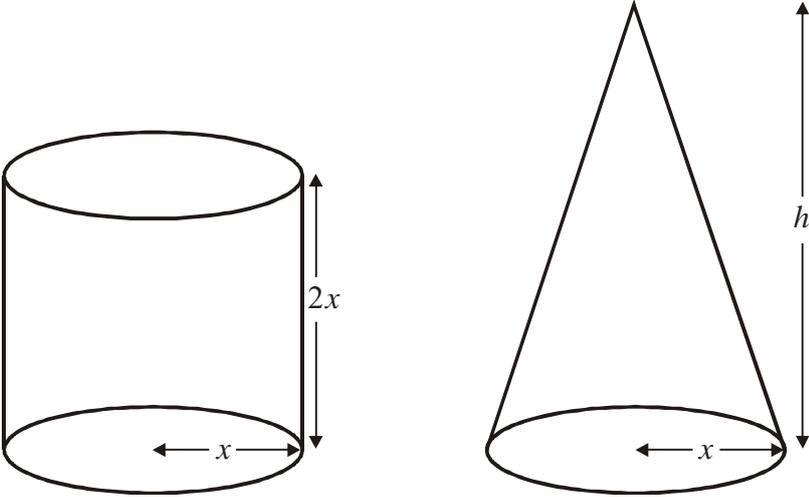
A cylinder has base radius x cm and height $2x$ cm.

A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form.

1)
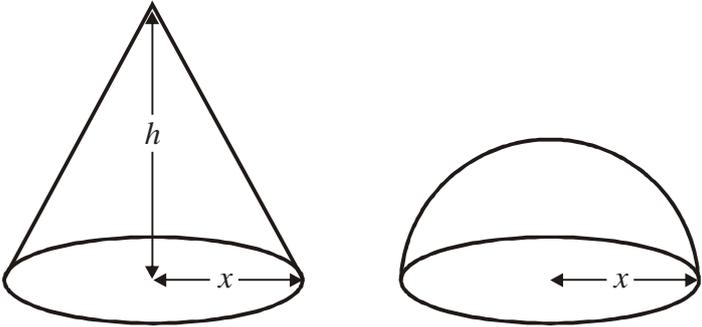
The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x. $h = \sqrt{3}\, x$ or $h = x\sqrt{3}$

2)
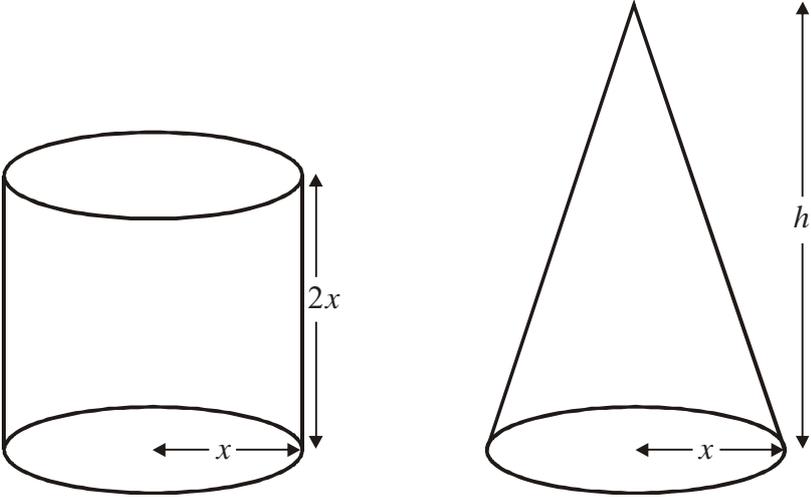
A cylinder has base radius x cm and height $2x$ cm.

A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form. $h = 6x$

Frustums

1)   A frustum is made by removing a small cone from a similar larger cone.

Work out the volume of the frustum.

15 cm

20 cm

9 cm

12 cm

2)   The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.

40 cm

10 cm

8 cm

r

r
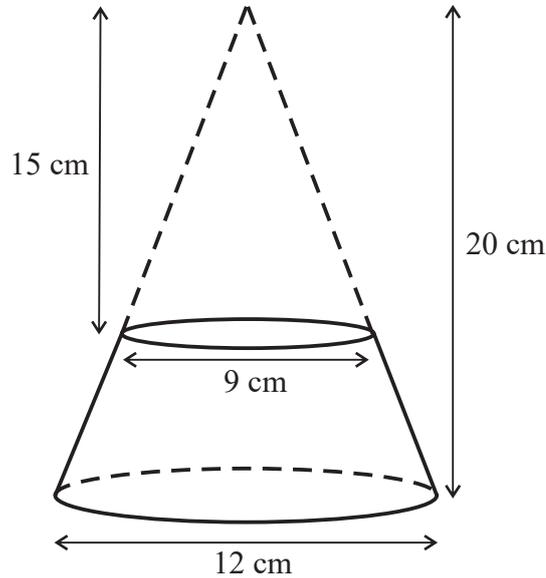
10 cm
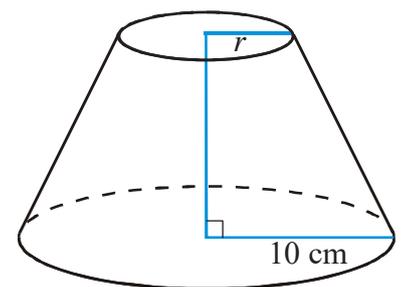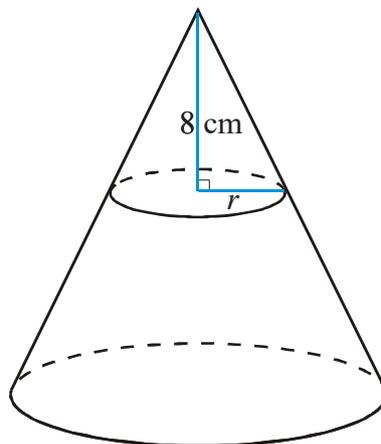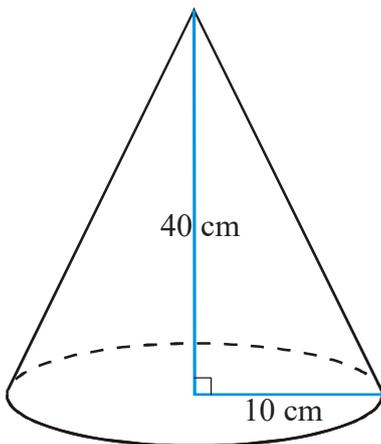
a) Work out the radius *r* of the base of the smaller cone.

Calculate, to the nearest cm³

b) The volume of the larger cone.

c) The volume of the smaller cone.

d) The volume of the frustum.

Frustums

1) A frustum is made by removing a small cone from a similar larger cone.

Work out the volume of the frustum.   435.9525 cm³
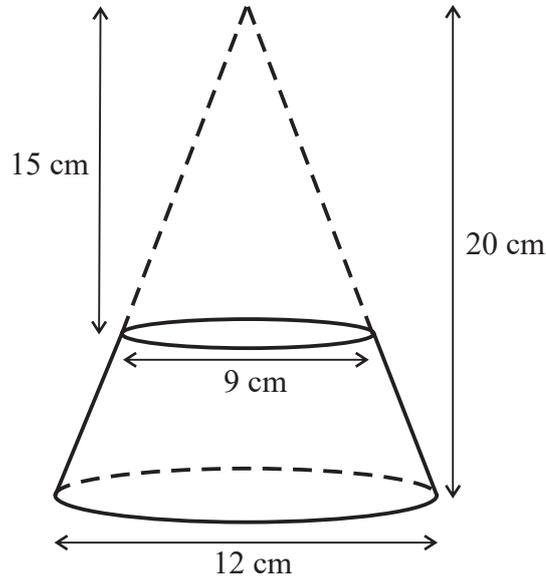
15 cm

20 cm

9 cm

12 cm

2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.

40 cm

10 cm

8 cm

r

10 cm

r
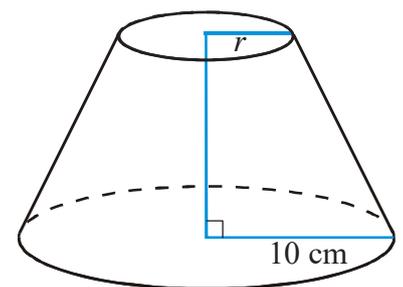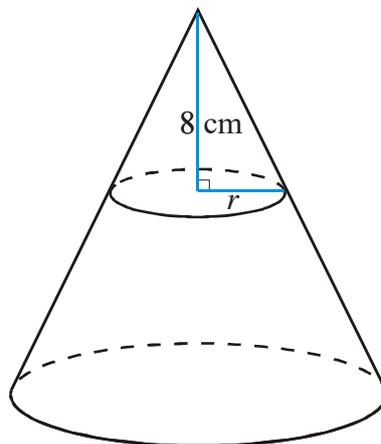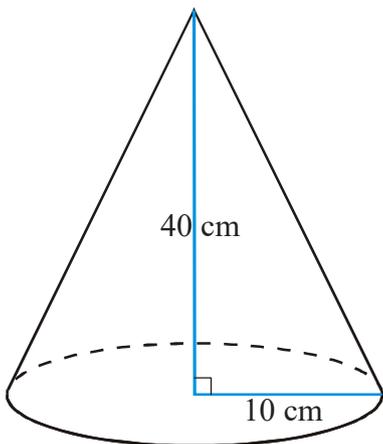
a) Work out the radius r of the base of the smaller cone.   2 cm

Calculate, to the nearest cm³

b) The volume of the larger cone.   4189 cm³

c) The volume of the smaller cone.   34 cm³

d) The volume of the frustum.   4156 cm³

1)   Work out the size of the angle marked *x*.
     Give your answer correct to one decimal place.
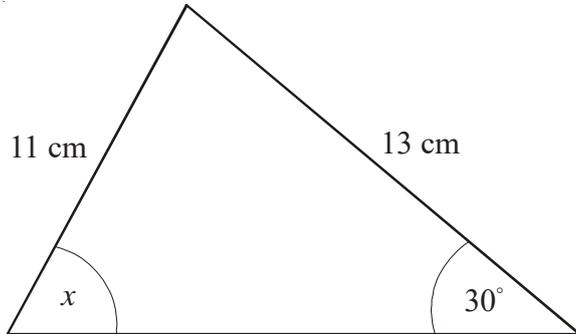
11 cm

13 cm

x

30°

2)   Find the missing lengths, *x* cm and *y* cm,
     in this triangle.

     Give your answers to 3 significant figures.

x

y

50°

71°

12.6 cm
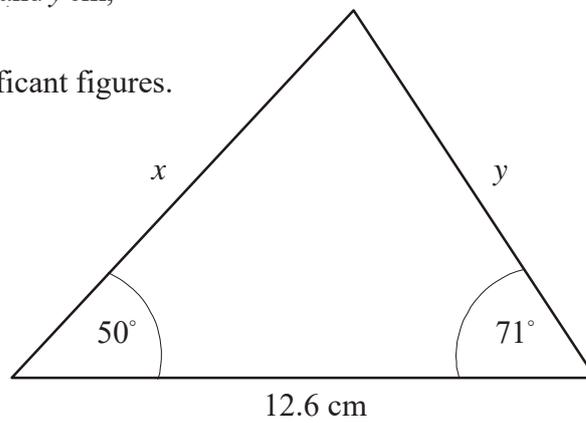
1) Work out the size of the angle marked *x*.   36.2°
   Give your answer correct to one decimal place.
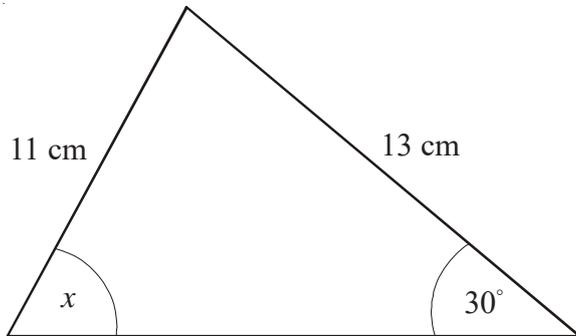
11 cm

13 cm

x

30°

2) Find the missing lengths, *x* cm and *y* cm,
   in this triangle.

   Give your answers to 3 significant figures.

   x = 13.9 cm *y* = 11.3 cm
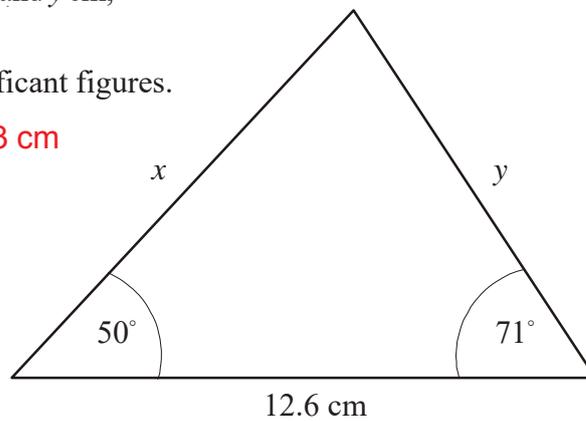
x

y

50°

71°

12.6 cm

1) *ABC* is a triangle.
   AC = 8 cm
   BC = 9 cm
   Angle *ACB* = 43°

   Calculate the length of *AB*.
   Give your answer correct to 3 significant figures.
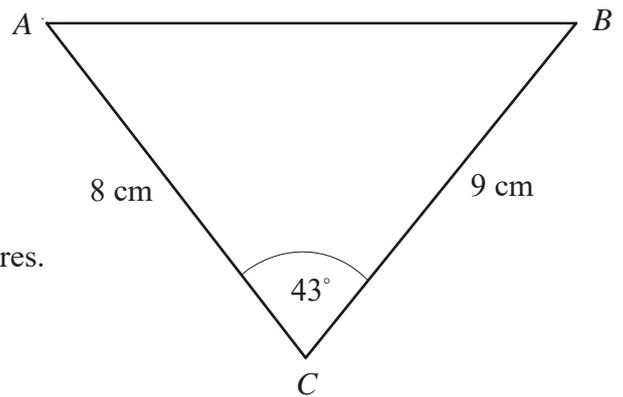
2) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

   Calculate the size of the largest angle of the triangle.
   Give your answer correct to 1 decimal place.
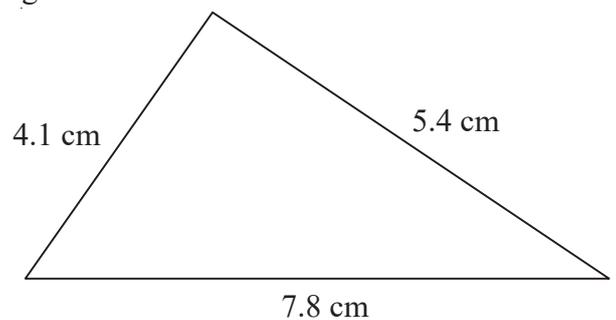
3)
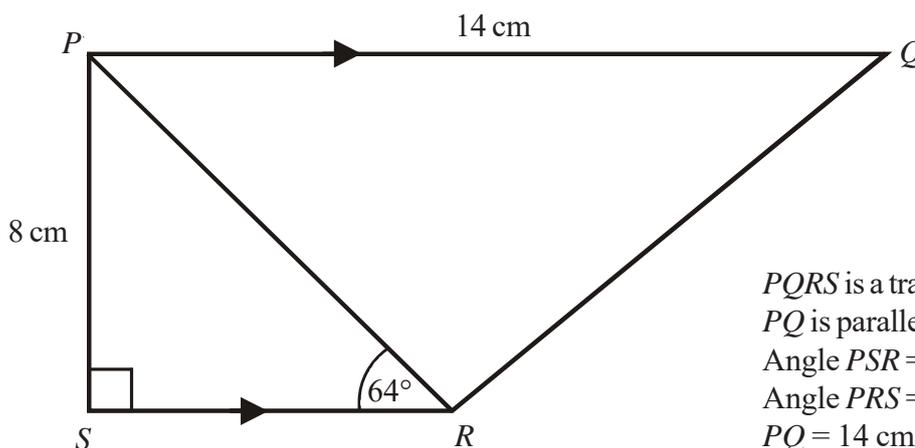
PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

   a) Work out the length of *PR*.
      Give your answer correct to 3 significant figures.

   b) Work out the length of *QR*.
      Give your answer correct to 3 significant figures.

1) *ABC* is a triangle.
   AC = 8 cm
   BC = 9 cm
   Angle *ACB* = 43°

   Calculate the length of *AB*.
   Give your answer correct to 3 significant figures.

   6.30 cm
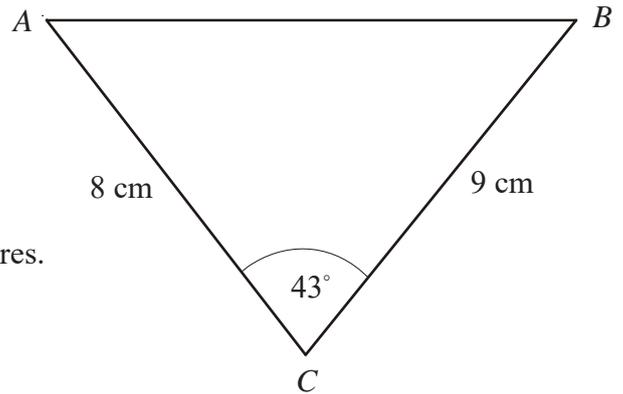
2) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

   Calculate the size of the largest angle of the triangle.
   Give your answer correct to 1 decimal place.

   109.6°
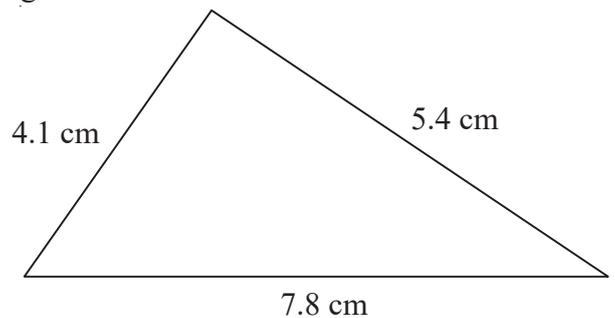
3)
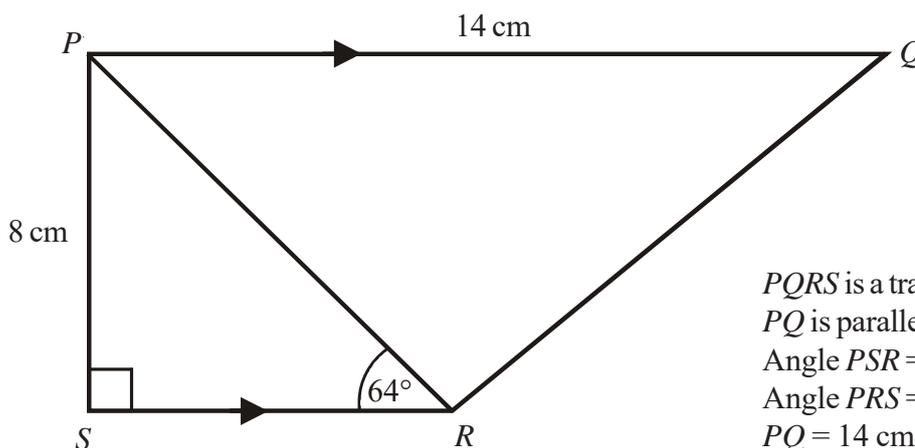
   14 cm

   8 cm

   64°

   S   *R*

   PQRS is a trapezium.
   PQ is parallel to *SR*.
   Angle *PSR* = 90°
   Angle *PRS* = 64°
   PQ = 14 cm.
   PS = 8 cm.

   a) Work out the length of *PR*.
      Give your answer correct to 3 significant figures. **8.90 cm**

   b) Work out the length of *QR*.
      Give your answer correct to 3 significant figures. **12.9 cm**

1)

Diagram **NOT**
accurately drawn.

8 cm

10 cm

42°

A

B

C

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

2)

Diagram **NOT**
accurately drawn.

C

18 cm

144°

B

20 cm

A

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

3)

Diagram **NOT**
accurately drawn.

C

23 cm

31 cm

54°

39°

A

B

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

Advanced Trigonometry - Area of a Triangle Using Sine

1)

A _____ B

Diagram **NOT**
accurately drawn.

8 cm   10 cm

42°

C

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.   26.8 cm²

2)
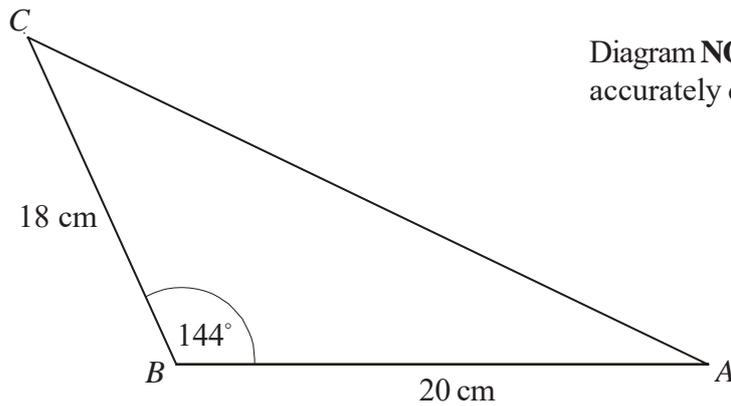
C

Diagram **NOT**
accurately drawn.

18 cm

144°

B _____ A

20 cm

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.   106 cm²

3)
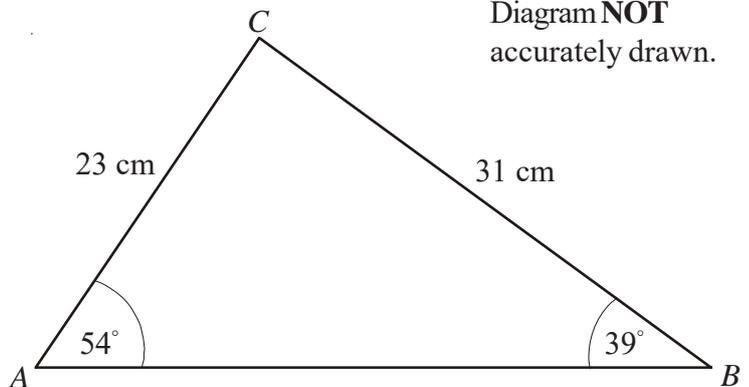
Diagram **NOT**
accurately drawn.

C

23 cm   31 cm

54°   39°

A _____ B

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.   356 cm²

Pythagoras in 3D
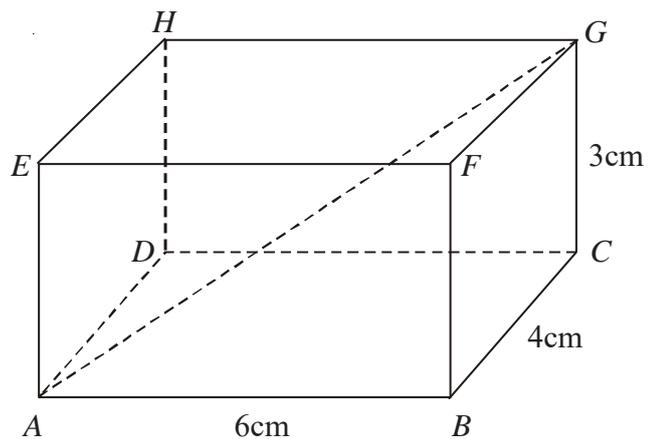
1) The diagram shows a box in the shape of a cuboid.
AB = 6cm, BC = 4cm, CG = 3cm
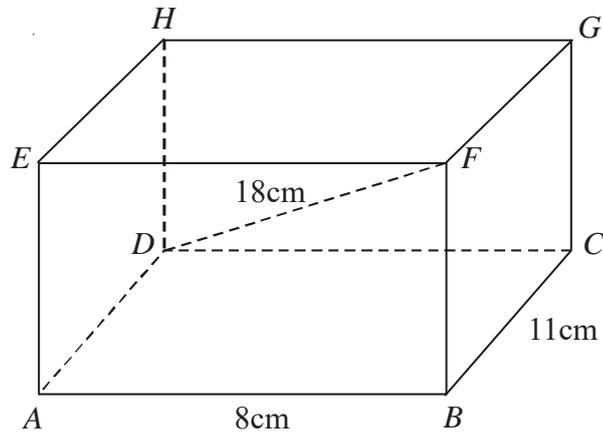
A string runs diagonally across the box from A to G.

Calculate the length of the string AG.
Give your answer correct to 3 significant figures.

H   G
E   F   3cm
D   C
          4cm
A   6cm   B
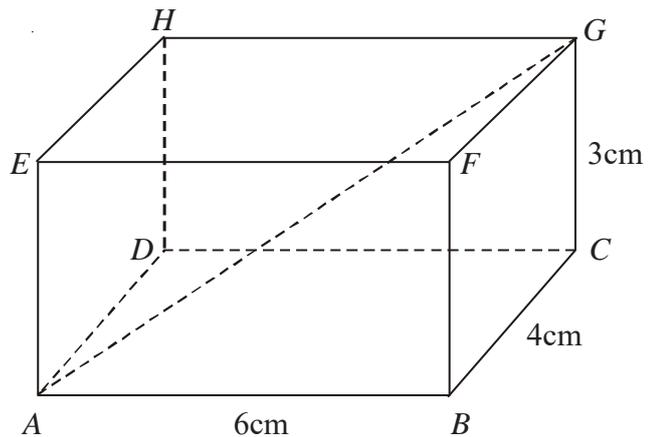
2) The diagram shows a box in the shape of a cuboid.
AB = 8cm, BC = 11cm

A string runs diagonally across the box from D to F and is 18cm long.

Calculate the length AE.
Give your answer correct to 3 significant figures.
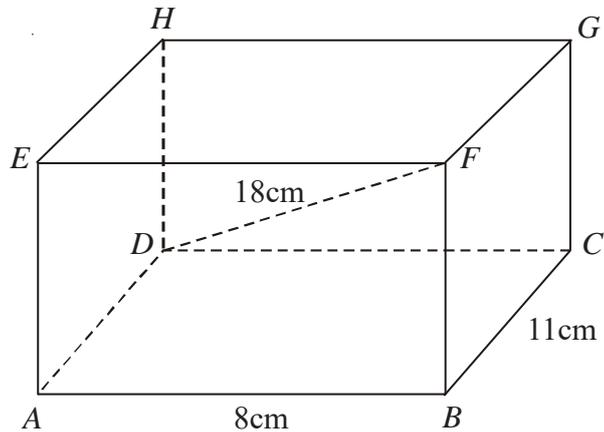
H   G
E   F
     18cm
D   C
          11cm
A   8cm   B

3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.

Calculate the length AC
Give your answer correct to 3 significant figures.

D   C
          8cm
E   F
          17cm
A   20cm   B
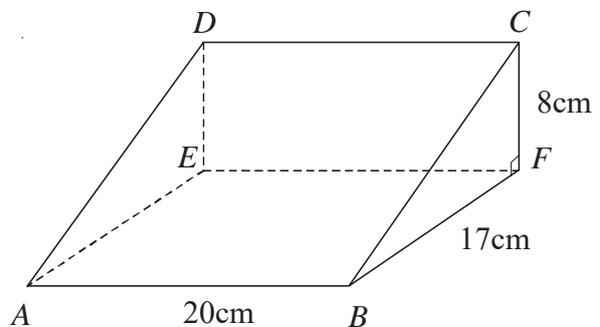
1) The diagram shows a box in the shape of a cuboid.
AB = 6cm, BC = 4cm, CG = 3cm

A string runs diagonally across the box from A to G.

Calculate the length of the string AG.
Give your answer correct
to 3 significant figures. **7.81 cm**

2) The diagram shows a box in the shape of a cuboid.
AB = 8cm, BC = 11cm

A string runs diagonally across the box from D to F and is 18cm long.

Calculate the length AE. **11.8 cm**
Give your answer correct
to 3 significant figures.

3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.

Calculate the length AC
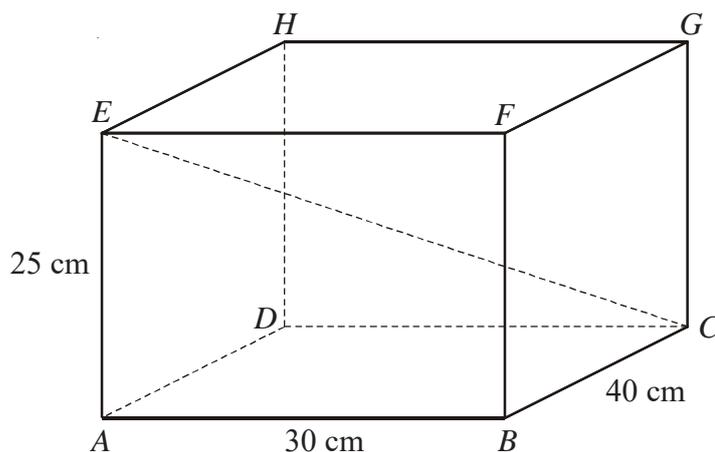Give your answer correct to
3 significant figures. **27.4 cm**
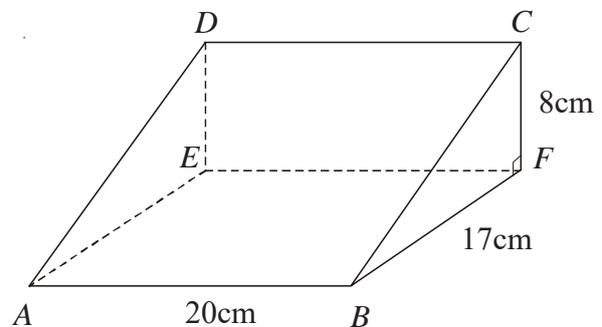
1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.
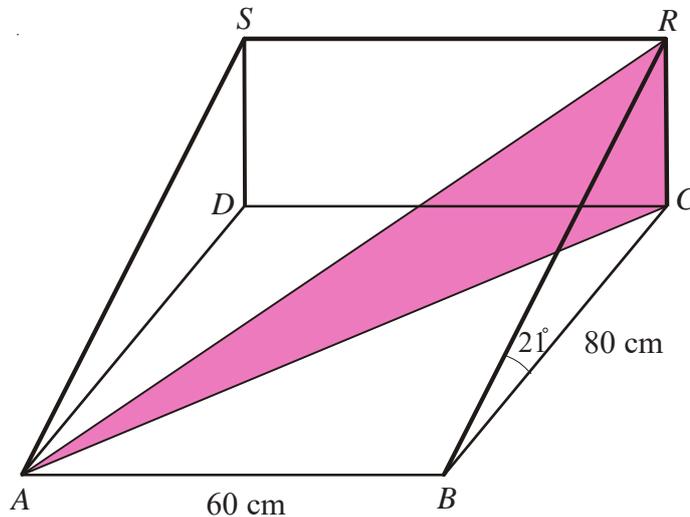
Calculate the angle that *AR* makes with the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.

2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.
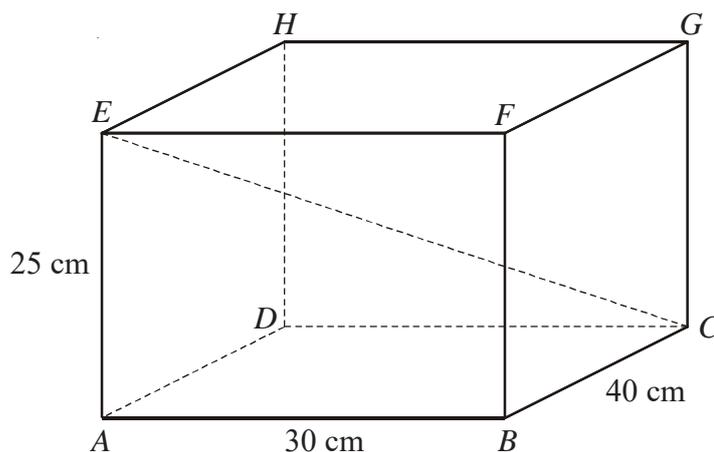
a) Work out the length of the string *CE*.
   Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
   Give your answer correct to 1 decimal place.

1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.
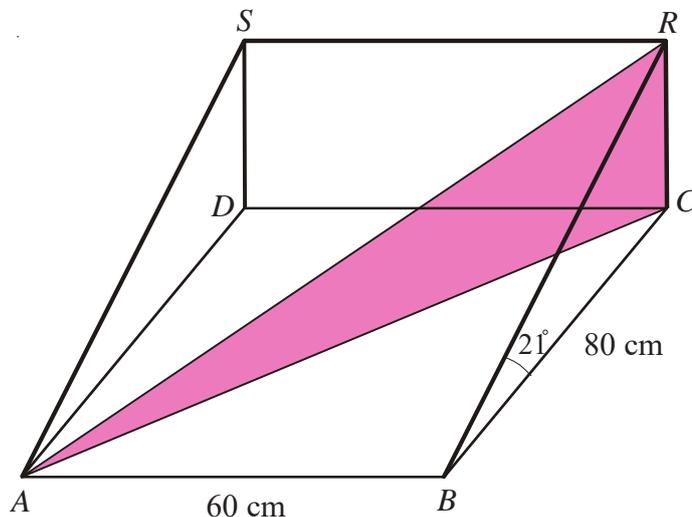
Calculate the angle that *AR* makes with the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.   17.1°

2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.

a) Work out the length of the string *CE*.   55.9 cm
Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.   26.6°

1) On the axes below below, draw a sketch-graph to show $y = \sin x$
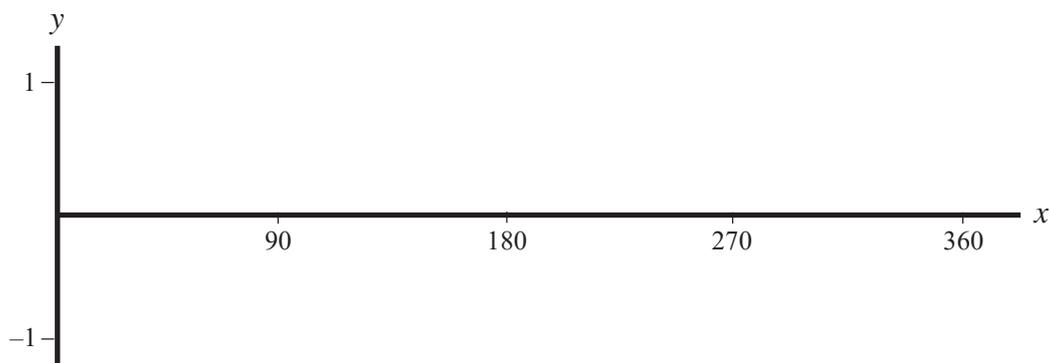
Given that $\sin 30° = 0.5$, write down the value of:

(i) $\sin 150°$

(ii) $\sin 330°$
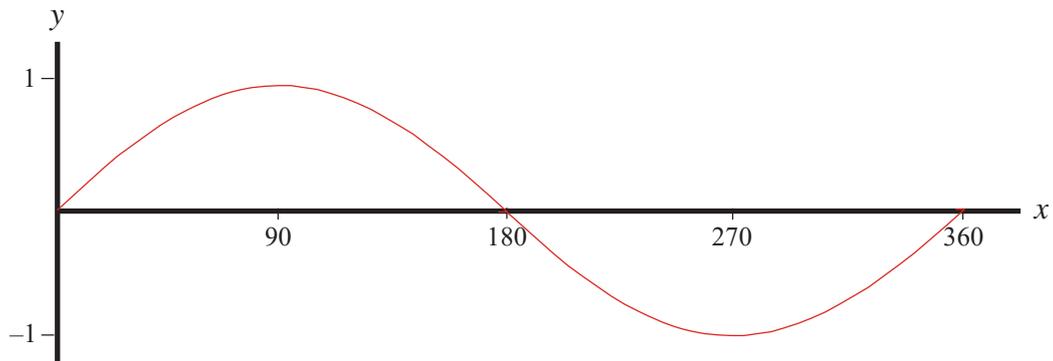
2) On the axes below, draw a sketch-graph to show $y = \cos x$
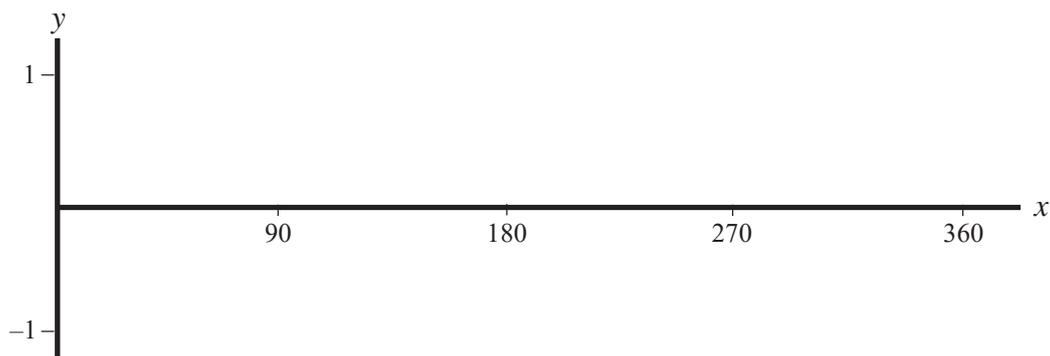
Given that $\cos 60° = 0.5$, write down the value of:

(i) $\cos 120°$

(ii) $\cos 240°$

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

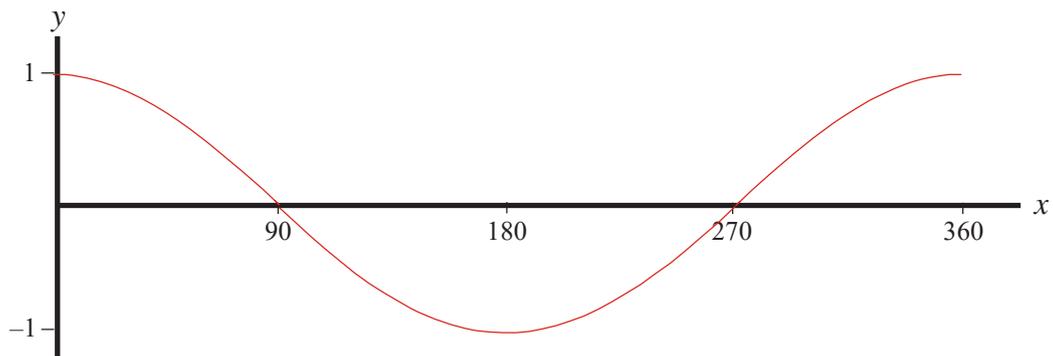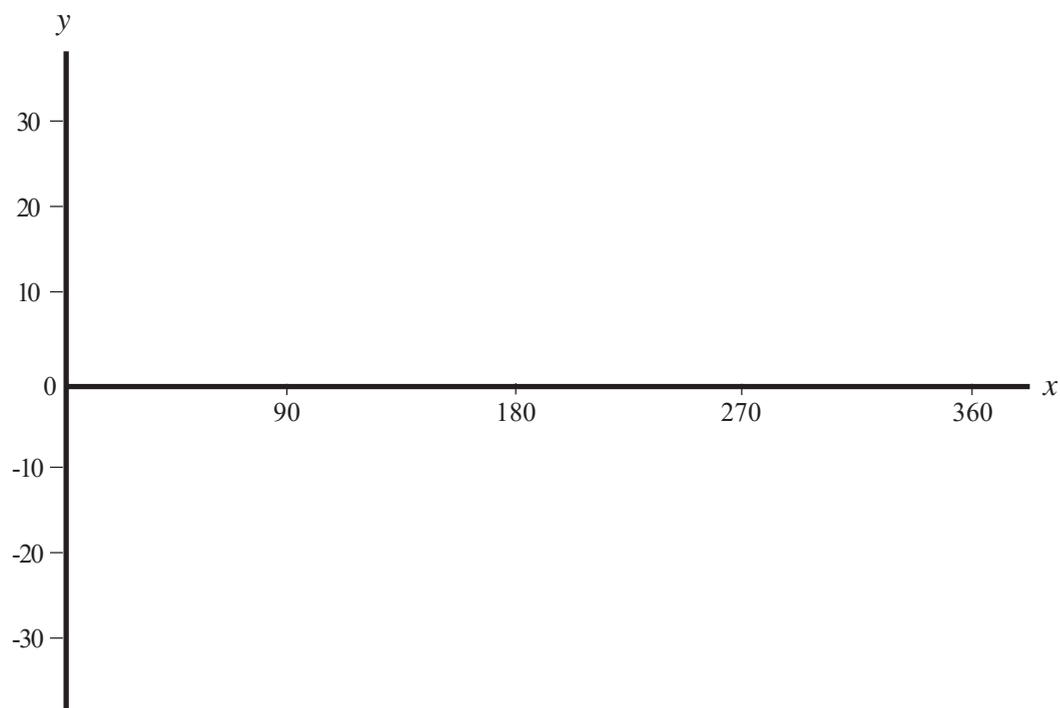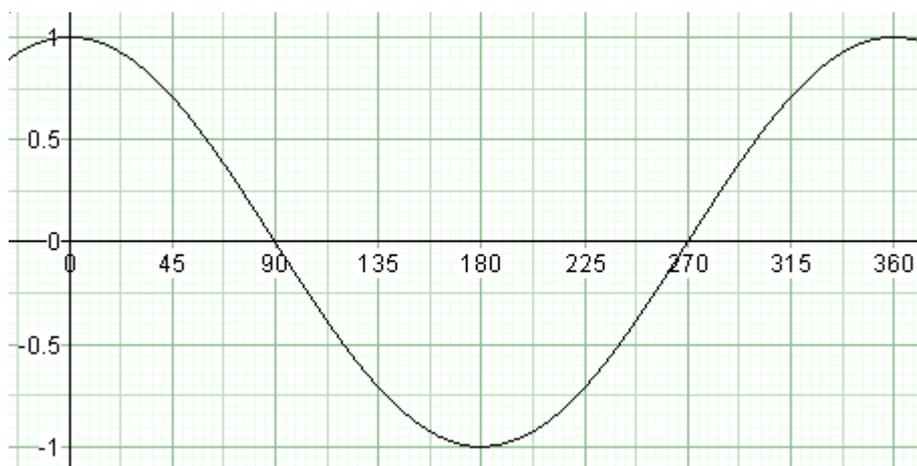Given that $\sin 30° = 0.5$, write down the value of:

(i) $\sin 150°$ 0.5

(ii) $\sin 330°$ -0.5

2) On the axes below, draw a sketch-graph to show $y = \cos x$

Given that $\cos 60° = 0.5$, write down the value of:

(i) $\cos 120°$ -0.5

(ii) $\cos 240°$ -0.5

Trigonometric Graphs - Tangent

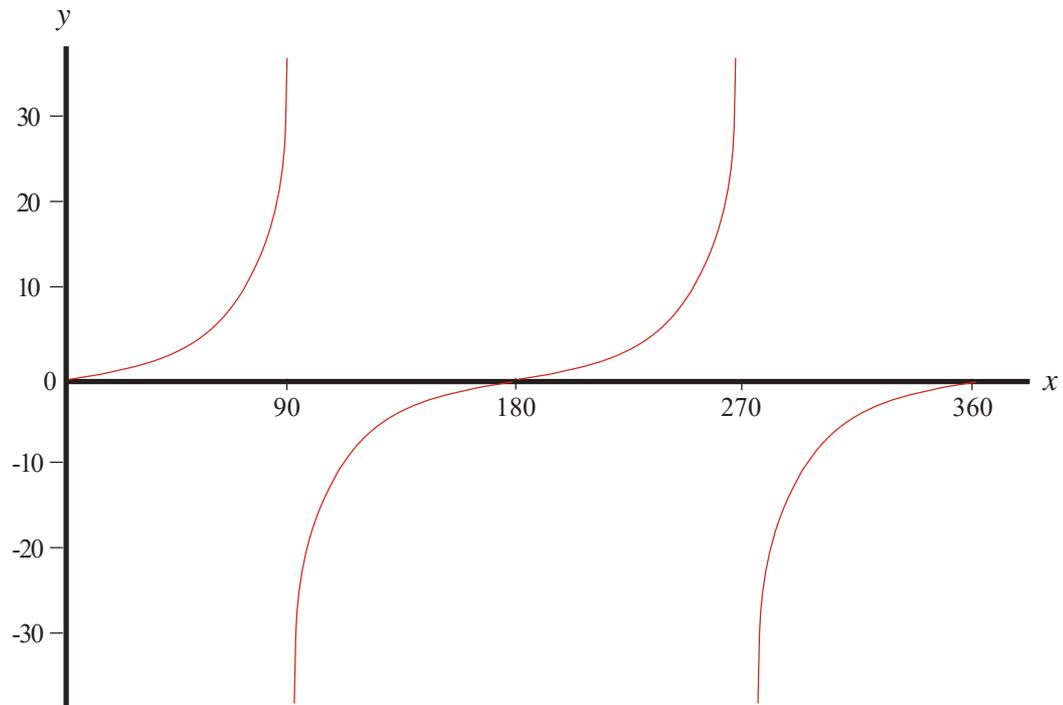1) On the axes below, draw a sketch-graph to show $y = \tan x$

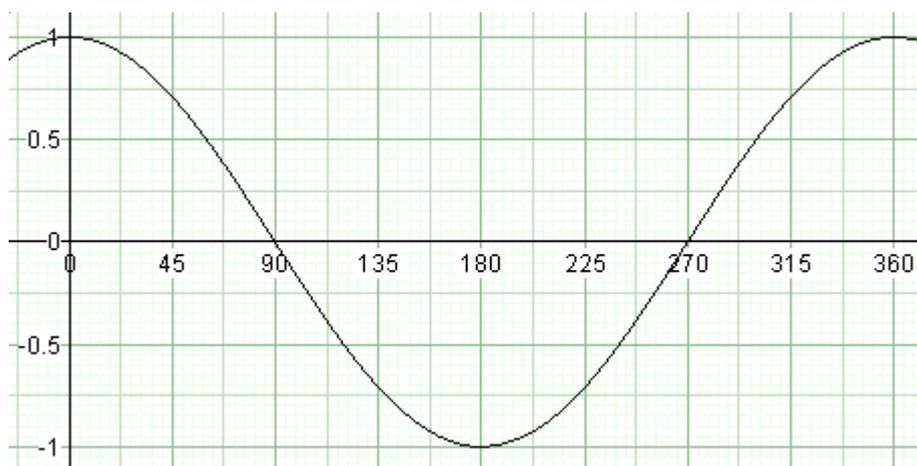2) Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360°$.

a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360°$

b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360°$

Page 186 B

Trigonometric Graphs - Tangent

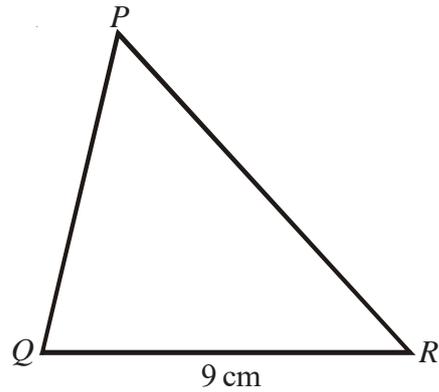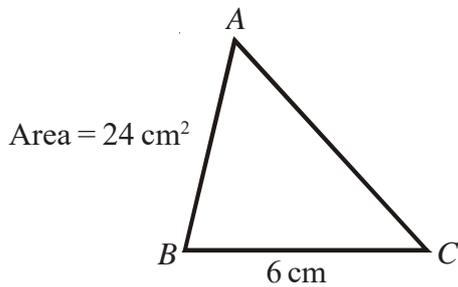1)   On the axes below, draw a sketch-graph to show $y = \tan x$

2)   Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360°$.

a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360°$ **x = 42° and 318°**

b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360°$ **x = 138° and 222°**

Similarity - Area and Volume

1) Triangle *ABC* is similar to triangle *PQR*.

Area = 24 cm²

6 cm

9 cm

The area of triangle *ABC* is 24 cm².

Calculate the area of triangle *PQR*.

2) Cylinder A is mathematically similar to cylinder B.

Volume = 240 cm³

A

8 cm

B

10 cm
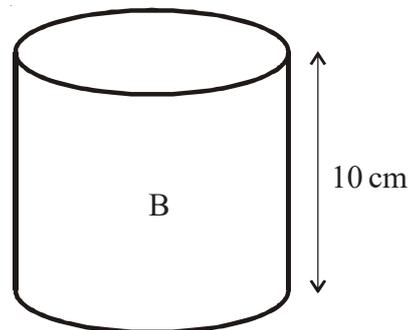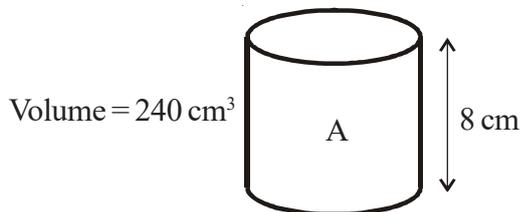
The volume of cylinder A is 240 cm³

Calculate the volume of cylinder B.
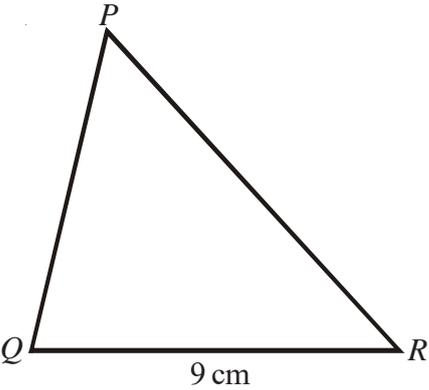
3) P and Q are two geometrically similar solid shapes.

The total surface area of shape P is 540 cm².
The total surface area of shape Q is 2160 cm².

The volume of shape P is 2700 cm³.

Calculate the volume of shape Q.

1) Triangle *ABC* is similar to triangle *PQR*.

A

Area = 24 cm²

B ____ *C*
6 cm

P

Q ____ *R*
9 cm

The area of triangle *ABC* is 24 cm².

Calculate the area of triangle *PQR*.   **54 cm²**

2) Cylinder A is mathematically similar to cylinder B.

Volume = 240 cm³
A   8 cm

B   10 cm

The volume of cylinder A is 240 cm³
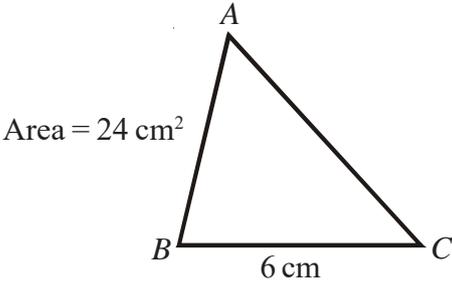
Calculate the volume of cylinder B.   **468.75 cm³**

3) P and Q are two geometrically similar solid shapes.

The total surface area of shape P is 540 cm².
The total surface area of shape Q is 2160 cm².

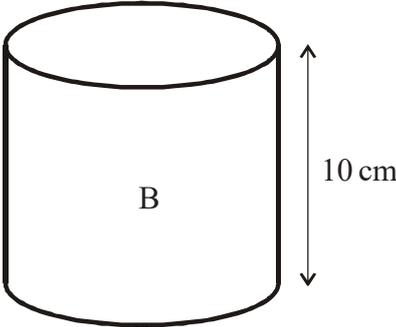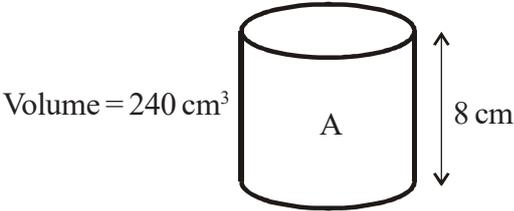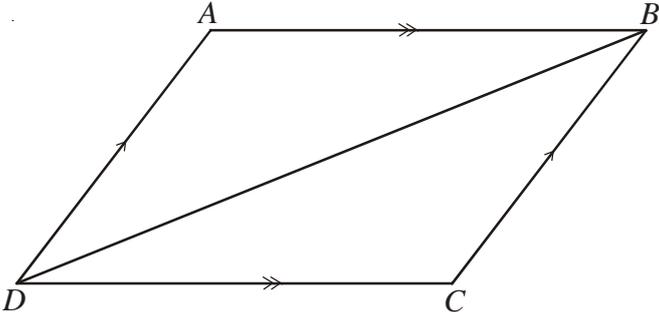The volume of shape P is 2700 cm³.

Calculate the volume of shape Q.   **21600 cm³**

1) *ABCD* is a quadrilateral.

AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

2)

PQRS is a square.
PTS and *SUR* are equilateral triangles.

a) Prove that triangle *USP* is congruent to triangle *TSR*.

X is the point such that *RUXT* is a parallelogram.
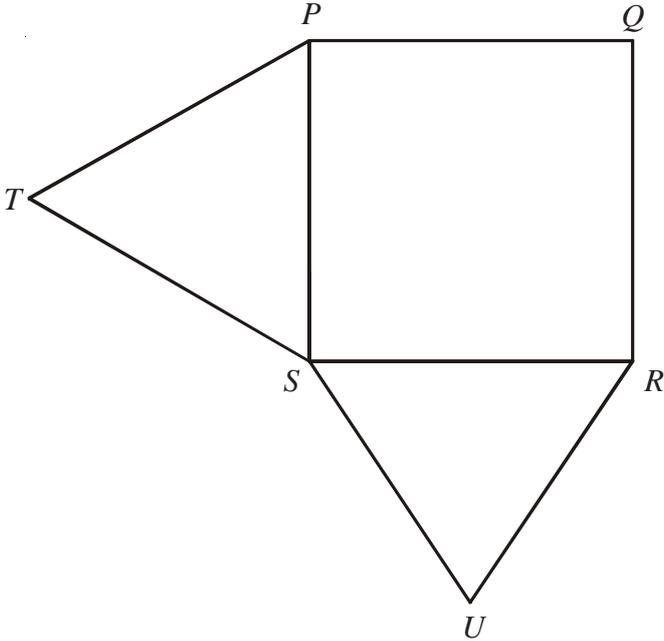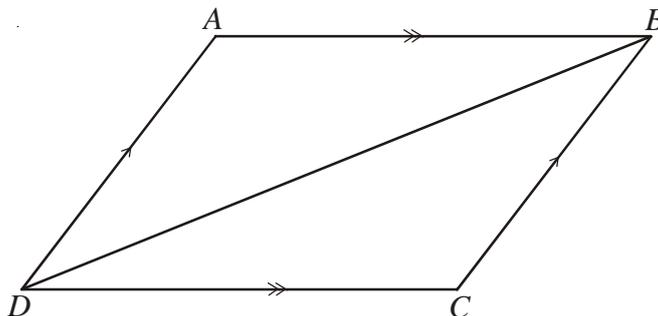
b) Prove that *UP = UX*

Congruent Triangles

1) *ABCD* is a quadrilateral.

AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

AB = CD (opp. sides of parallelogram are equal)
AD = CB (opp. sides of parallelogram are equal)
DB is a shared side.
Therefore *ABD* is congruent to *CDB* (SSS)

2)

PQRS is a square.
PTS and *SUR* are equilateral triangles.
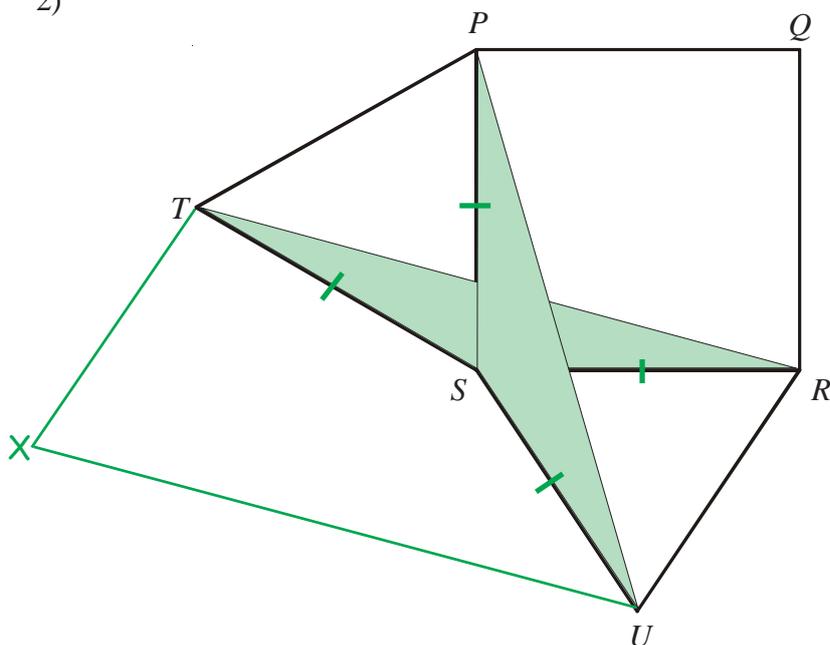
a) Prove that triangle *USP* is congruent to triangle *TSR*.

US = TS
SP = SR
Angle *USP* = 60° + 90° = 150°
Angle *TSR* = 60° + 90° = 150°
USP is congruent to *TSR* (SAS)

X is the point such that *RUXT* is a parallelogram.

b) Prove that *UP = UX*

UP = RT (corresponding sides of congruent triangles)
RT = UX (opp. sides of parallelogram are equal)
Therefore *UP = UX*
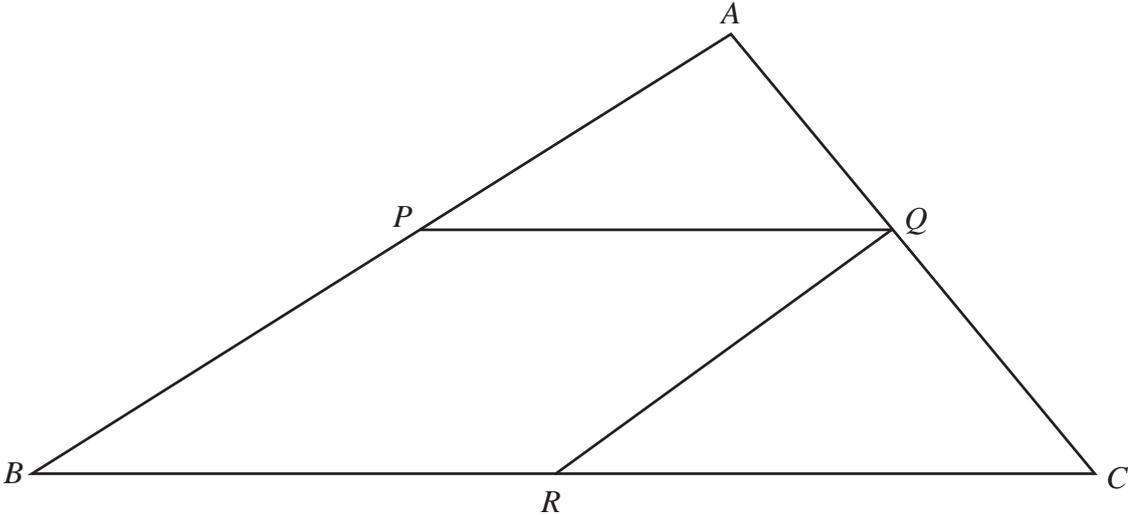
1)

The diagram shows a triangle *ABC*.

PQRB is a parallelogram where
  P is the midpoint of *AB*,
  Q is the midpoint of *AC*,
and *R* is the midpoint of *BC*.

Prove that triangle *APQ* and triangle *QRC* are congruent.
You must give reasons for each stage of your proof.

2)

ABC is an equilateral triangle.

D lies on *BC*.

AD is perpendicular to *BC*.

a) Prove that triangle *ADC* is congruent to triangle *ADB*.

b) Hence, prove that $BD = \frac{1}{2}AB$

1)

The diagram shows a triangle *ABC*.

PQRB is a parallelogram where
  P is the midpoint of *AB*,
  Q is the midpoint of *AC*,
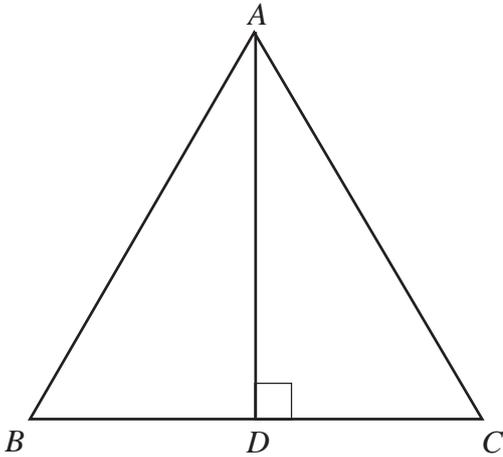and *R* is the midpoint of *BC*.

Prove that triangle *APQ* and triangle *QRC* are congruent.
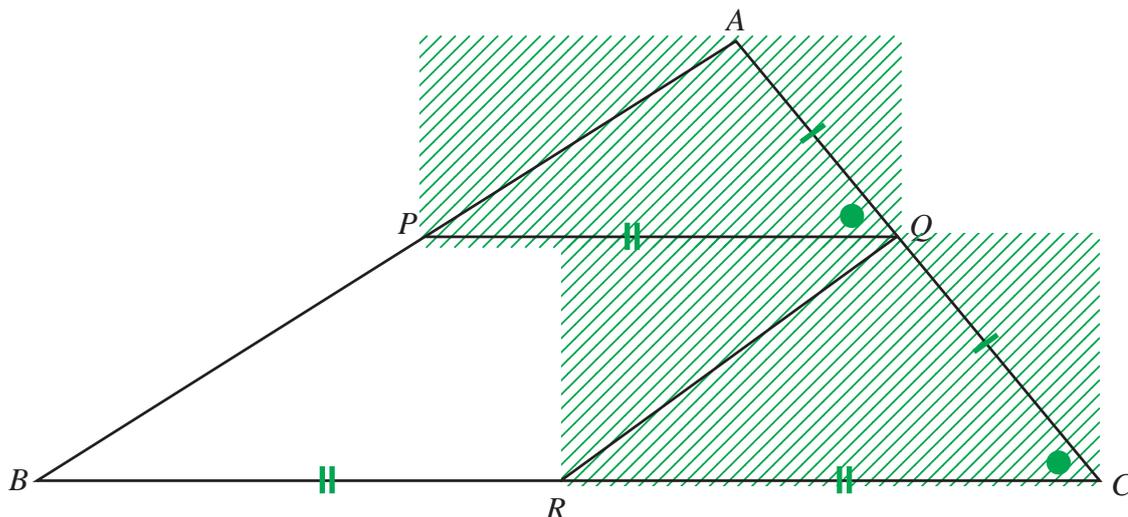You must give reasons for each stage of your proof.

AQ = QC (*Q* is midpoint of *AC*)
Angle *AQP*= angle *QCR* (corresponding angles)
PQ = BR (opposite sides of parallelogram)
BR = RC (*R* is midpoint of *BC*)
∴ *PQ = RC*
∴ *APQ* is congruent to *QRC* (SAS)

2)
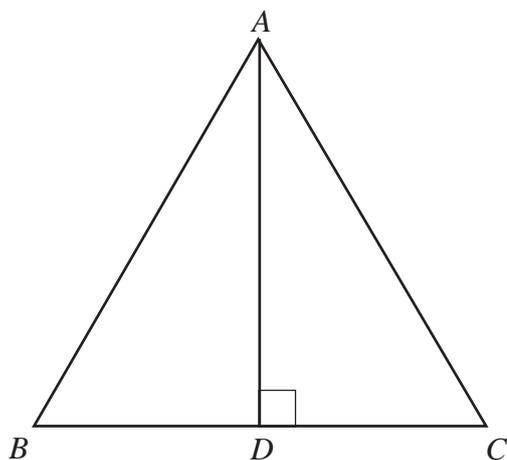
ABC is an equilateral triangle.

D lies on *BC*.

AD is perpendicular to *BC*.

Angle *ADB* = angle *ADC* = $90°$ (*AD* is perp. to *BC*)
AB = *AC* (equilateral triangle)
AD is a side in triangles *ADC* and *ADB*
∴ Triangle *ADC* is congruent to triangle *ADB* (RHS)

a) Prove that triangle *ADC* is congruent to triangle *ADB*.

b) Hence, prove that $BD = \frac{1}{2}AB$

ADC is congruent to *ADB*
∴ *BD = DC*
$BD = \frac{1}{2}BC$
BC = *AB* (equilateral triangles)
∴ $BD = \frac{1}{2}AB$

Page 188 B

And and Or Probability Questions

1) Jordan designs a game for a school fair.
   He has two 8-sided spinners.
   The spinners are equally likely to land on each of their sides.

   One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
   The other spinner has 2 blue sides, 2 green sides and 4 white sides.

   Calculate the probability that the two spinners will land on the same colour.

2) The probability that it will snow in Paris on Christmas day is 0.06.
   a) Work out the probability that it will snow in Paris on **both** Christmas day 2015
      and Christmas day 2016.

   b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015
      or Christmas Day 2016, but **not** on both.

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
   Natalie takes a bead at random from the bag, records its colour and replaces it.
   She does this two more times.

   Work out the probability that, of the three beads Natalie takes, exactly two are
   the same colour.

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour. $\dfrac{18}{64}$

2) The probability that it will snow in Paris on Christmas day is 0.06.
   a) Work out the probability that it will snow in Paris on **both** Christmas day 2015
   and Christmas day 2016.   0.0036

   b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015
   **or** Christmas Day 2016, but **not** on both.   0.1128

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are
the same colour. $\dfrac{660}{1000}$

Histograms

The table and histogram give some information about the weights of parcels received at a post office during one Thursday.

Frequency density
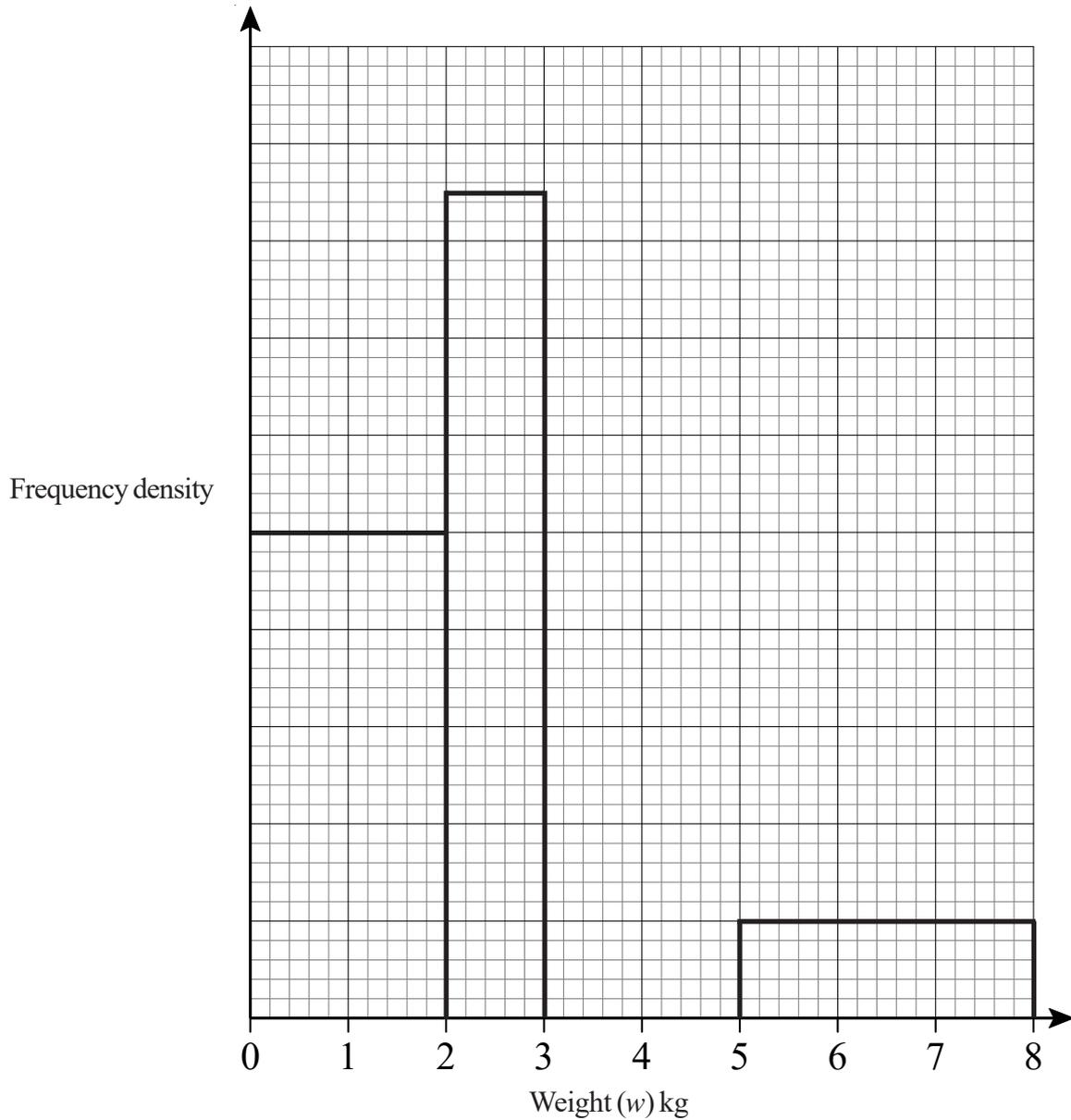
Weight (*w*) kg

a) Use the histogram to complete the frequency table.

Weight (*w*) kg	Frequency
0 < *w* ⩽ 2	40
2 < *w* ⩽ 3	
3 < *w* ⩽ 4	24
4 < *w* ⩽ 5	18
5 < *w* ⩽ 8	

b) Use the table to complete the histogram.

Page 190 A

Histograms

The table and histogram give some information about the weights of parcels received at a post office during one Thursday.
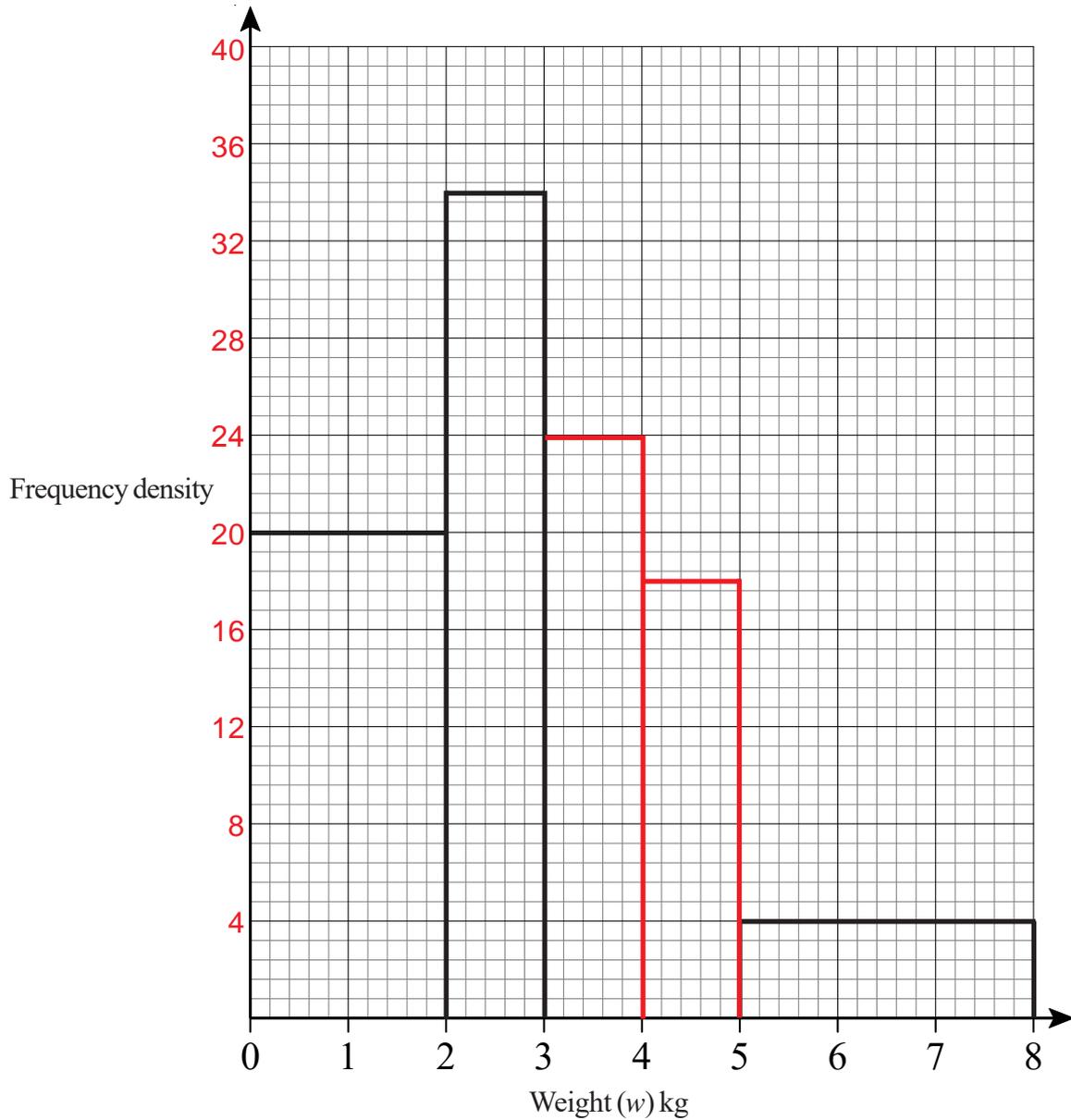

Frequency density

Weight (*w*) kg

a)   Use the histogram to complete the frequency table.

Weight (*w*) kg	Frequency
0 < *w* ⩽ 2	40
2 < *w* ⩽ 3	34
3 < *w* ⩽ 4	24
4 < *w* ⩽ 5	18
5 < *w* ⩽ 8	12

b)   Use the table to complete the histogram.

Histograms

The incomplete table and histogram give some information about the heights (in cm) of some plants.

Height (h cm)	Frequency
100 < h ⩽ 130	30
130 < h ⩽ 150	
150 < h ⩽ 160	
160 < h ⩽ 180	40
180 < h ⩽ 210	18

Frequency density

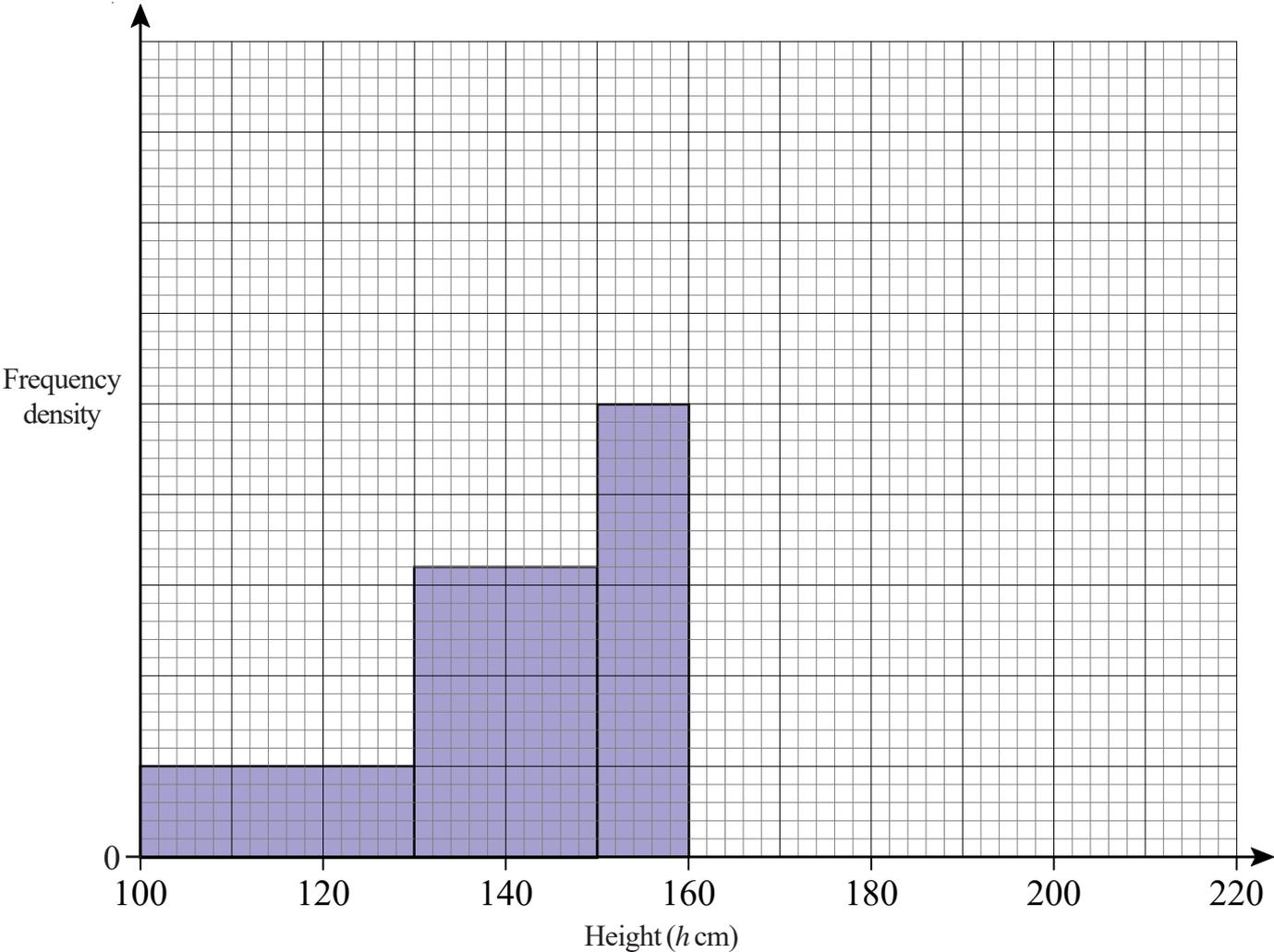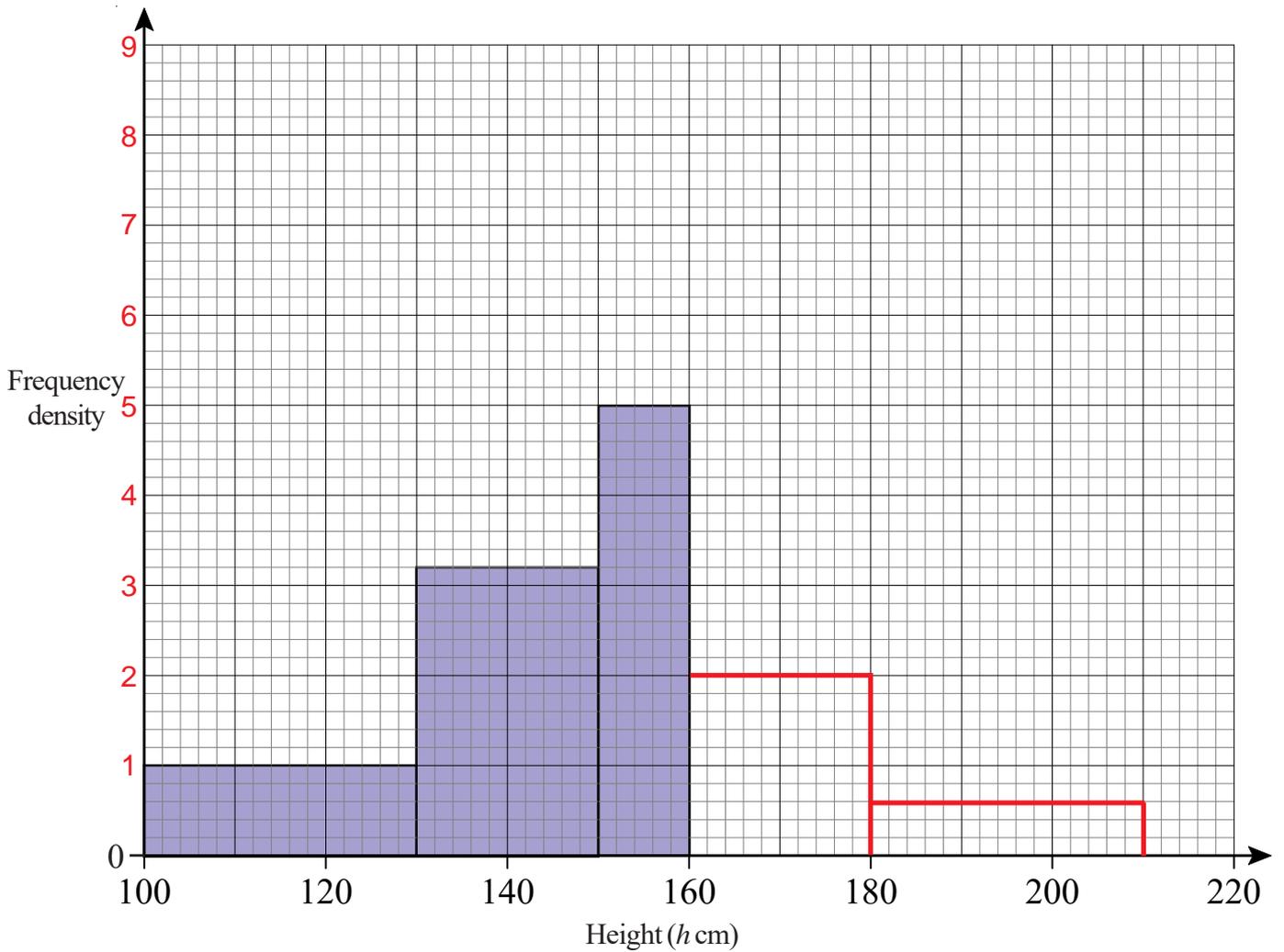Height (h cm)

a)   Use the histogram to complete the table.

b)   Use the table to complete the histogram.

Histograms

The incomplete table and histogram give some information about the heights (in cm) of some plants.

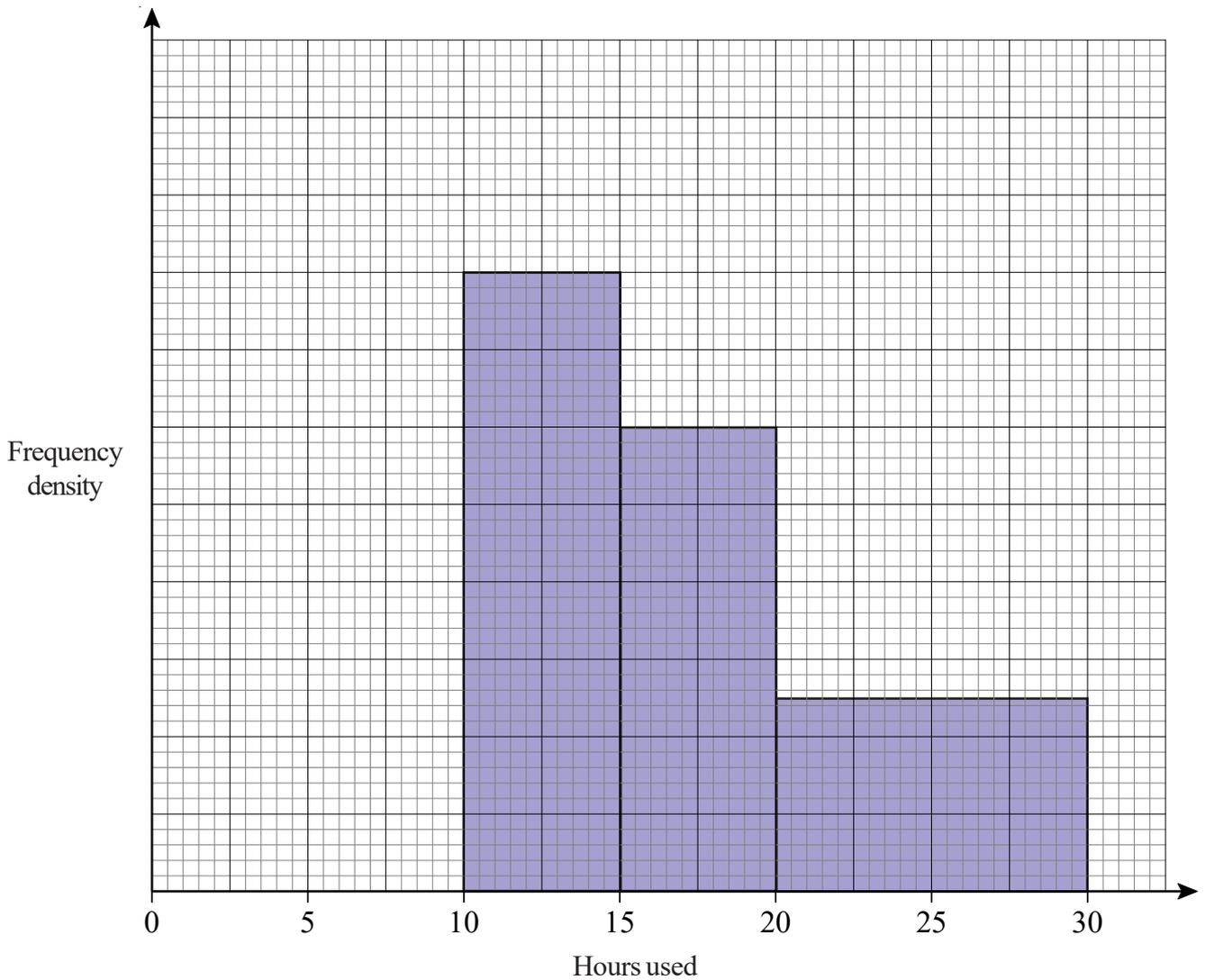| Height (h cm)	Frequency
$100 < h \leqslant 130$	30
$130 < h \leqslant 150$	64
$150 < h \leqslant 160$	50
$160 < h \leqslant 180$	40
$180 < h \leqslant 210$	18

a)   Use the histogram to complete the table.

b)   Use the table to complete the histogram.

Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.

Frequency density

Hours used

Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a)   Use this information to complete the histogram.

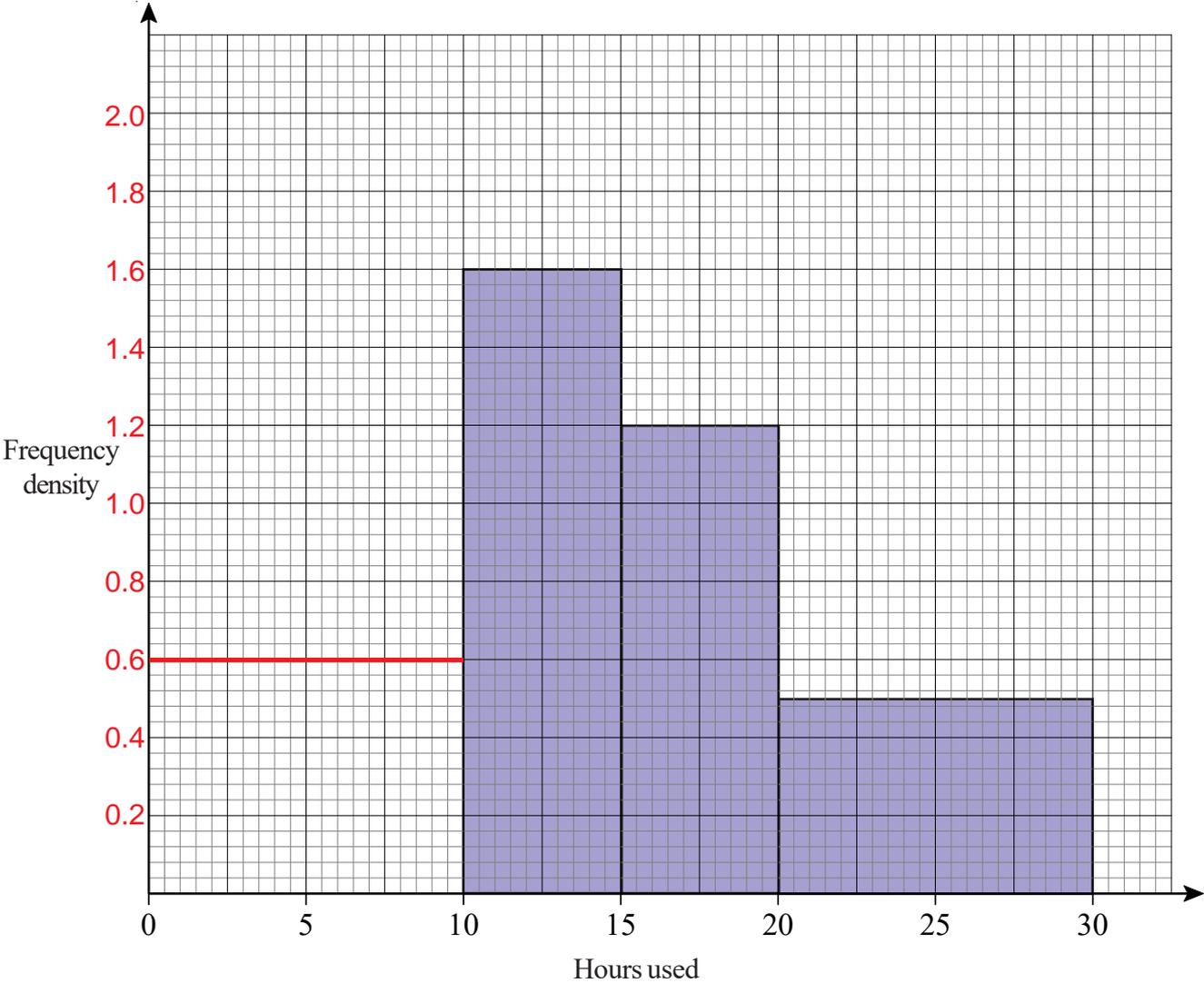No students used the internet for more than 30 hours.

b)   Work out how many students Paul asked.

Histograms

Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.

Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a)   Use this information to complete the histogram.

No students used the internet for more than 30 hours.
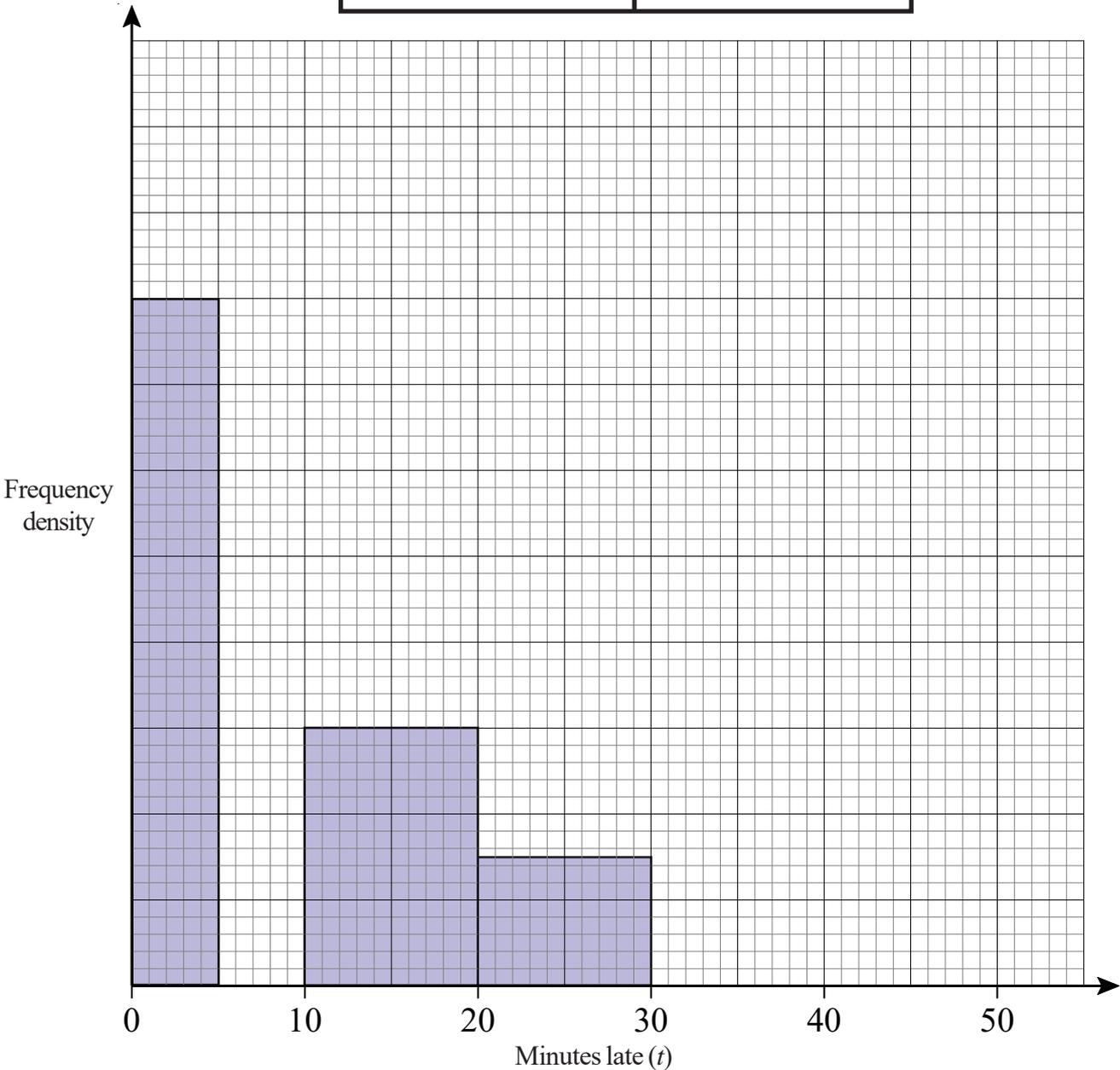
b)   Work out how many students Paul asked.
6 + 8 + 6 + 5 = 25

Histograms

Some trains from Nottingham to Leeds were late.
The incomplete table and histogram give some information about how late the trains were.

Minutes late (t)	Frequency
$0 < t \leqslant 5$	16
$5 < t \leqslant 10$	10
$10 < t \leqslant 20$	
$20 < t \leqslant 30$	
$30 < t \leqslant 50$	8

a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.

Histograms

Some trains from Nottingham to Leeds were late.
The incomplete table and histogram give some information about how late the trains were.

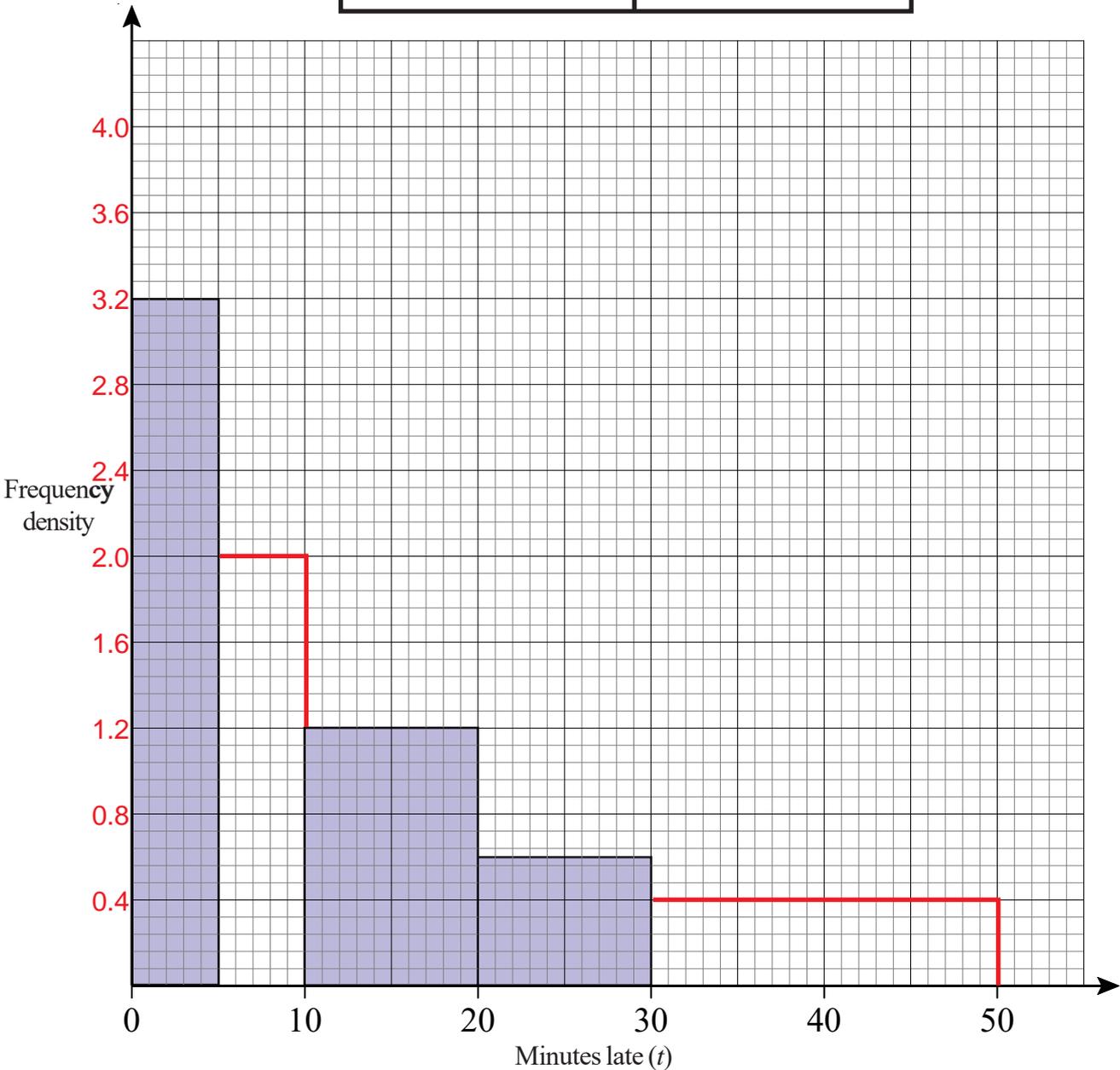| Minutes late (t)	Frequency
$0 < t \leqslant 5$	16
$5 < t \leqslant 10$	10
$10 < t \leqslant 20$	12
$20 < t \leqslant 30$	6
$30 < t \leqslant 50$	8

a)   Use the information in the histogram to complete the table.

b)   Use the information in the table to complete the histogram.

Histograms

The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

Time (*t*) in minutes	Frequency
$0 < t \leqslant 10$	20
$10 < t \leqslant 15$	
$15 < t \leqslant 30$	
$30 < t \leqslant 50$	62
$50 < t \leqslant 60$	23
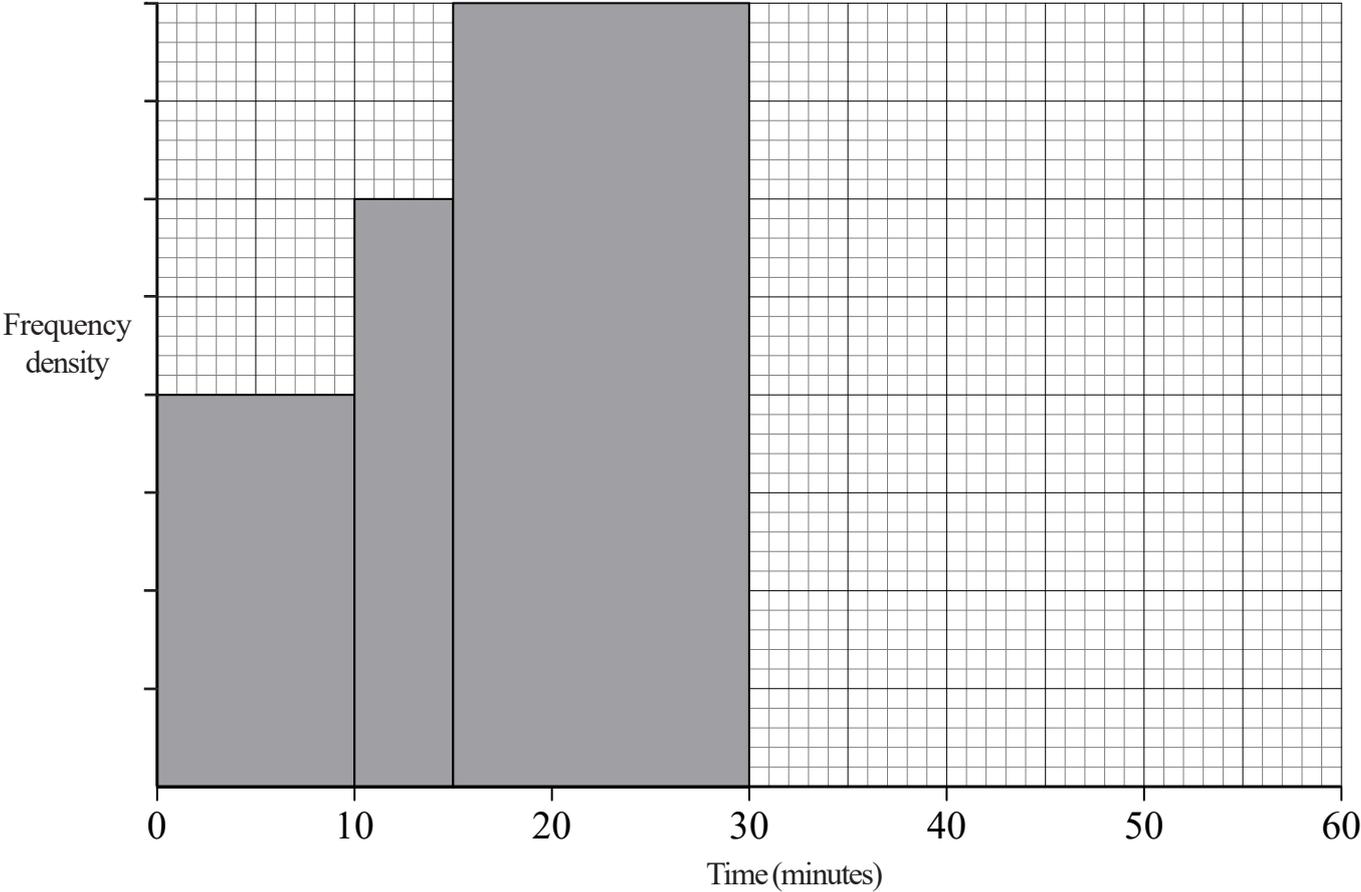
a) Use the information in the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

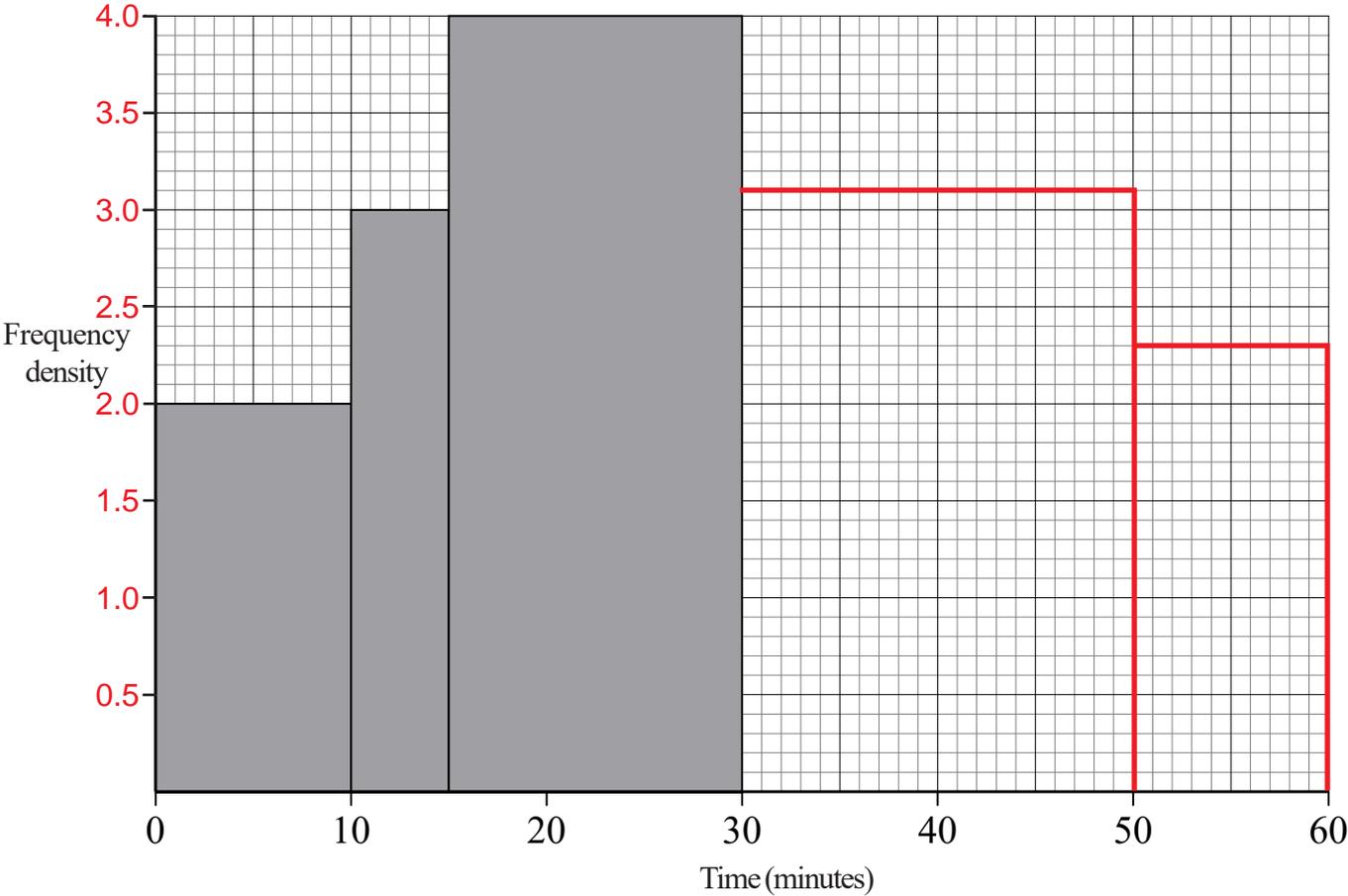| Time (*t*) in minutes	Frequency
$0 < t \leqslant 10$	20
$10 < t \leqslant 15$	15
$15 < t \leqslant 30$	60
$30 < t \leqslant 50$	62
$50 < t \leqslant 60$	23

a)   Use the information in the histogram to complete the table.

b)   Use the table to complete the histogram.

Histograms

The incomplete histogram and table give some information about the distances some students travel to school.
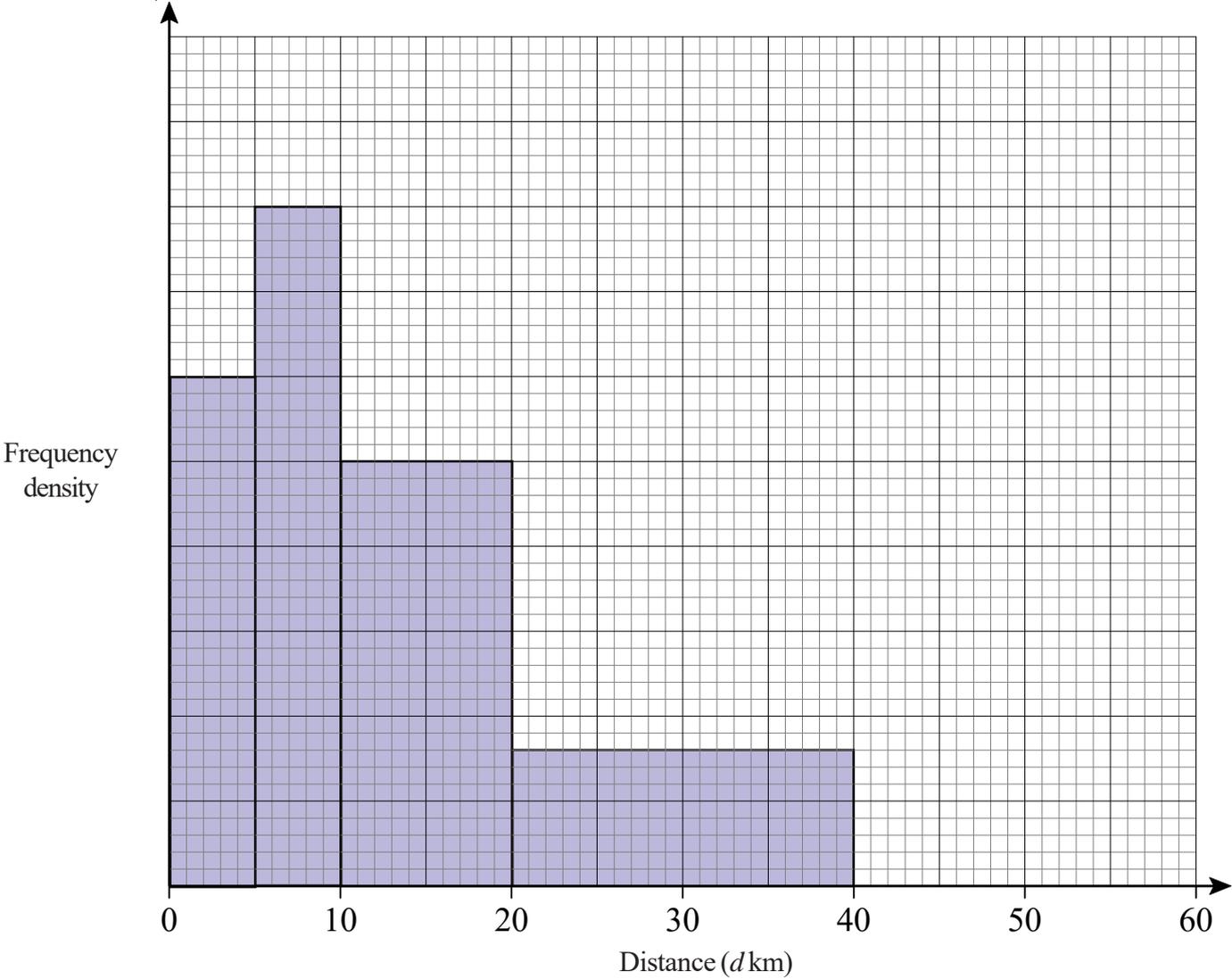
a)   Use the information in the histogram to complete the frequency table.

Distance (d km)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	20
$10 < d \leqslant 20$	
$20 < d \leqslant 40$	
$40 < d \leqslant 60$	10

b)   Use the information in the table to complete the histogram.

Histograms

The incomplete histogram and table give some information about the distances some students travel to school.
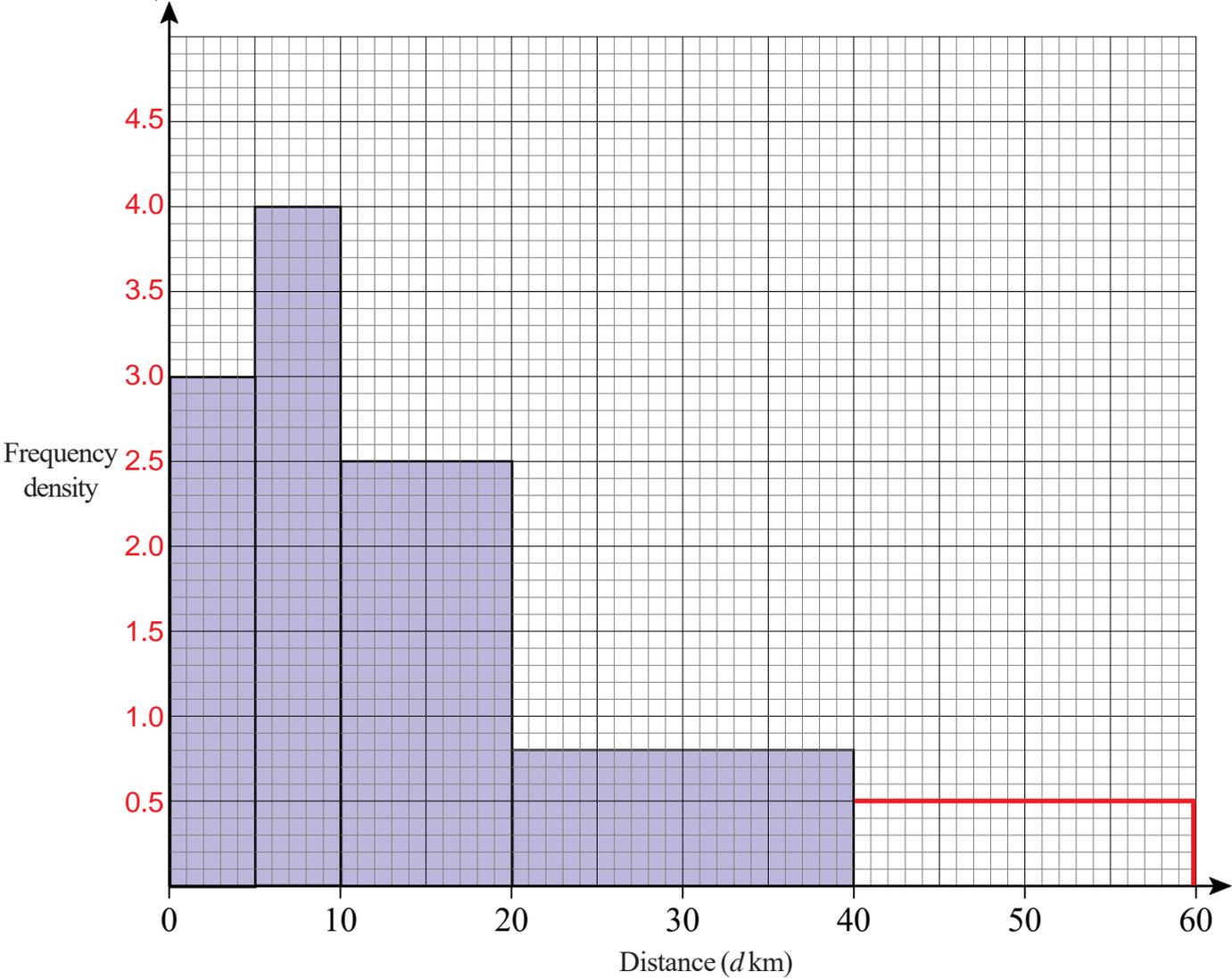

a)   Use the information in the histogram to complete the frequency table.

Distance (d km)	Frequency
0 < d ≤ 5	15
5 < d ≤ 10	20
10 < d ≤ 20	25
20 < d ≤ 40	16
40 < d ≤ 60	10

b)   Use the information in the table to complete the histogram.

Histograms

There are 100 pupils in Year 11. The time taken by each pupil to answer a question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	6	19	25	36	14

Draw a histogram to illustrate the distribution on the graph paper below.

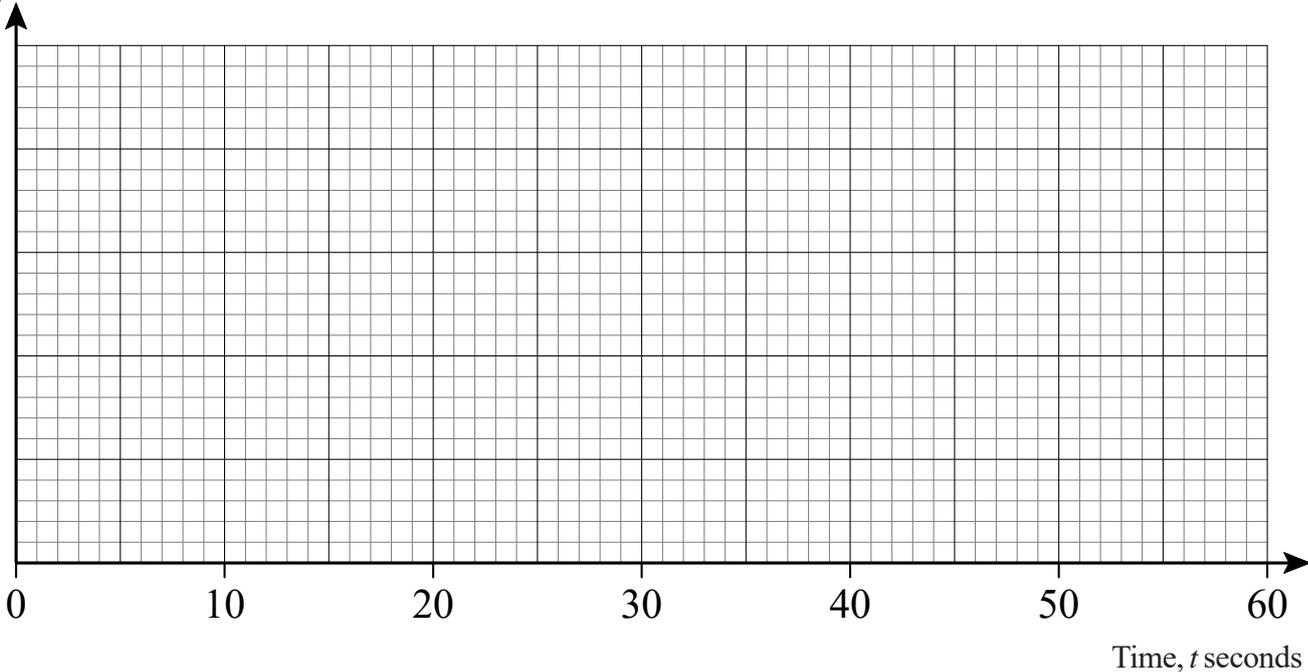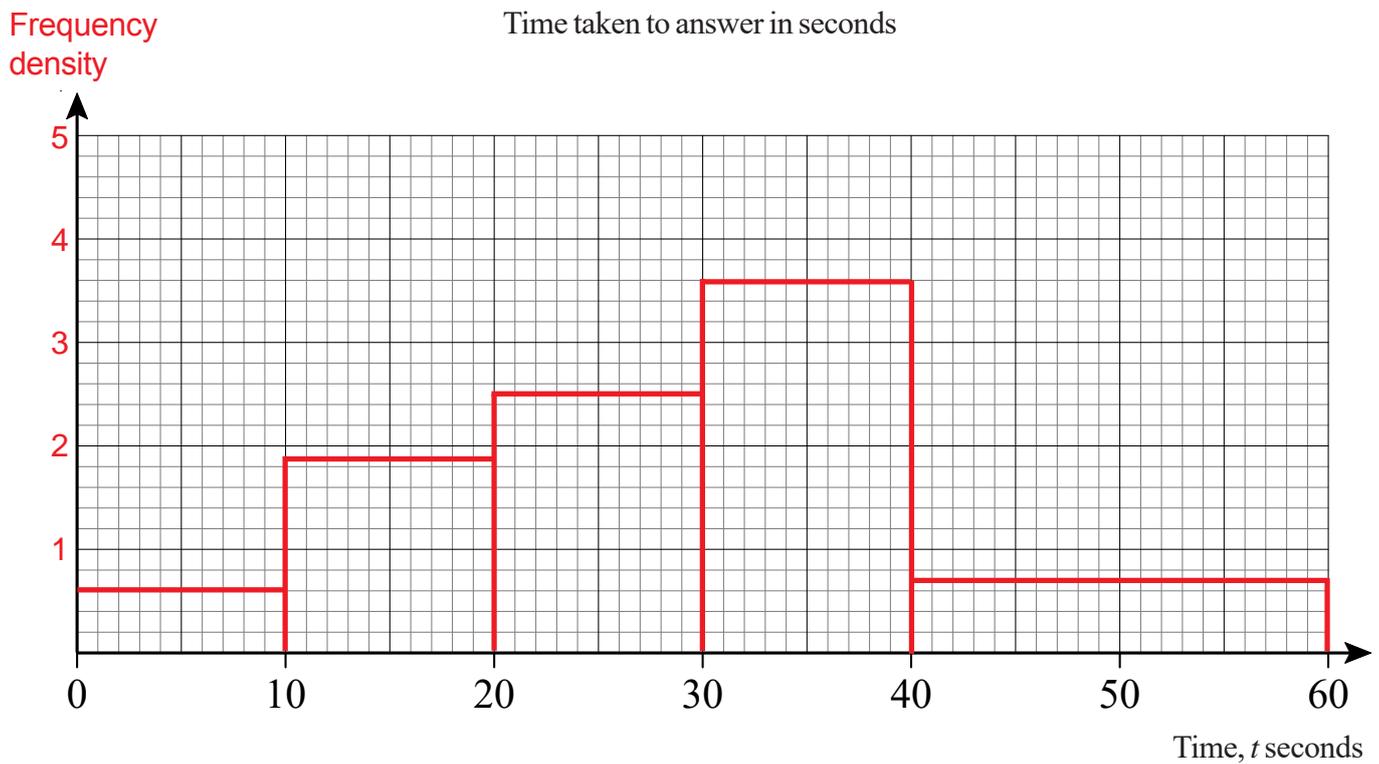Time taken to answer in seconds

Time, t seconds

Histograms

There are 100 pupils in Year 11. The time taken by each pupil to answer a question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	6	19	25	36	14

Draw a histogram to illustrate the distribution on the graph paper below.

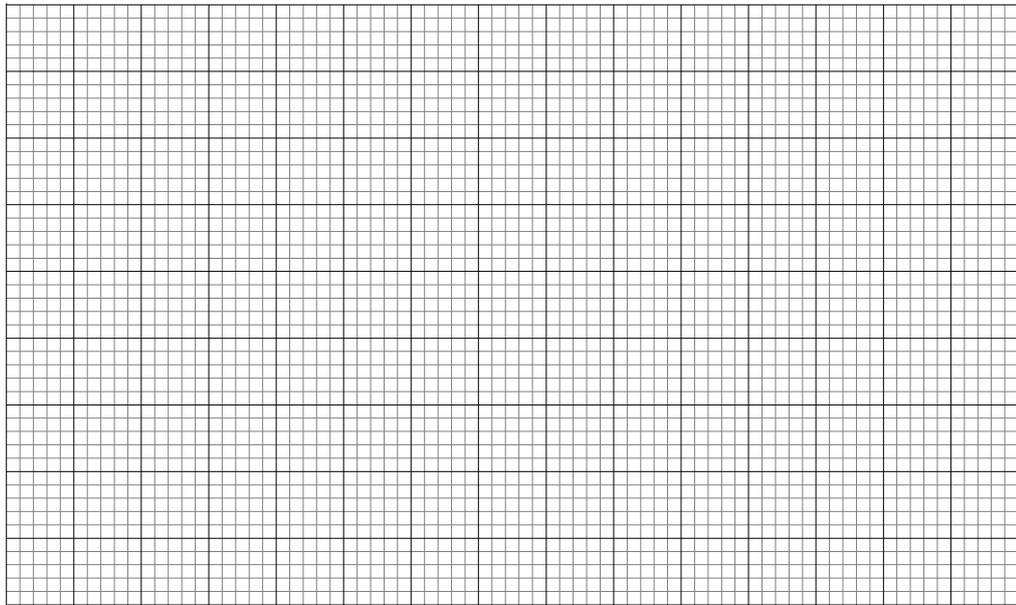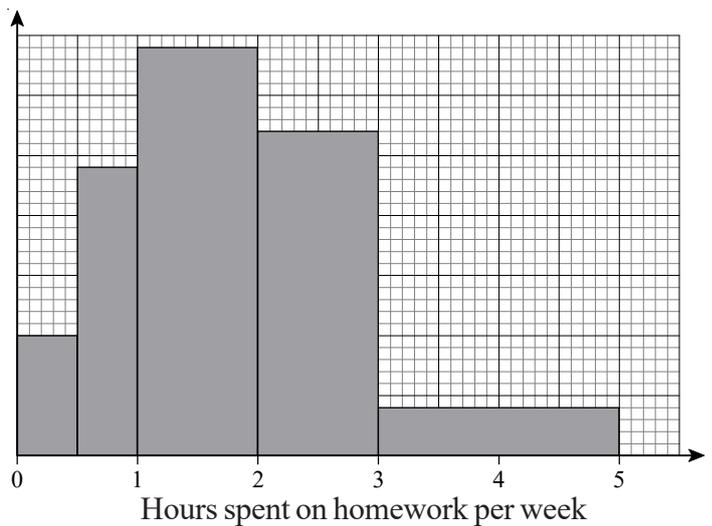Time taken to answer in seconds

Frequency density

Time, t seconds

Histograms

1) The table gives information about the heights, in centimetres, of some 18 year old students.

Height (h cm)	Frequency
$135 < h \leqslant 145$	12
$145 < h \leqslant 165$	46
$165 < h \leqslant 180$	45
$180 < h \leqslant 190$	25
$190 < h \leqslant 195$	4

Use the table to draw a histogram.

2) The histogram shows the amount of time, in hours, that students spend on their homework per week.

Hours spent on homework per week

Use the histogram to complete the table.

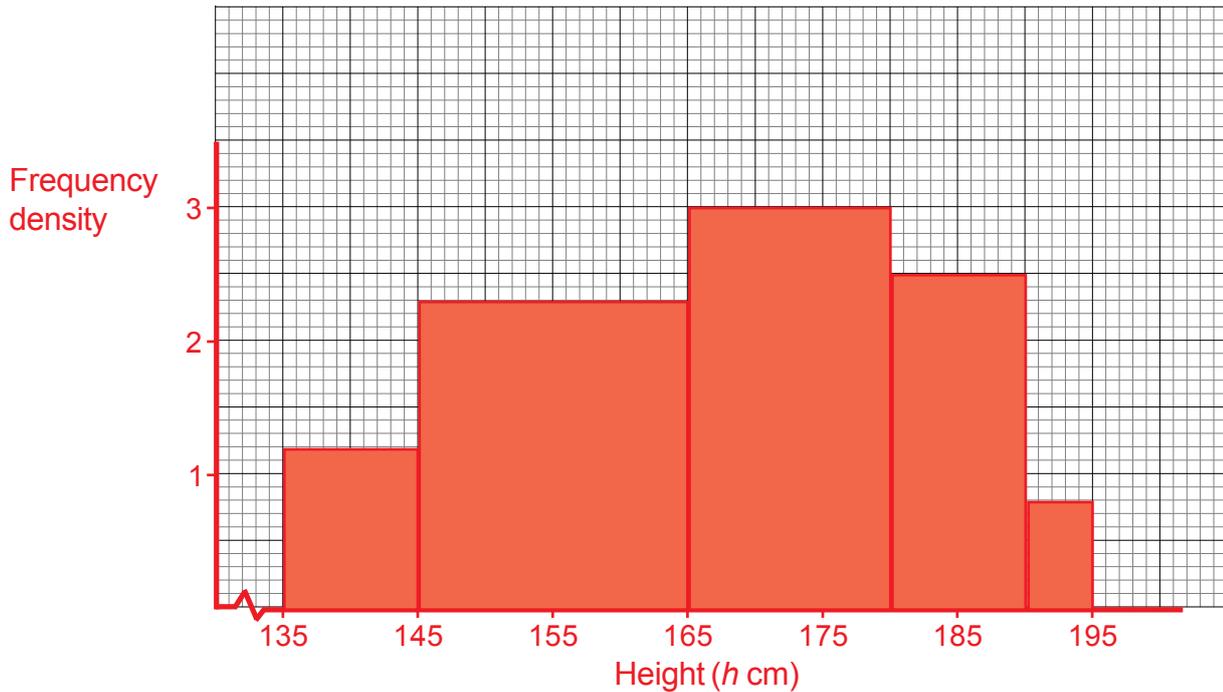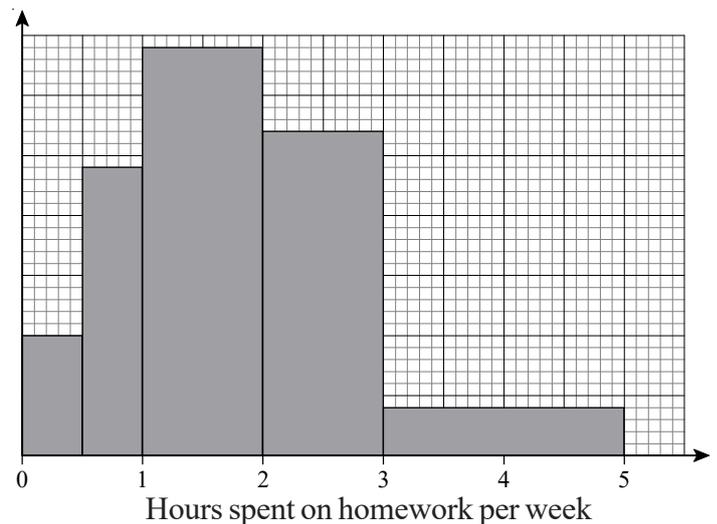| Time (t hours)	Frequency
$0 < t \leqslant ½$	
$½ < t \leqslant 1$	
$1 < t \leqslant 2$	
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	

Histograms

1) The table gives information about the heights, in centimetres, of some 18 year old students.

Height (h cm)	Frequency
$135 < h \leqslant 145$	12
$145 < h \leqslant 165$	46
$165 < h \leqslant 180$	45
$180 < h \leqslant 190$	25
$190 < h \leqslant 195$	4

Use the table to draw a histogram.

2) The histogram shows the amount of time, in hours, that students spend on their homework per week.

Use the histogram to complete the table.

Time (t hours)	Frequency
$0 < t \leqslant \frac{1}{2}$	5
$\frac{1}{2} < t \leqslant 1$	12
$1 < t \leqslant 2$	34
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	8