# REVISE EDEXCEL GCSE (9–1)

## Mathematics

# REVISION WORKBOOK

## Foundation

For the (9–1) exams

**P** Pearson
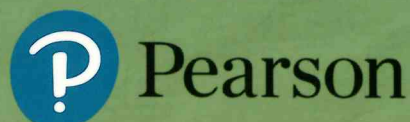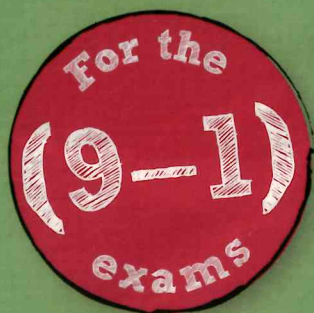
# REVISE EDEXCEL GCSE (9–1)
# Mathematics
## Foundation

# REVISION WORKBOOK

Series Consultant: Harry Smith
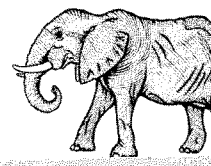
Author: Navtej Marwaha

## Also available to support your revision:

Revise GCSE Study Skills Guide      9781447967071

The **Revise GCSE Study Skills Guide** is full of tried-and-trusted hints and tips for how to learn more effectively. It gives you techniques to help you achieve your best – throughout your GCSE studies and beyond!

Revise GCSE Revision Planner      9781447967828

The **Revise GCSE Revision Planner** helps you to plan and organise your time, step-by-step, throughout your GCSE revision. Use this book and wall chart to mastermind your revision.
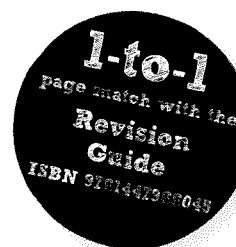
For the full range of Pearson revision titles across KS2, KS3, GCSE, AS/A Level and BTEC visit:
www.pearsonschools.co.uk/revise

**P** Pearson

# Contents

# Symmetry

**Guided**

1   The following shapes have lines of symmetry.
Draw the lines of symmetry as indicated.

(a)  exactly **one** line of symmetry

(b)  exactly **two** lines of symmetry
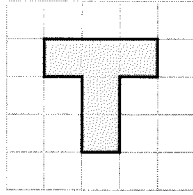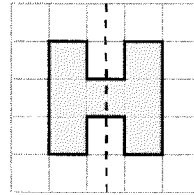
**(1 mark)**

**(1 mark)**

2   Here are four shapes.
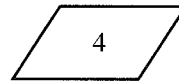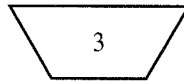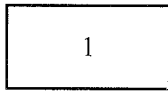
Write down the number of a shape that has

(a)  **no** lines of
symmetry

(b)  exactly **one** line
of symmetry

(c)  exactly **two** lines
of symmetry.

.......................... **(1 mark)**

.......................... **(1 mark)**

.......................... **(1 mark)**

3   On the diagram below, shade one square so that the shape has

(a)  exactly **one** line of symmetry

(b)  rotational symmetry of order 2
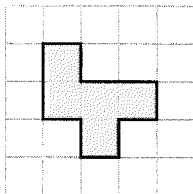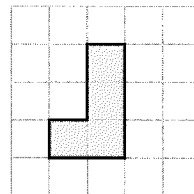
**(1 mark)**

**(1 mark)**

(c)  exactly **one** line of symmetry

(d)  rotational symmetry of order 2
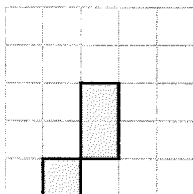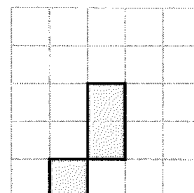
**(1 mark)**

**(1 mark)**

4   Here is a regular hexagon.
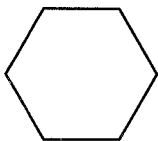
(a)  What is the order of rotational symmetry of the hexagon?

...................................... **(1 mark)**

(b)  Draw a line of symmetry on the hexagon.

**(1 mark)**

# Quadrilaterals

**1** Write down the mathematical name of each of these quadrilaterals.

> **Guided**

(a)

.................................. 
Rectangle

**(1 mark)**

(b)

..................................

**(1 mark)**

(c)

..................................

**(1 mark)**

(d)

..................................

**(1 mark)**

(e)

..................................

**(1 mark)**

(f)

..................................
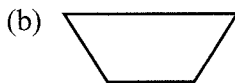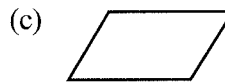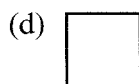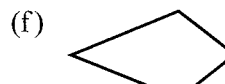
**(1 mark)**

**2** Draw a quadrilateral with the following properties.

(a)   one pair of parallel sides

> Use arrows to show parallel lines, and dashes to show lines of equal length.

**(1 mark)**

(b)   two pairs of parallel sides, all sides equal and diagonals cross at right angles

**(1 mark)**

(c)   two pairs of adjacent sides equal, one pair of opposite angles equal and diagonals cross at 90°

**(1 mark)**

(d)   two pairs of parallel sides, opposite sides equal and opposite angles equal

**(1 mark)**

(e)   all angles 90°, opposite sides equal and parallel and diagonals equal

**(1 mark)**

(f)   all angles 90°, all sides equal, opposite sides parallel, diagonals equal and cross at right angles

**(1 mark)**

# Angles 1

**1** Draw lines from the name of the angle to the correct diagram.

acute          obtuse          reflex
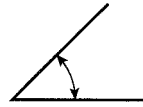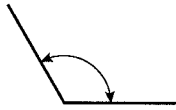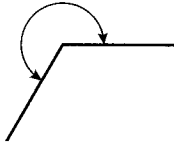
**(3 marks)**

**2** (a)
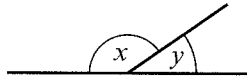
(b)
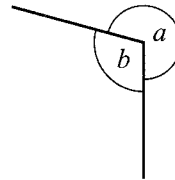
> Use one of the words given in question 1 above.

(i) What type of angle is $x$?

..........................................

**(1 mark)**

(ii) Give a reason for your answer.

..........................................

**(1 mark)**

(i) What type of angle is $a$?

..........................................

**(1 mark)**

(ii) Give a reason for your answer.

..........................................

**(1 mark)**

**3** (a)

*Guided*

$x$ / 71°
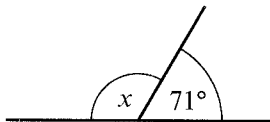
(i) Work out the size of the angle marked $x$.

.............................. $- 71° =$ ..............................°     **(1 mark)**

(ii) Give a reason for your answer.

Angles on a straight line add up to ..............................°     **(1 mark)**

(b)

$y$

124°
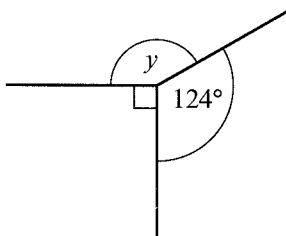
> A right angle is 90°.

(i) Work out the size of the angle marked $y$.

.............................°     **(1 mark)**

(ii) Give a reason for your answer.

Angles around a point add up to ..............................°     **(1 mark)**

# Angles 2

**4**

Work out the size of the angle marked $x$.
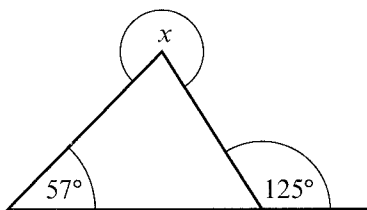
> Angles on a straight line add up to 180°, angles around a point add up to 360° and angles in a triangle add up to 180°.

.................................. − 125° = ..................................°

$180° − 57° −$ ..................................° = ..................................°

$x = 360° −$ ..................................° = ..................................°

$x =$ ..................................  **(3 marks)**

**5** The diagram shows a 5-sided shape. All the sides are equal in length.

(a) (i) Work out the size of the angle marked $x$.

.............................. ÷ ..............................
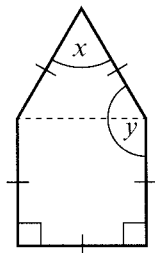
= ..............................°  **(1 mark)**

(ii) Give a reason for your answer.

The triangle at the top of the shape is an

.............................. triangle.  **(1 mark)**

(b) Work out the size of the angle marked $y$.

..............................° **(2 marks)**

**6** Work out the size of each marked angle. Give a reason for your answers.
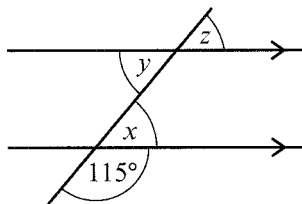
> Angles $x$ and $y$ are alternate angles between parallel lines.

(a) $x =$ ..............................°

Reason .......................................................................................................... **(1 mark)**

(b) $y =$ ..............................°

Reason .......................................................................................................... **(1 mark)**

(c) $z =$ ..............................°

Reason .......................................................................................................... **(1 mark)**

# Solving angle problems

> Guided >
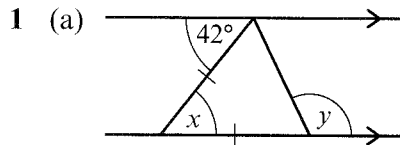
**1** (a)



(i) Work out the size of the angle marked $x$.

$x = $ ..................................° **(1 mark)**

(ii) Give a reason for your answer.

.................................... angles are equal **(1 mark)**

(iii) Work out the size of the angle marked $y$. Give reasons for each step of your working.

$180 - x = $ ....................................

.................................... $\div 2 = $ ....................................

$y = 180 - $ ................. $= $ ................. **(2 marks)**
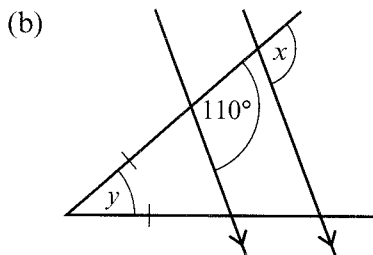
(b)



(i) Work out the size of the angle marked $x$.

....................................° **(1 mark)**

(ii) Give a reason for your answer.

.................................................................... **(1 mark)**

(iii) Work out the size of the angle marked $y$.

....................................° **(1 mark)**

(iv) Give a reason for your answer.

.................................................................... **(1 mark)**

> Guided >

**2** The diagram shows three straight lines. Work out the value of $x$.
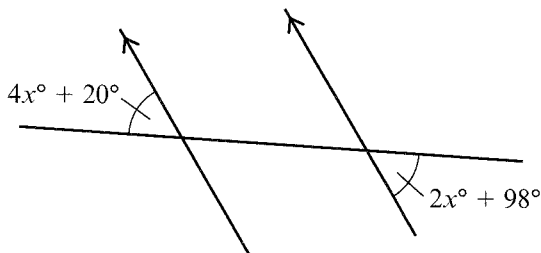


Alternate angles are equal.

Corresponding angles are equal.

$4x^\circ + 20 = $ ....................................

Solve for $x$.

....................................° **(3 marks)**

75

# Angles in polygons

**1** The diagrams show regular polygons.
Work out the size of an exterior angle for each regular polygon.

> Guided

(a)
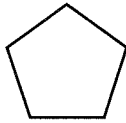
> Exterior angle = 360 ÷ number of sides

Exterior angle = 360 ÷ ..................................... = .....................................° **(2 marks)**

(b)

(c)
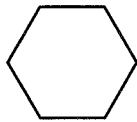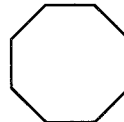
.........................° **(2 marks)**          .........................° **(2 marks)**

**2** The interior angle of a regular polygon is 140°.

> Guided

(a) Write down the size of the exterior angle of the polygon.

$140°$
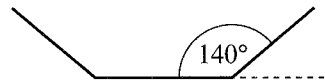
Exterior angle = 180 − ..................................... = .....................................° **(1 mark)**

(b) Work out the number of sides of the polygon.

Number of sides = 360 ÷ ..................................... = ..................................... **(2 marks)**

**3** Each diagram shows part of a regular polygon.
The size of one interior angle is given.
Work out the number of sides in each polygon.

> You will need to use problem-solving skills throughout your exam – **be prepared!**

**PROBLEM SOLVED!**

(a) $150°$

(b) $144°$

(c) $162°$
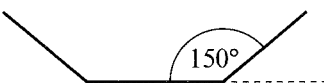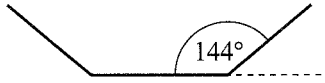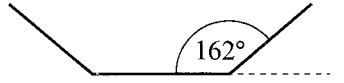
......................... **(3 marks)**   ......................... **(3 marks)**   ......................... **(3 marks)**

**4** The diagram shows part of a regular octagon.
Work out the size of the angle marked $x$.

$x$

.....................................° **(3 marks)**

**5** The diagram shows three sides of a regular hexagon. Show that $x = 30°$.

$x$
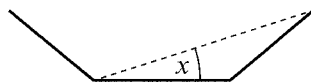
**(3 marks)**

# Time and timetables

**1** Write down the following times using the 24-hour clock.

(a)  3.15 pm                    (b)  2.25 am                    (c)  11.48 pm

..................:l5  **(1 mark)**   ..................:25  **(1 mark)**   ..........................  **(1 mark)**

**2** The following times are given using the 24-hour clock. Write the times using am or pm.

(a)  04:25                    (b)  12:10                    (c)  20:32

..........................  **(1 mark)**   ..........................  **(1 mark)**   ..........................  **(1 mark)**

**3** A train sets off from Coventry at 08:25 and arrives at London Euston at 09:17.
How long does the journey take?

08.25   to   09.00   to   09.17

........... mins + ........... mins = ........... mins

> Break the journey up.

.................................... minutes  **(2 marks)**

**4** A cyclist sets off at 10.25 and cycles for one and three quarter hours.
He then rests for 35 minutes and returns home by a different route which
takes 2 hours and 45 minutes.
What time does he arrive back home?

> Give your answer using the 24-hour clock.

....................................  **(2 marks)**

**5** Here is part of a timetable.

| Train | A | B | C | D | E |
|---|---|---|---|---|---|
| Wolverhampton | 06:45 | 07:05 | 07:25 | 07:45 | 08:10 |
| London | 08:35 | 08:56 | 09:15 | 09:34 | 10:15 |

(a)  Which train took more than two hours to go from Wolverhampton to London?

....................................  **(1 mark)**

(b)  Work out the number of minutes taken by train B to go from Wolverhampton
to London.

.................................... minutes  **(2 marks)**

(c)  Aaron has a meeting in London. He needs to arrive in London before 10:00.
Write down the time of the latest train he can catch.

....................................  **(1 mark)**

(d)  Train B arrives 36 minutes late in London. What time does this train arrive
in London?

....................................  **(1 mark)**

# Reading scales

1   Write down the number marked with an arrow.    | Look at the scales carefully. |

(a)   20     30     40

2.................................................. **(1 mark)**

(b)   200     300     400

3.................................................. **(1 mark)**

(c)   4000     5000     6000

.................................................. **(1 mark)**

(d)   3     4     5
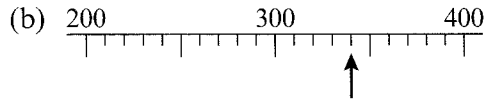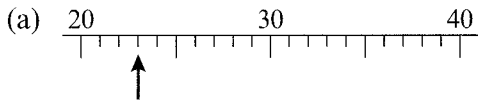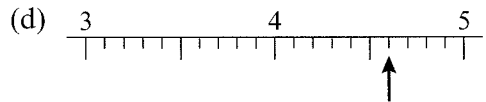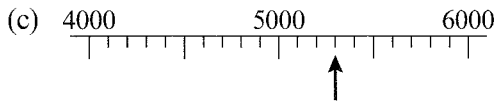
.................................................. **(1 mark)**

2   Find the following numbers on the number line. Mark them with an arrow (↑).

(a)   33

20     30     40

**(1 mark)**

(b)   280

200     300     400

**(1 mark)**

(c)   5700

4000     5000     6000

**(1 mark)**

(d)   3.8

3     4     5
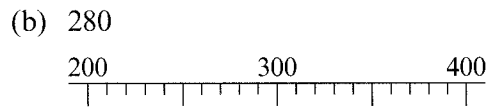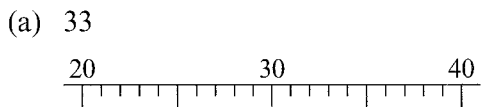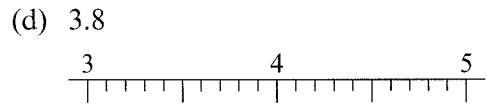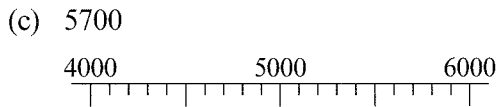
**(1 mark)**

3   (a)   Write down the speed marked with an arrow.

.................................... **(1 mark)**

(b)   Mark 42 km/h with an arrow (↑).
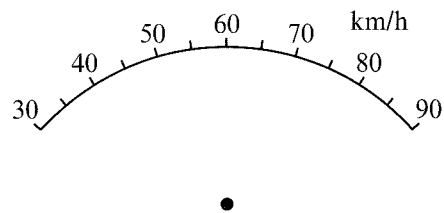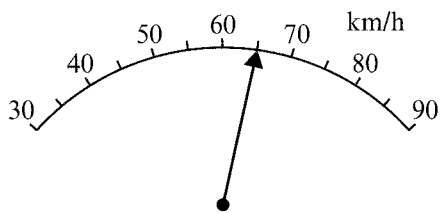
**(1 mark)**

4   The diagram below shows six identical cubes and four identical triangles.

| You will need to use problem-solving skills throughout your exam – **be prepared!** |
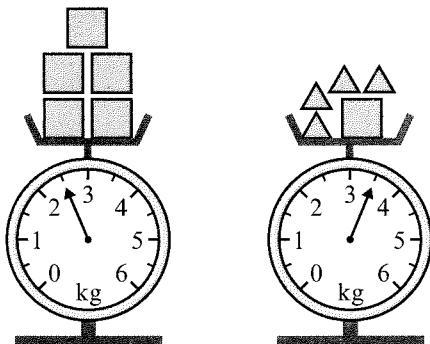
Work out the weight, in kg, of one triangle.

........................................kg   **(3 marks)**

# Perimeter and area

**1** A shape has been drawn on a grid of centimetre squares.
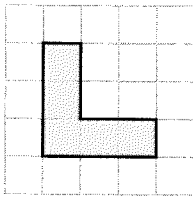
Count the number of shaded squares to find the area.

Count around the shape to find the perimeter.

(a) Find the area of the shaded shape.

Area = .................................... cm² **(1 mark)**

(b) Find the perimeter of the shaded shape.

Perimeter = .................................... cm **(1 mark)**

**2** Two shapes have been drawn on a grid of centimetre squares.

Count 1 cm² for every whole square and $\frac{1}{2}$ cm² for every part square.

(a)   Work out the area of the shape.

Area of whole squares = ..................... cm²

Area of part squares = ..................... cm²

Total area = ................. + ................. = ................. cm² **(1 mark)**

(b)   Work out the area of the shape.

.................................... cm² **(1 mark)**

**3** Work out the perimeter of

(a) this rectangle

13 cm

7 cm
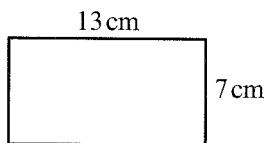
.................................... cm **(1 mark)**

(b) this trapezium

15 cm

3 cm        3 cm

6 cm
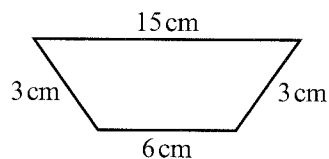
.................................... cm **(1 mark)**

(c) this regular hexagon

12 cm
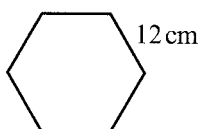
.................................... cm **(1 mark)**

(d) this parallelogram

22 cm

7 cm
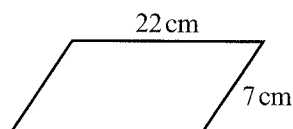
.................................... cm **(1 mark)**

# Area formulae

**Guided**

1  Find the areas of the following shapes.
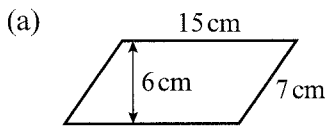
(a)

15 cm

6 cm      7 cm

Area = .................... × ....................

Area = ....................cm²

**(2 marks)**

(b)

16 cm

3 cm

8 cm

Area = ½(.................... + ....................)

× ....................

Area = ....................cm²     **(2 marks)**

(c)

4 cm

14 cm

Area = ½ × .................... × ....................

Area = ....................cm²

**(2 marks)**

(d)

14 cm

10 cm

24 cm

Area = ½(.................... + ....................)

× ....................
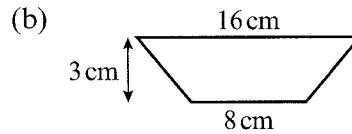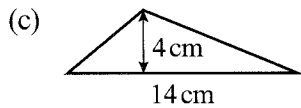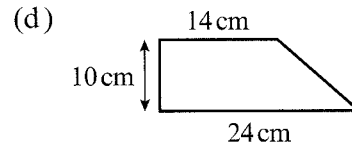
Area = ....................cm²     **(2 marks)**

**Guided**

2  (a)  The length of a rectangle is twice its width. The length is 12 cm.
Work out the area of the rectangle.

......

......
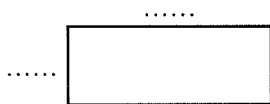
Draw a diagram and then write
the length and width on it.

.......................................cm² **(2 marks)**

(b)  The base of a right-angled triangle is four times its vertical height.
The vertical height is 14 cm. Work out the area of the right-angled triangle.

.......................................cm² **(2 marks)**

3  The area of the parallelogram is three times the area of the trapezium.

21 cm

5 cm

6 cm

h cm

8 cm
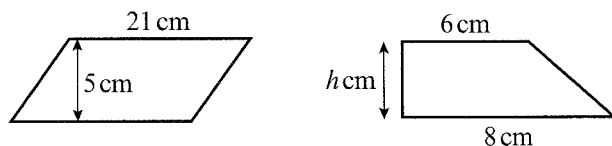
Find the height, h cm, of the trapezium. You must show all your working.

**(3 marks)**

# Solving area problems

**1**

22 cm

B

A    10 cm

4 cm

7 cm
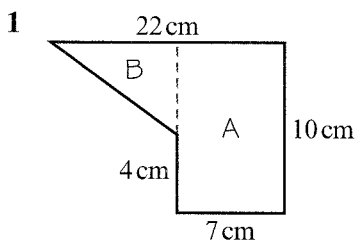
The diagram shows a compound shape.
Work out the area of the shape.

> Divide the shape into a rectangle and
> a triangle. Label the shapes A and B.

Area A = .......................... × ........................... = ..........................cm²

Area B = $\frac{1}{2}$ × .......................... × ........................... = ..........................cm²

Total area = Area A + Area B = .......................... + ..........................

= .......................... cm²

**(3 marks)**

**2**

14.5 m

12 m                    7 m

←——20 m——→
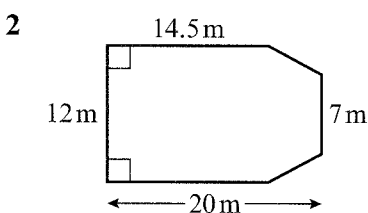
The diagram shows the plan of a car park.
The council wants to sell the car park.
The council wants at least £27 per square metre.
A local developer offers £6000. Will the council accept this offer?

.................................... **(5 marks)**

**3**

7 m

1 m

4 m

2 m
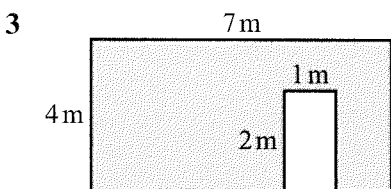
The diagram shows a wall with a door in it.
Amanda wants to paint the wall.
She buys five tins of paint.
Each tin covers 1.5 m² of wall.
Does she have enough tins to paint the wall?
Give a reason for your answer.

.................................................................................................................................. **(3 marks)**

# 3D shapes

> **Guided**

**1** Write down the names of these shapes.

(a)

Cube                    **(1 mark)**

(b)

Cub.................... **(1 mark)**

(c)

.......................... **(1 mark)**

(d)

.......................... **(1 mark)**

(e)

.......................... **(1 mark)**

(f)
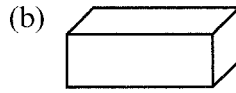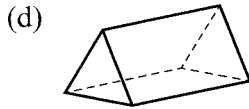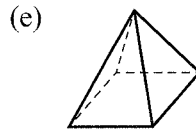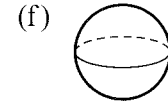
Sp..................... **(1 mark)**

**2** Find the surface area of the following shapes.

(a)

5 cm   5 cm
5 cm
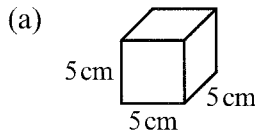
Area of 1 face = ..................................... × ......................................

Area of 6 faces = 6 × ......................................=...................................... cm²   **(2 marks)**

(b)

3 cm
4 cm
7 cm

..............................cm²  **(2 marks)**

(c)

4 cm   5 cm
6 cm   10 cm
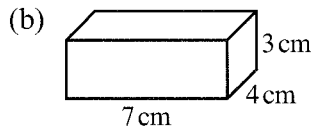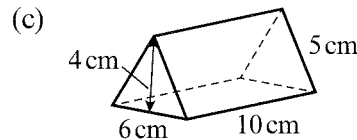
..............................cm²  **(2 marks)**

**3** Complete the table.

| 3D shape | Number of faces | Number of edges | Number of vertices |
|----------|----------------|-----------------|--------------------|
| (a) Cube | | | |
| (b) Cuboid | | | |
| (c) Triangular prism | | | |
| (d) Tetrahedron | | | |

**(4 marks)**

**4** The diagram shows a cube.

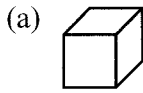(a) Work out the total surface area of the cube.

4 cm
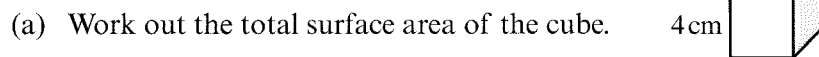
.......................................cm²  **(2 marks)**

(b) Sara wants to paint all six faces of 40 of these cubes.
Each tin of paint covers an area of 350 cm². She buys ten tins.
Does she buy enough tins?
Give a reason for your answer.

..............................................................................................................................  **(3 marks)**

# Volumes of cuboids

**1** Find the volumes of the following cuboids.

(a) 5cm

5cm

5cm

Volume = ............................. × ............................. × .............................

Volume = .............................cm³                                                                 **(2 marks)**

(b)

6cm

15cm

4cm

.............................cm³  **(2 marks)**

(c)

16cm

12cm

7cm
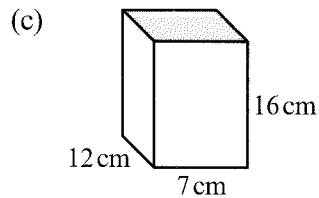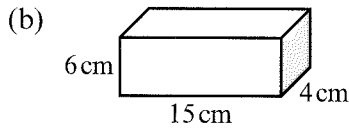
.............................cm³  **(2 marks)**

**2** A cuboid has a volume of 504 cm³, a length of 12 cm and a width of 7 cm.
Work out the height of the cuboid.

Volume = length × width × height

............................. = ............................. × ............................. × height

height = ............................. ÷ ............................. = .............................cm  **(2 marks)**

**3** A box measures 175 cm × 125 cm × 100 cm. The box is to be completely filled
with cubes. Each cube measures 25 cm × 25 cm × 25 cm.
Work out the number of cubes which can completely fill the box.

> Work out how many cubes can fit along each dimension of the box.

= ............................. cubes  **(3 marks)**
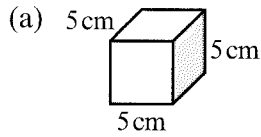
**4** The diagrams show a rectangular tray and a carton.
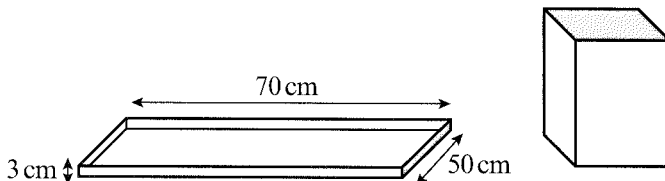
> You will need to use
> problem-solving skills
> throughout your exam
> – **be prepared!**

70cm

3cm

50cm

The rectangular tray has length 70 cm, width 50 cm and depth 3 cm.
The carton is a cuboid with a square base of side 30 cm.
The tray is full of water. The water is poured into the empty carton.
Work out the depth, in cm, of the water in the carton.

............................. cm  **(3 marks)**

# Prisms

**1** Find the volumes of the following prisms.

> **Guided**

(a)



4 cm
8 cm
3 cm

> Volume of a prism = area of cross-section × length.
> You need to learn this formula for your exam.

Volume = ($\frac{1}{2}$ × ........................ × ........................) × ........................

Volume = ........................ cm³                                                              **(2 marks)**

(b)



5 cm
4 cm
6 cm   12 cm

........................ cm³   **(2 marks)**

(c)



4 cm
6 cm
12 cm   8 cm
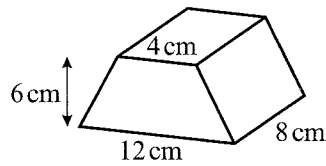
........................ cm³  **(2 marks)**

**2** Find the surface areas of the following prisms.

> **Guided**
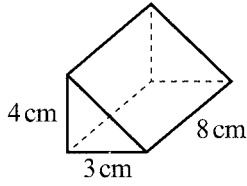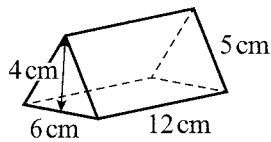
(a)



5 cm
4 cm
8 cm
3 cm
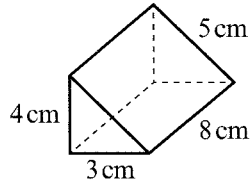
Surface area = 2 ($\frac{1}{2}$ × ........................ × ........................)

+ (........................ × ........................) + (........................ × ........................)

+ (........................ × ........................)

Surface area = ........................ cm²                                                       **(3 marks)**

(b)



4 cm
5 cm
6 cm   12 cm

........................ cm²   **(2 marks)**

(c)



4 cm   7 cm
6 cm
12 cm   9 cm
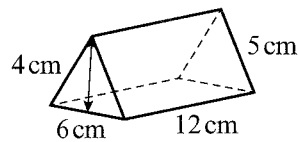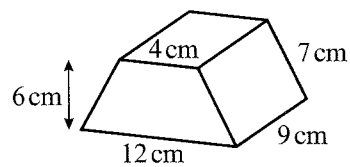
........................ cm²  **(2 marks)**

**3** The diagram shows a prism.
The area of the cross-section of the prism is 22 cm².
The length of the prism is 16 cm.
Work out the volume of the prism.



22 cm²
16 cm

........................ cm³  **(2 marks)**

# Units of area and volume

**1** Convert

> **Guided**

(a)  6 m² into cm²

6 m² = 6 × .............................. = ..............................cm²                    **(2 marks)**

(b)  15 cm² into mm²          (c)  4 km² into m²          (d)  500 000 cm² into m²

.................... mm²  **(2 marks)**     .................... m²  **(2 marks)**     .................... m²  **(2 marks)**

(e)  60 000 mm² into cm²          (f)  800 000 m² into km²

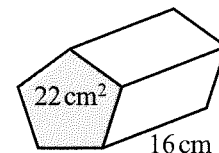.................... cm²  **(2 marks)**     .................... km²  **(2 marks)**

**2** Convert

> **Guided**

(a)  22 m³ into cm³

22 m³ = 22 × .............................. × ..............................

= ..............................cm³                    **(2 marks)**

(b)  28 cm³ into mm³          (c)  3 km³ into m³          (d)  200 000 000 cm³ into m³

.................... mm³  **(2 marks)**     .................... m³  **(2 marks)**     .................... m³  **(2 marks)**

(e)  50 000 000 mm³ into cm³          (f)  420 000 000 m³ into km³

.................... cm³  **(2 marks)**     .................... km³  **(2 marks)**

**3** Convert

(a)  200 000 cm³ into litres          (b)  8 m³ into litres          (c)  12 m³ into litres

.................... litres  **(2 marks)**     .................... litres  **(2 marks)**     .................... litres  **(2 marks)**

**4** Work out how many litres of water each tank in the shape of a cuboid can hold.

(a)

20 cm     50 cm
45 cm

(b)

2 m     8 m
6 m
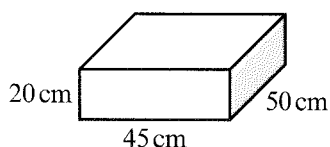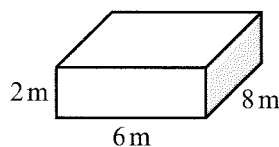
.......................... litres  **(2 marks)**              .......................... litres  **(2 marks)**

# Translations

> **Guided**

**1** Write down the following information in vector notation.

(a) 3 to the right
4 up

$$\left(\begin{array}{c} 3 \\ \rule{2cm}{0.4pt} \end{array}\right)$$ **(1 mark)**

(b) 2 to the left
3 down

$$\left(\begin{array}{c} - \rule{1.5cm}{0.4pt} \\ - \rule{1.5cm}{0.4pt} \end{array}\right)$$ **(1 mark)**

(c) 5 to the left
6 up

$$\left(\begin{array}{c} \rule{1.5cm}{0.4pt} \\ \rule{1.5cm}{0.4pt} \end{array}\right)$$ **(1 mark)**

**2** (a) Translate shape A 3 squares right and 4 squares down.
Label the image C.

**(2 marks)**

(b) Translate shape B 5 squares left and 7 squares up.
Label the image D.
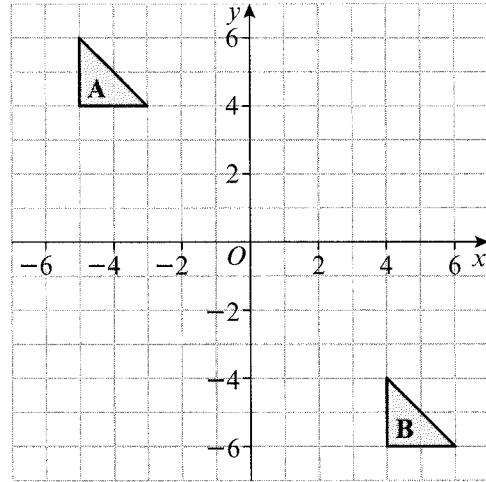
**(2 marks)**



**3** (a) Describe fully the single transformation that will map shape G onto shape H.

...................................................

...................................................

...................................................

(b) Describe fully the single transformation that will map shape M onto shape N.

...................................................

...................................................
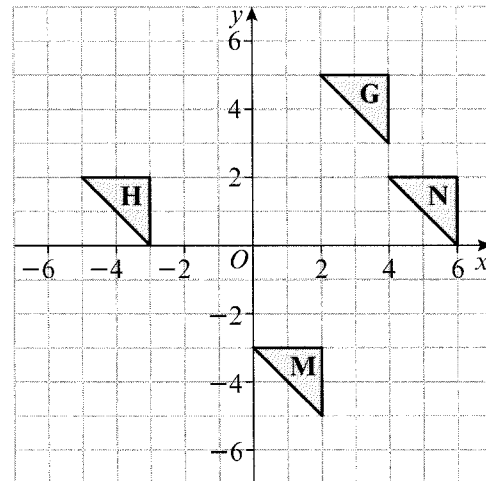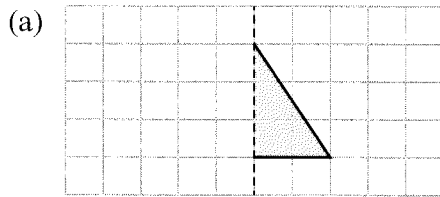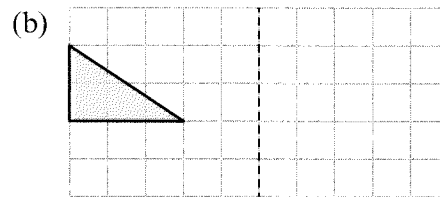
**(2 marks)**

**(2 marks)**

# Reflections

1  Reflect the shaded shape in the mirror line (indicated by a dashed line).

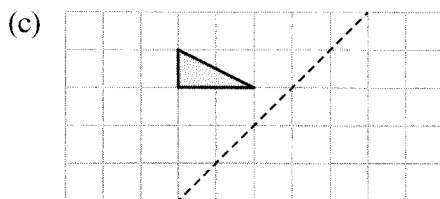> The reflected shape should be the same distance from the mirror line as the original shape.
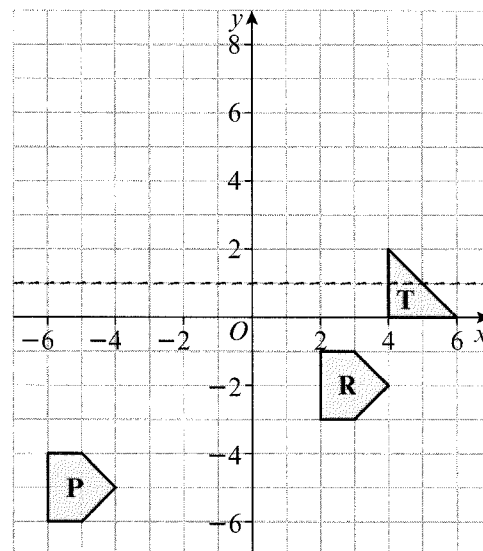
(a)

**(1 mark)**

(b)

**(1 mark)**

(c)

**(1 mark)**

2  (a)  Reflect shape P in the line $y = 1$.
Label the image Q.

> First draw the line $y = 1$ on the graph.

**(2 marks)**

(b)  Reflect shape R in the line $x = 1$.
Label the image S.

> First draw the line $x = 1$ on the graph.

**(2 marks)**

(c)  Reflect shape T in the line $y = x$.
Label the image U.

**(2 marks)**

3  (a)  Describe fully the single transformation that will map image A onto image B.

..............................................................

..............................................................

**(2 marks)**

(b)  Describe fully the single transformation that will map image B onto image C.

..............................................................

..............................................................
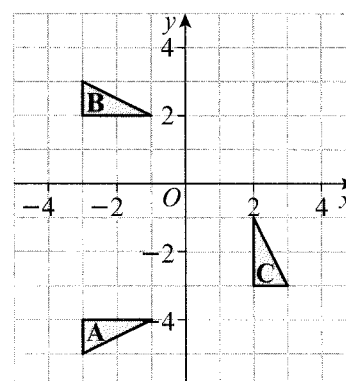
**(3 marks)**

# Rotations

**1** (a) Rotate triangle A 180° about the point $(-1, 2)$.
Label the image B.

**(2 marks)**

> Guided

> Trace triangle A using tracing paper. Put your pencil at the point $(-1, 2)$ and then rotate the tracing paper through 180°.

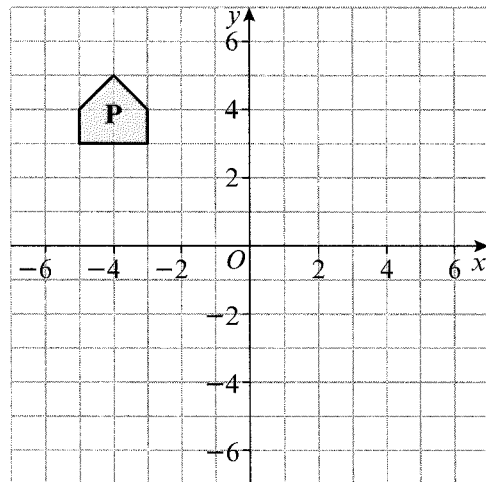(b) Rotate triangle A 90° anticlockwise about the point $(2, 1)$.
Label the image C.
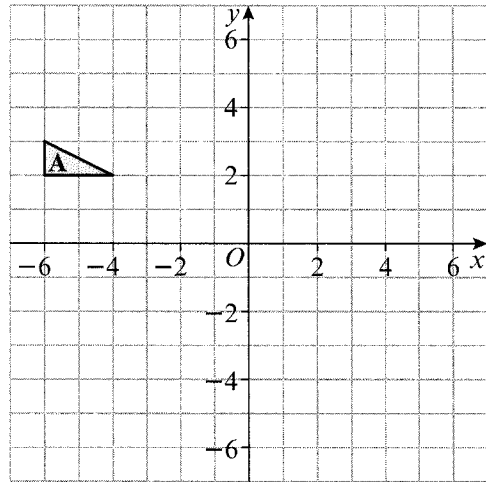
**(2 marks)**

**2** (a) Rotate shape P 90° clockwise about the point $(0, 1)$.
Label the image Q.

**(2 marks)**

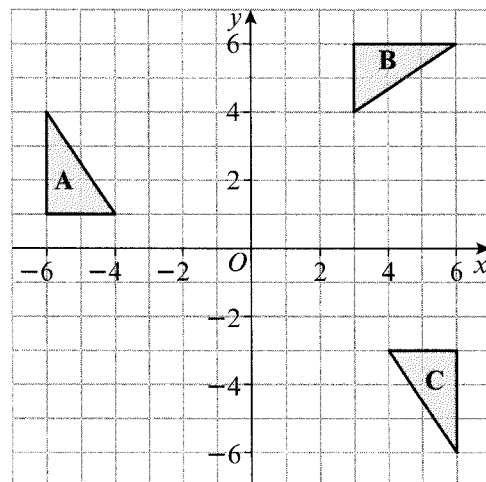(b) Rotate shape P 180° about the point $(-2, -1)$.
Label the image R.

**(2 marks)**

**3** (a) Describe fully the single transformation that will map shape A onto shape B.

......................................................

......................................................

......................................................

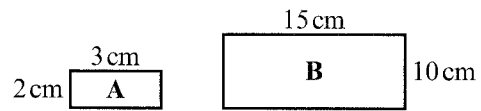(b) Describe fully the single transformation that will map shape A onto shape C.

......................................................

**(3 marks)**

......................................................

......................................................

**(3 marks)**

# Enlargements

**1** (a) Shape B is an enlargement of shape A.
Find the scale factor of the
enlargement.

2 cm [ A ] 3 cm    15 cm [ B ] 10 cm

> Guided

.................................. ÷ .................................. = .................................. **(1 mark)**

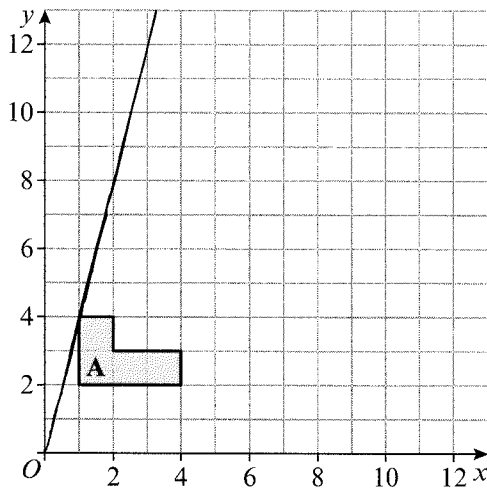(b) Enlarge the triangle below by scale factor 2.
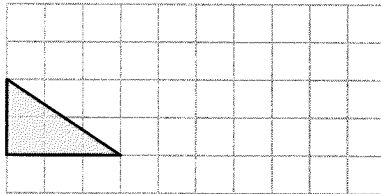
> No centre of enlargement is given so the enlarged shape can be placed anywhere on the grid.

**(1 mark)**

**2** Enlarge L shape A by scale factor 3, centre (0, 0).
Label the image B.

> Draw lines from the centre of enlargement through each vertex of the triangle.
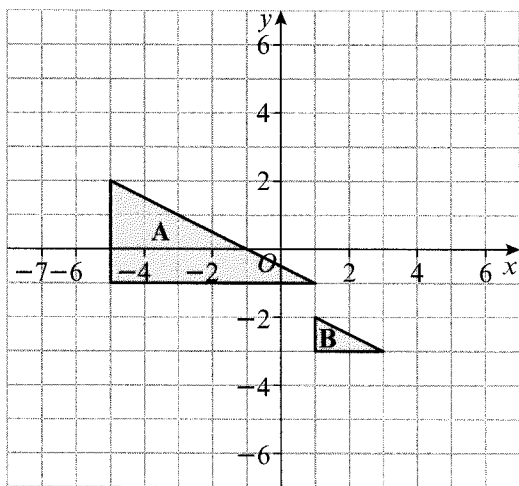
**(2 marks)**

**3** (a) Describe fully the single transformation that will map shape A onto shape B.

> The image is **smaller** than the object, so the scale factor will be a **fraction**.

......................................................

......................................................

......................................................

**(3 marks)**

(b) Enlarge shape A with scale factor $\frac{1}{2}$, centre $(-7, -5)$.
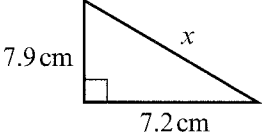
**(2 marks)**

# Pythagoras' theorem

**Guided**

1  Work out the lengths of the sides marked with letters in the following triangles.
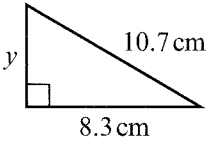   Give your answers correct to 3 significant figures.

$$\text{short}^2 + \text{short}^2 = \text{long}^2$$
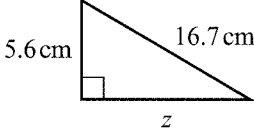
(a)

7.9 cm  $x$  7.2 cm

$x^2 = \dots\dots\dots^2 + \dots\dots\dots^2$

$x^2 = \dots\dots\dots$

$x = \sqrt{\dots\dots\dots}$

$x = \dots\dots\dots$ cm                                **(2 marks)**

(b)

$y$  10.7 cm  8.3 cm

$\dots\dots\dots$                                        **(2 marks)**

(c)

5.6 cm  16.7 cm  $z$

$\dots\dots\dots^2 = z^2 + \dots\dots\dots^2$

$z^2 = \dots\dots\dots^2 - \dots\dots\dots^2$

$z = \sqrt{\dots\dots\dots}$  $\dots\dots\dots\dots\dots$

$z = \dots\dots\dots$                                    **(2 marks)**

2  One end of a rope is tied to the top of a vertical flagpole of height 12.8 m.
   When the rope is pulled tight, the other end is on the
   ground 4.2 m from the base of the flagpole.
   Work out the length of the rope.
   Give your answer correct to the nearest cm.

Sketch a diagram to help you see what is going on.
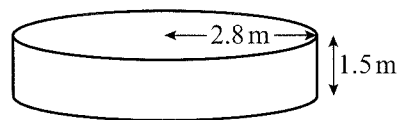
$\dots\dots\dots$ cm   **(2 marks)**

3  Cindy has a rectangular suitcase of length 95 cm and a width 72 cm.
   She wants to put her walking stick into her suitcase.
   The length of the walking stick is 125 cm.
   She thinks that the walking stick will fit into her suitcase. Is she correct?
   Give a reason for your answer.

$\dots\dots\dots$   **(2 marks)**

4  The diagram shows a small pool with a
   radius of 2.8 m and a height of 1.5 m.
   A straight pole is 6 m long.
   The pole cannot be broken.
   Can the pole be totally immersed in the pool?
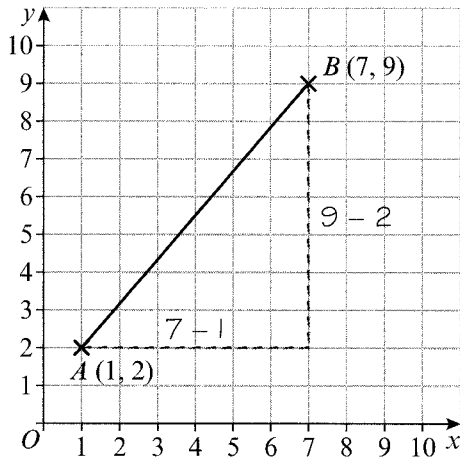   Give a reason for your answer.

←—2.8 m—→  1.5 m

$\dots\dots\dots$   **(2 marks)**

# Line segments

**1** Find the length of the following line segment. Give your answer to 3 significant figures.

> **Guided**

$AB^2 = \underline{\hspace{2cm}}^2 + \underline{\hspace{2cm}}^2$

$AB^2 = \underline{\hspace{2cm}}$

$AB = \sqrt{\underline{\hspace{3cm}}}$
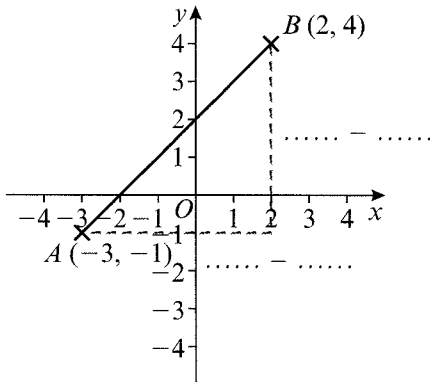
$AB = \underline{\hspace{2cm}}$

> Draw a horizontal and a vertical line to make a triangle.

**(2 marks)**

**2** Find the length of the following line segment. Give your answer to 3 significant figures.

> **Guided**

$AB^2 = \underline{\hspace{2cm}}^2 + \underline{\hspace{2cm}}^2$

$AB^2 = \underline{\hspace{2cm}}$

$AB = \sqrt{\underline{\hspace{3cm}}}$

$AB = \underline{\hspace{2cm}}$

> There is no grid so use subtraction to work out the distance across and the distance down.

**(2 marks)**

**3** Point A has coordinates (3, 1) and point B has coordinates (11, 7).
Work out the length of the line segment AB.

> Draw a sketch showing both points in roughly the right positions.

$\underline{\hspace{5cm}}$ **(2 marks)**

**4** The points A(−2, −6) and B(4, 2) are the opposite ends of a diameter of a circle.

(a) Find the coordinates of the centre of the circle.

$\underline{\hspace{5cm}}$ **(2 marks)**

(b) Show that the radius of the circle is 5 units.
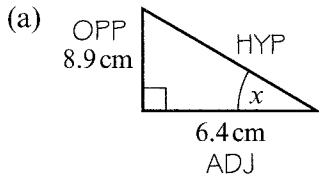
**(2 marks)**

# Trigonometry 1

**Guided**

**1** Work out the size of each of the angles marked with letters.
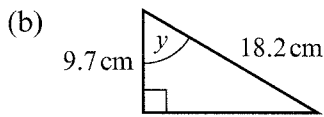Give each answer to 3 significant figures.

SOH CAH TOA

(a)

OPP
8.9 cm
HYP
$x$
6.4 cm
ADJ

$\tan x = \dfrac{opp}{adj} = \dfrac{\text{...................}}{\text{...................}}$

$x = \tan^{-1} \text{...................}$

$x = \text{...................}°$   **(3 marks)**

> Start by labelling the sides of the triangle. Then write down the trigonometric ratio that uses these two sides.

(b)

9.7 cm   $y$   18.2 cm

$\text{...................} \; y = \dfrac{adj}{hyp} = \dfrac{\text{...................}}{\text{...................}}$

$y = \text{...................}^{-1} \text{...................}$

$y = \text{...................}°$   **(3 marks)**

**Guided**

**2** One end of a rope is tied to the top of a vertical mast of height 7.2 m.
When the rope is pulled tight, the other end is on the ground 3.7 m from the base of the mast. Work out the angle between the ground and the rope.
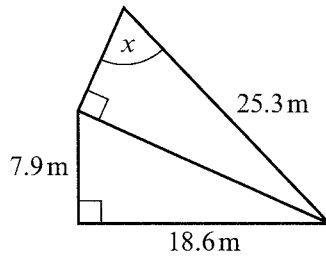
......

$°$

......
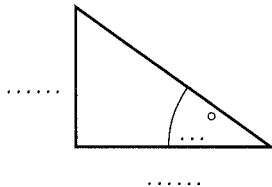
> Draw a diagram.

.............................° **(3 marks)**

**3** The diagram shows two right-angled triangles.
Work out the size of angle $x$.
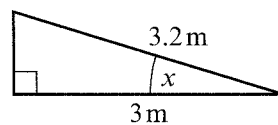Give your answer correct to 3 significant figures.

> You will have to use Pythagoras' theorem on the bottom triangle first.

$x$
25.3 m
7.9 m
18.6 m

.............................° **(2 marks)**

**4** The diagram shows a pitched roof.
Hayley wants to use smooth tiles to cover the roof.
The smooth tiles can only be used when the angle, $x$, is no more than 17°.
Can she use the smooth tiles on her roof?
Give a reason for your answer.

3.2 m
$x$
3 m

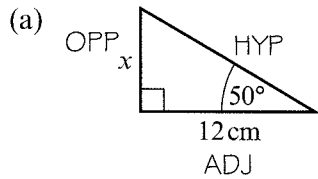.................................................................................................. **(3 marks)**

# Trigonometry 2

**5**   Work out the length, in cm, of each of the marked sides.
Give each answer correct to 3 significant figures.

> **Guided**
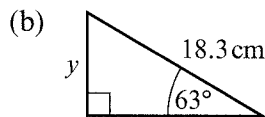
**SOH CAH TOA**

(a)

OPP $x$    HYP

50°

12 cm

ADJ

$\tan \rule{1.5cm}{0.4pt}° = \dfrac{opp}{adj} = \dfrac{x}{\rule{2.5cm}{0.4pt}}$

$x = \rule{3.5cm}{0.4pt} \times \tan 50°$

$x = \rule{3.5cm}{0.4pt} cm$     **(3 marks)**

> Start by labelling the sides of the triangle. Then write down the trigonometric ratio that uses the given and unknown side.

(b)

18.3 cm

$y$

63°

$\rule{3.5cm}{0.4pt} 63° = \dfrac{opp}{hyp} = \dfrac{y}{18.3}$

$y = \rule{2.5cm}{0.4pt} \times \rule{2.5cm}{0.4pt} 63°$

$y = \rule{3cm}{0.4pt} cm$     **(3 marks)**

**6**   A ladder is 6 m long. The ladder rests against a vertical wall with the foot of the ladder resting on horizontal ground. The ladder makes an angle of 63° with the ground when it is leaning against the wall.
How far does the ladder reach up the wall?

> **Guided**

......    ......

°
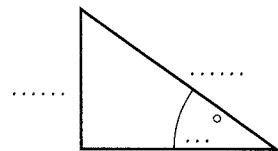
**Draw a diagram.**

$\rule{5cm}{0.4pt} m$   **(2 marks)**

**7**   A tower 40 m stands at a point A. At a point B on the ground which is level with the foot of the tower, the angle of elevation of the top of the tower is 36°.
Work out the distance of B from A.

$\rule{5cm}{0.4pt} m$   **(2 marks)**

**8**   The diagram shows a vertical pole standing on horizontal ground. The points A, B and C are in a straight line on the ground. The point D is at the top of the pole so that DC is vertical. The angle of elevation of D from A is 35°.

D

35°

C    12 m    B        A

← 30 m →
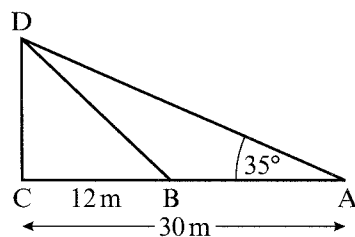
(a)   Work out the height of the pole.
Give your answer correct to 3 significant figures.

$\rule{5cm}{0.4pt} m$   **(2 marks)**

(b)   Work out the size of the angle of elevation of D from B.
Give your answer correct to 3 significant figures.

$\rule{5cm}{0.4pt}°$   **(2 marks)**

# Solving trigonometry problems

**1** Complete the table.

> **Guided**

You must remember these for the exam.

|  | **0°** | **30°** | **45°** | **60°** | **90°** |
|---|---|---|---|---|---|
| **sin** | ................. | $\frac{1}{2}$ | ................. | ................. | ................. |
| **cos** | ................. | ................. | $\frac{1}{\sqrt{2}}$ | ................. | ................. |
| **tan** | ................. | ................. | ................. | $\sqrt{3}$ | ................. |

**(5 marks)**

**2** Work out the length, in cm, of the side marked.

SOH CAH TOA

> **Guided**

**(a)**
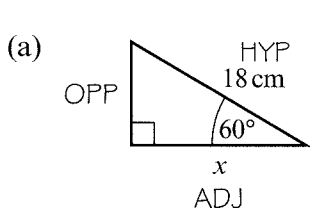


$$\cos 60° = \frac{adj}{hyp} = \frac{...................}{..................}$$

$$x = .................................... \times \cos 60°$$

$$x = ....................................\,cm$$

**(3 marks)**

Start by labelling the sides of the triangle. Then write down the trig ratio that uses the given and unknown side.

**3** Work out the size of each of the angles marked with letters.

SOH CAH TOA

> **Guided**

**(a)**



$$\tan x = \frac{............}{...........} = \frac{.....................}{.........................}$$

$$x = \tan^{-1} ...................................$$

$$x = ....................................°$$

**(3 marks)**

**(b)**



$$.................................. \; y = \frac{.....................}{..................} = \frac{...................}{..................}$$
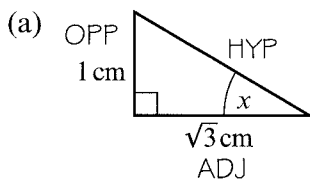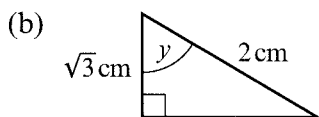
$$y = ...................................^{-1} ..................................$$

$$y = ....................................°$$

**(3 marks)**

**4** Alan is sitting on the ground and his distance from the base of a tower is 30 feet.
The angle of elevation from Alan to the top of the tower is 60°.
Work out the height of the tower. Leave your answer as an exact value.

> **Guided**
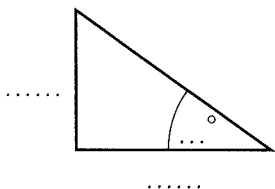


Draw a diagram.

....................................feet  **(3 marks)**

# Measuring and drawing angles

> Guided

**1** Measure the sizes of the following angles.
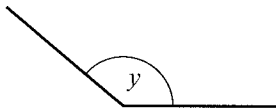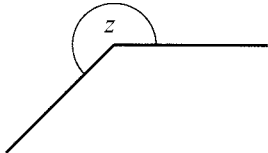
First estimate the size of the angle.

(a)
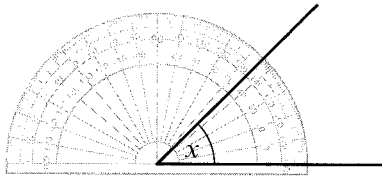
...................................° **(1 mark)**

(b)

...................................° **(1 mark)**

(c)

Measure the small angle and then subtract it from 360°.
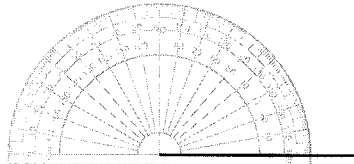
...................................° **(1 mark)**

> Guided

**2** In the space below, accurately draw the following angles.

(a) 74°

Draw a line and place your protractor at one end. Mark the angle to the nearest degree then draw a straight line between the end of your line and the mark.

**(1 mark)**

(b) 148°          (c) 262°

**(1 mark)**          **(1 mark)**

**3** Measure and name the following angles.

To name the angles, choose from acute, obtuse and reflex.

(a)          (b)          (c)
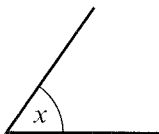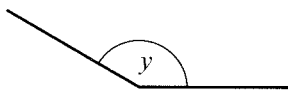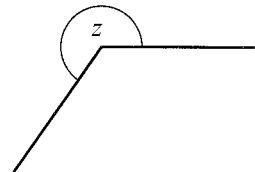
..................... **(1 mark)**     ..................... **(1 mark)**     ..................... **(1 mark)**

**4** Make an accurate drawing of the following triangle.

58°          44°
5 cm
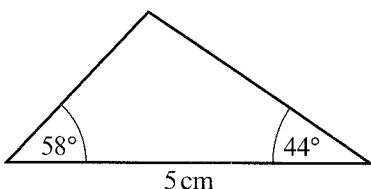
**(2 marks)**

# Measuring lines

**1** Measure the lengths of these lines. State the units of measurement.

> First estimate the length of the line.

(a)

(b)
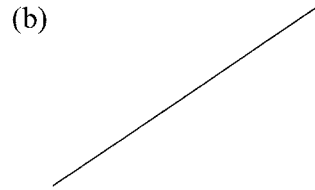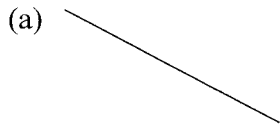
.................................................. **(1 mark)**      .................................................. **(1 mark)**

(c) ————————————————

.................................................. **(1 mark)**

**2** In the space below, draw straight lines with the following lengths.

(a) 52 mm           (b) 6 cm           (c) 7.8 cm

                   **(1 mark)**                    **(1 mark)**                    **(1 mark)**

**3** Mark the midpoint of the line AB with a cross (×).

> Measure the line and then divide by 2.

> Guided

A ————————————————————————————— B     **(2 marks)**

**4** The diagram shows an adult woman standing next to a building.
The woman and the building are drawn to the same scale.
Work out an estimate for the height, in metres, of the building.

> 1.6 m is a good estimate for the height of an adult woman.
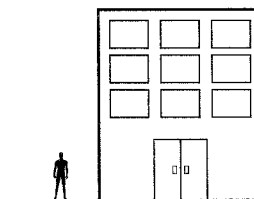
.................................... m    **(3 marks)**

**5** The picture shows a house.

(a) Write down an estimate for the height, in metres, of the front door.

.................................... m
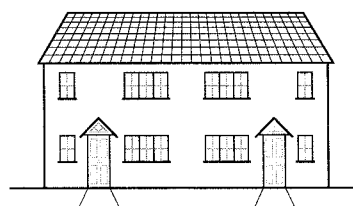
(b) Using your answer for part (a), work out an estimate, in metres, for the height of the house.

                   **(1 mark)**

.................................... m    **(1 mark)**

# Plans and elevations

**1** Match each solid shape to its net.

> Guided
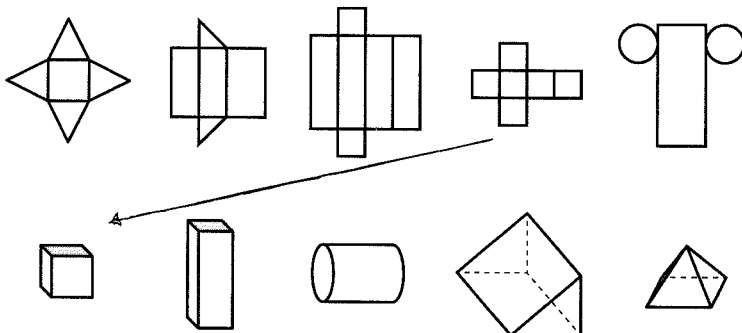
When the net (arrowed) is folded it will be a cube.

**(3 marks)**

**2** The diagram shows a solid object made of eight identical cubes.
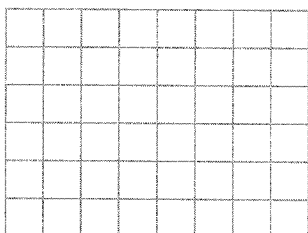
> Guided

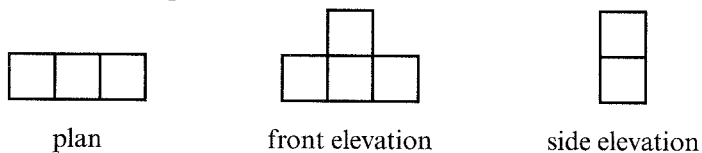   (a) On the grid below, draw the elevation of the solid object from the direction of the arrow
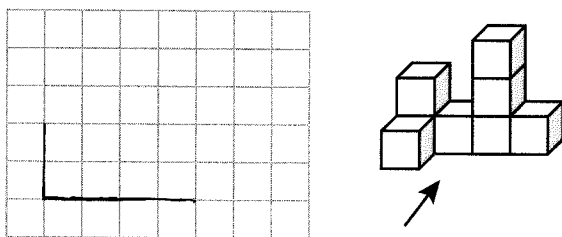
**(2 marks)**

   (b) On the grid below, draw the plan of the solid object.

**(2 marks)**

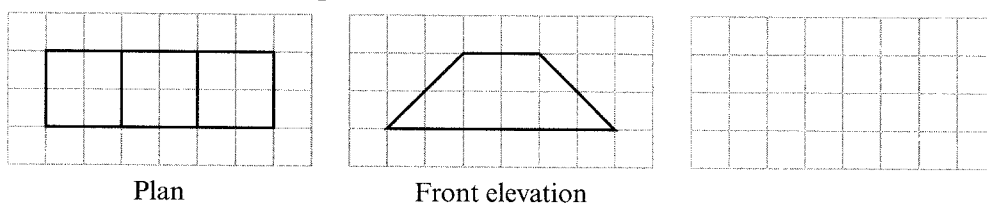**3** Here are the plan, front elevation and side elevation of a 3D shape.

plan        front elevation        side elevation

In the space below, draw a sketch of the 3D shape.

**(2 marks)**

**4** Here are the plan and front elevation of a solid shape. On the third grid, draw the side elevation of the solid shape.

Plan                    Front elevation

**(2 marks)**

# Scale drawings and maps

**Guided**

**1** The lines below are drawn to scale.
Work out the actual lengths by using the scales.

> Measure the line first.

(a)  1 cm to 10 m
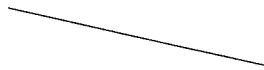
Actual length = ............................. ✕ 10 m = .............................. m        **(2 marks)**
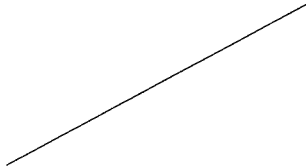
(b)  1 cm to 5 km                                    (c)  1 cm to 15 km
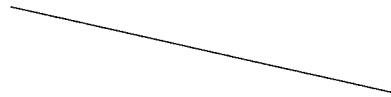
............................. km    **(2 marks)**                    ............................. km    **(2 marks)**

**Guided**

**2** On a map the distance between two towns is measured and recorded.
Work out the actual distance between the towns using the scale below.

(a)  Distance on map = 5 cm
Scale = 1 : 50 000

Actual distance = ............................. ✕ 50 000 = ............................. cm

= ............................. ÷ 100 = ............................. m

= ............................. ÷ 1000 = ............................. km        **(2 marks)**

(b)  Distance on map = 12 cm                       (c)  Distance on map = 15.4 cm
Scale = 1 : 100 000                                      Scale = 1 : 1 000 000

............................. km    **(2 marks)**                    ............................. km    **(2 marks)**

**3** What distance on a map will represent an actual distance of    | Convert 10 km into cm. |

(a)  10 km using a scale          (b)  15 km using a scale          (c)  50 km using a scale
1 : 50 000?                          1 : 100 000?                       1 : 1 000 000?

............... cm    **(2 marks)**        ............... cm    **(2 marks)**        ............... cm    **(2 marks)**

**4** Arthur uses a scale of 1 : 300 to make a model of an aeroplane.

(a)  The wing length of the model is 5 cm. Work out the wing length of the aeroplane.

............................. m   **(2 marks)**

(b)  The length of the aeroplane is 45 m. Work out the length of the model.

............................. cm   **(2 marks)**

# Constructions 1

**Guided**

1 Use a ruler and compasses to construct the perpendicular bisector of $AB$.

> Do not rub out the arcs you make when using your compasses.

$A$ ——————————— $B$

> 1. Draw an arc, centre $A$, with radius more than half the length of $AB$ above and below the line segment $AB$.
> 2. Draw another arc, centre $B$, with the same radius. Again above and below the line segment $AB$.
> 3. Draw a line through the two points where the arcs cross each other above and below the line segment $AB$.

**(2 marks)**

**Guided**

2 Use a ruler and compasses to construct the perpendicular to the line segment AB that passes through the point T.

> You must show all your construction lines.

$A$ ——✗—————— $B$
　　$T$

> Draw two arcs, centre $T$, with the same radius to cross either side of $T$.

**(2 marks)**

3 Use a ruler and compasses to construct the perpendicular from $P$ to the line segment $AB$.

✗ $P$

$A$ ——————————— $B$

**(3 marks)**

# Constructions 2

**4** Use a ruler and compasses to construct a triangle with sides of lengths 3.5 cm, 4 cm and 5 cm.

> Guided

A ———————————————• B

> Do not rub out the arcs you draw when using your compasses.

**(2 marks)**

> 1. Draw a horizontal line of 5 cm and label it *AB*.
> 2. Set the compasses at 3.5 cm then draw an arc with centre *A*.
> 3. Set the compasses at 4 cm then draw the arc with centre B.
> 4. Draw lines from the point of intersection to *A* and *B*.

**5** Use a ruler and compasses to construct the bisector of angle *ABC*.

> Guided

*A*

*B* ——————————— *C*
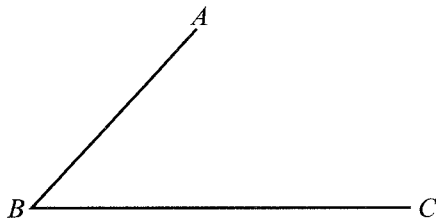
> 1. Draw an arc, centre *B*, to cross *AB* at *P* and *BC* at *Q*.
> 2. Draw an arc, centre P, and an arc, centre Q, with the same radius. The two arcs intersect.
> 3. Draw a line through point *B* and the point of intersection.

**(2 marks)**

**6** Use a ruler and compasses to construct a 60° angle at *A*. You must show all your construction lines.

*A* ——————— *B*
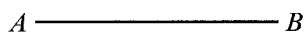
**(2 marks)**

**7** Use a ruler and compasses to construct a 45° angle at *A*. You must show all your construction lines.

*A* ——————— *B*
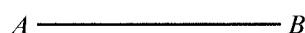
**(2 marks)**

# Loci

**1**  Draw the locus of all points that are exactly 2 cm from the line *AB*.

> **Guided**

$A$ ————————— $B$

1. Draw a circle of radius 2 cm with centre *A*.
2. Draw a circle of radius 2 cm with centre *B*.
3. Draw two parallel lines 2 cm above and below the line *AB*.

**(2 marks)**

**2**  The diagram shows the boundary of a rectangular garden, *ABCD*.
A dog is tied to corner *B* with a rope of length 6 m.
Shade the region where the dog can reach.
1 cm represents 2 m.

> **Guided**

$A$ ——————————— $D$

$B$                                          $C$
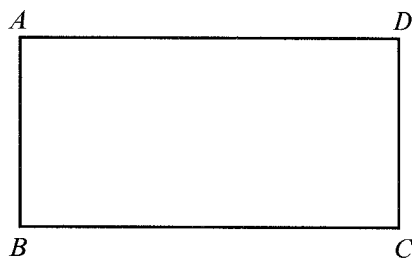
1. Use the scale to set the compasses at the required distance.
2. Draw an arc with centre *B*.
3. Shade the required region.

**(3 marks)**

**3**  *P*, *Q* and *R* represent three radio masts on a plan. Signals from mast *P* can be received 100 km away, from mast *Q* 50 km away and from mast *R* 75 km away.
Show by shading, the region in which signals can be received from all three masts.
1 cm represents 25 km.

×*Q*

*P*×

×*R*

**(3 marks)**

**4**  *ABC* is a triangle. Shade the region inside the triangle which is both less than 3 cm from the point *B* and closer to line *AC* than *AB*.

*C*

*A*

*B*
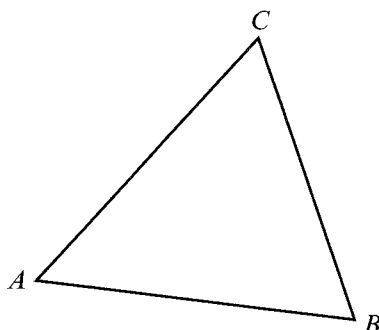
**(4 marks)**

# Bearings

**Guided**

1   Work out the bearing of

(a)   N   (i) *B* from *A*

$180° + $ .......................°

$= $ .......................°

(ii) *A* from *B*

.......................°
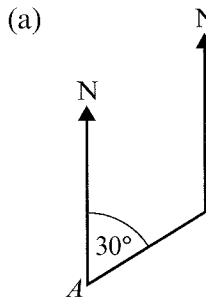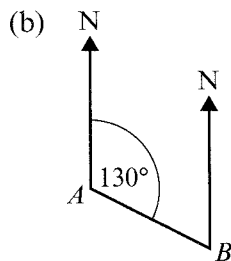
**(2 marks)**

(b)   N   (i) *B* from *A*

.......................°

(ii) *A* from *B*

.......................°

**(2 marks)**

2   Draw a line on a bearing of

(a)  30°     (b)  200°     (c)  320°

N             N             N

**(1 mark)**     **(1 mark)**     **(1 mark)**

3   The diagram shows three locations on a map. The scale of the map is 1 cm to 4 km.

C

N

A   4 cm   B
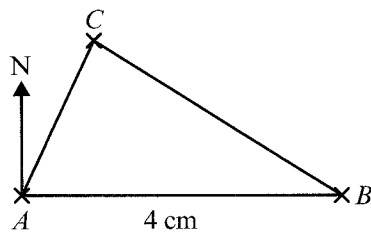
(a)   Find the actual distance between *A* and *B*.

.......................km   **(1 mark)**

(b)   Measure the bearing of *C* from *A*.

.......................°   **(1 mark)**

*D* is a fourth location. The actual distance of *D* from A is 16 km.
The bearing of *D* from *A* is 120°.

(c)   Mark with a cross (✕) the position of *D* on the diagram. Label point *D*.   **(2 marks)**

# Circles

**1** Label the diagram with the correct names for the parts of a circle:

(a) chord

(b) ........................
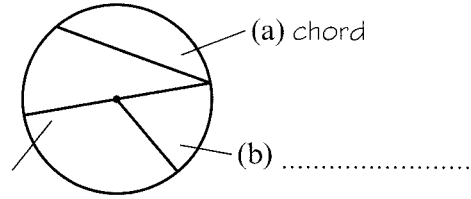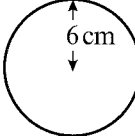
(c) ........................
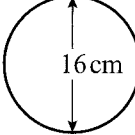
**(3 marks)**

**2** Work out the circumferences of the following circles. Give your answers correct to 3 significant figures.

> You need to learn the formula for the circumference of a circle.

(a)

6 cm

$C = 2 \times \pi \times r$

$= 2 \times \pi \times r$ ...........................

$=$ ........................... cm

**(2 marks)**

(b)

16 cm

> Check whether you are given the **radius** or the **diameter**.

........................... cm

**(2 marks)**

**3** Work out the radii of circles with the following circumferences. Give your answers correct to 3 significant figures.
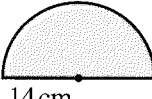
(a) circumference = 35 cm

$C = 2 \times \pi \times r$

........................... $= 2 \times \pi \times r$

$r =$ ........................ ÷ ........................

radius = ........................... cm  **(2 marks)**

(b) circumference = 92 cm

radius = ........................... cm  **(2 marks)**

**4** Work out the perimeters of the following shapes. Give your answers correct to 3 significant figures.

(a)

12 cm

........................................... cm  **(3 marks)**

(b)

14 cm

........................................... cm  **(3 marks)**

**5** A reel of thread has a radius of 2.5 cm.
The thread is wrapped round the reel 200 times.
Work out the length of the thread.
Give your answer correct to 3 significant figures.

........................................... cm  **(3 marks)**

# Area of a circle

**Guided**

**1** Work out the areas of the following circles.
Give your answers correct to 3 significant figures.

(a)  ⬤ 6 cm
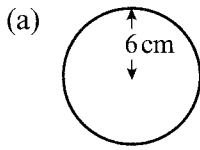
$A = \pi \times r^2$

$= \pi \times \dots\dots\dots^2$

$= \dots\dots\dots cm^2$

You need to learn this formula.

First work out the radius.

**(2 marks)**

(b)  ⬤ 16 cm

(c)  ⬤ 26 cm
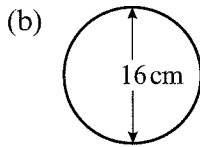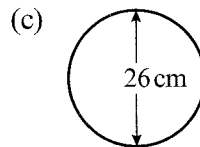
...................................cm² **(3 marks)**    ...................................cm² **(3 marks)**

**Guided**

**2** Work out the areas of the following shapes.
Give your answers correct to 3 significant figures.

(a)  ◱ 12 cm
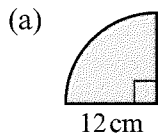
Area of whole circle $= \pi \times r^2$

$= \pi \times \dots\dots \times \dots\dots$

$= \dots\dots cm^2$

Area $= \dots\dots \div 4 = \dots\dots cm^2$    **(3 marks)**

(b)  ◗ 14 cm

(c)  ⬤ 24 cm
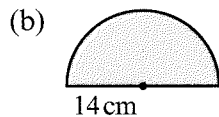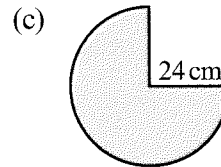
...................................cm² **(3 marks)**    ...................................cm² **(3 marks)**

**3** Work out the shaded area of each shape.
Give your answers correct to 3 significant figures.

(a)  ⬤ 4 cm, 9 cm

(b)  ◻ 14 cm

(c)  12 cm, 28 cm
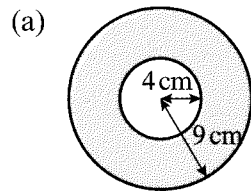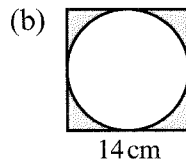
..............cm² **(3 marks)**    ..............cm² **(3 marks)**    ..............cm² **(3 marks)**
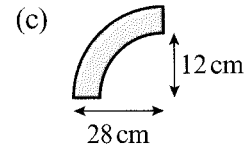
**4** The diagrams show two identical squares.

A    B
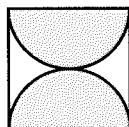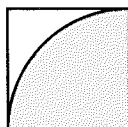
Diagram A shows a quarter of a circle shaded inside the square.
Diagram B shows two identical semi-circles shaded inside the square.

Show that the area of the region shaded in diagram A is equal to
area of the region shaded in diagram B.

**(3 marks)**

# Sectors of circles

**1** Work out the arc lengths of the following sectors of circles.
Give your answers correct to 3 significant figures.

**Guided**

(a)
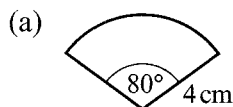


> You are only calculating the curved length in this question.

$$L = 2 \times \pi \times r \times \frac{..............}{360}$$

$$= 2 \times \pi \times .................. \times \frac{..............}{360}$$

$$= .................. \, cm$$

**(3 marks)**

(b)



.............................................cm   **(3 marks)**

(c)
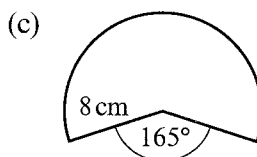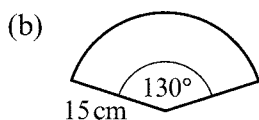


.............................................cm   **(3 marks)**

**2** Work out the perimeters of the following sectors of circles.
Give your answers correct to 3 significant figures.

> Find the arc length then add the two radii.

(a)



.....................cm   **(4 marks)**

(b)



.....................cm   **(4 marks)**

(c)
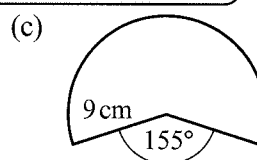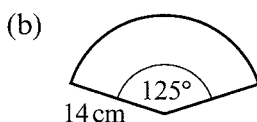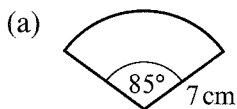


.....................cm   **(4 marks)**

**3** Work out the areas of the following sectors of circles.
Give your answers correct to 3 significant figures.

**Guided**

(a)
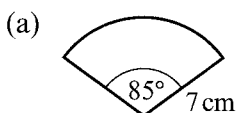


$$A = \pi \times r \times r \times \frac{..............}{360}$$

$$= \pi \times .................. \times .................. \times \frac{..............}{360}$$

$$= .................. \, cm^2$$

**(3 marks)**

(b)



.............................................cm²   **(3 marks)**

(c)



.............................................cm²   **(3 marks)**

**4** The diagram shows a sector of circle with radius 12 cm.
Show that the area of the shaded region is 41 cm²
correct to 2 significant figures.



**(4 marks)**

105
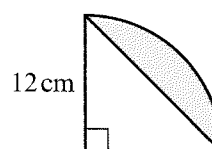
# Cylinders

**1** Work out the volumes of the following cylinders.
Give your answers correct to 3 significant figures.

**Guided**

(a)   4 cm
14 cm

$V = \pi \times r^2 \times h$

$= \pi \times \text{........................}^2 \times \text{........................}$

$= \text{........................} \ cm^3$   **(3 marks)**

(b)   12 cm
25 cm

(c)   ←28 cm→
17 cm
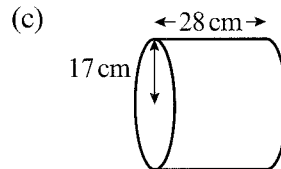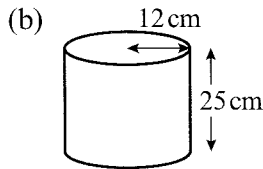
.................................................cm³  **(3 marks)**         .................................................cm³  **(3 marks)**

**2** Work out the total surface areas of the following cylinders.
Give your answers correct to 3 significant figures.

**Guided**

(a)   4 cm
14 cm
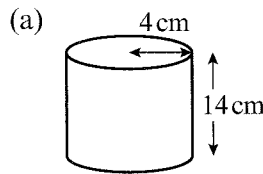
$SA = (2 \times \pi \times r \times h) + (2 \times \pi \times r^2)$

$= (2 \times \pi \times \text{........................} \times \text{........................})$

$+ (2 \times \pi \times \text{........................}^2)$

$= \text{........................} \ cm^2$   **(3 marks)**

(b)   12 cm
25 cm

(c)   ←28 cm→
17 cm
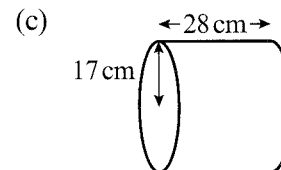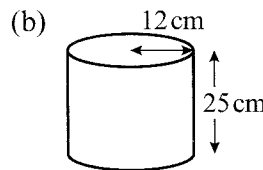
.................................................cm²  **(3 marks)**         .................................................cm²  **(3 marks)**

**3** Diagram A shows a cylinder with radius 15 cm
and height 18 cm.
Diagram B shows a cube with side 24 cm.
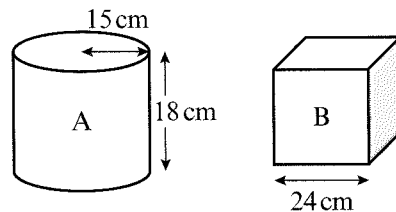
(a)  Show that the volume of the cube is greater
than the volume of the cylinder.

15 cm
A  18 cm
B
24 cm

**(4 marks)**

(b)  Which of the shapes has the greater surface area?
You must show your working.

**(4 marks)**

# Volumes of 3D shapes

**1** Work out the volumes of the following shapes.
Give your answers correct to 3 significant figures.

**⟩ Guided ⟩**

(a)



15 cm

4 cm
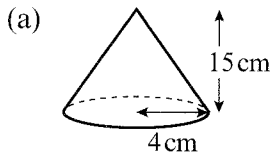
$V = \frac{1}{3} \times \pi \times r^2 \times h$

$= \frac{1}{3} \times \pi \times \text{............................}^2 \times \text{........................}$

$= \text{........................} \ cm^3$     **(2 marks)**

(b)



12 cm

(c)



17 cm

←5 cm→   5 cm
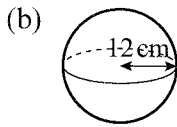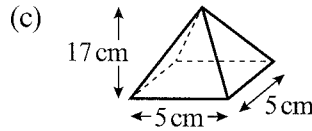
.............................................cm³  **(2 marks)**     .............................................cm³  **(2 marks)**

**2** Work out the volumes of the following shapes.
Give your answers correct to 3 significant figures.

(a)



4 cm

10 cm

(b)



3 m

30 m

3 m

(c)



6 cm

10 cm

5 cm

5 cm
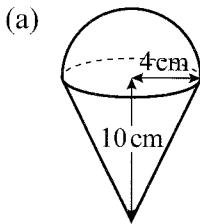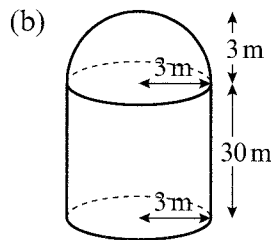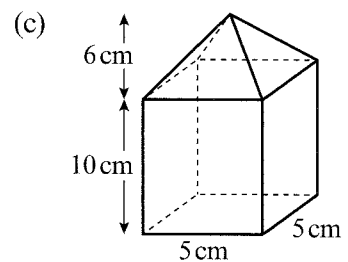
.....................cm³ **(3 marks)**    .....................cm³ **(3 marks)**    .....................cm³ **(3 marks)**

**3** A cylinder has radius 4 cm and height 15 cm.
A cone has base radius 6 cm and height 10 cm.
Show that the volume of the cylinder is twice the
volume of the cone.
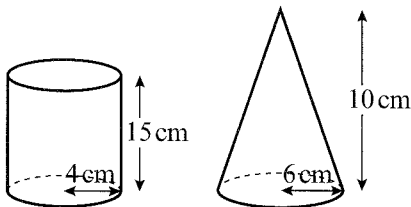
**PROBLEM SOLVED!**

> You will need to use
> problem-solving skills
> throughout your exam
> – **be prepared!**



15 cm

4 cm

10 cm

6 cm

**(4 marks)**

**4** The diagram shows a cylinder and a sphere.
The radius of the cylinder is $x$ cm and its height is 9 cm.
The radius of the sphere is 3 cm.
The volume of the cylinder is equal to the volume
of the sphere.
Show that the radius, $x$, of the cylinder is 2 cm.



9 cm

$x$ cm

3 cm
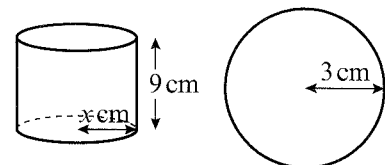
**(4 marks)**

# Surface area

**1** Work out the surface areas of the following shapes. Give your answers correct to 3 significant figures.

> **Guided**

(a)

16 cm
4 cm

$SA = (\pi \times r^2) + (\pi \times r \times l)$

$= (\pi \times \text{...............................}^2)$

$+ (\pi \times \text{...........................} \times \text{...........................})$

$= \text{...........................} \ cm^2$  **(2 marks)**

(b)

12 cm

.................................................cm²  **(2 marks)**

(c)

7 cm
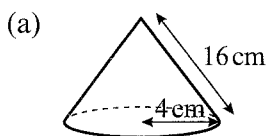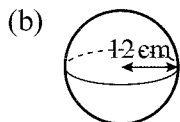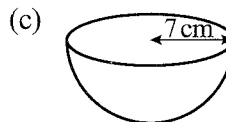
.................................................cm²  **(2 marks)**

**2** Work out the surface areas of the following shapes. Give your answers correct to 3 significant figures.

> **Guided**

(a)

4 cm
10 cm
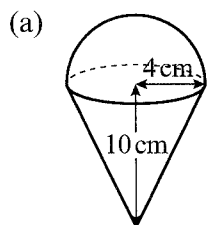
$SA = cone + hemisphere$

$= (\pi \times r \times l) + \frac{1}{2}(4 \times \pi \times r^2)$

$= (\pi \times \text{...........................} \times \text{...........................})$

$+ (4 \times \pi \times \text{...........................}^2)$

$= \text{...........................} \ cm^2$  **(3 marks)**

(b)

3 cm
3 cm
30 cm
3 cm

.................................................cm²  **(3 marks)**

(c)

21 cm
5 cm
3 cm
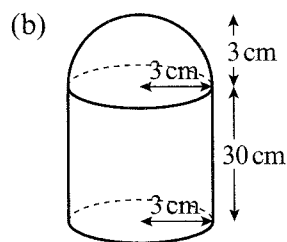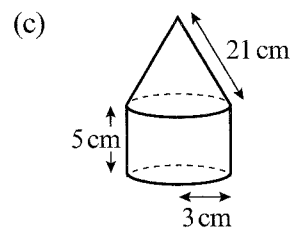
.................................................cm²  **(3 marks)**

**3** The diagram shows a cone with vertical height 15 cm and base diameter 16 cm. Work out the curved surface area of the cone.

**PROBLEM SOLVED!**

15 cm
16 cm
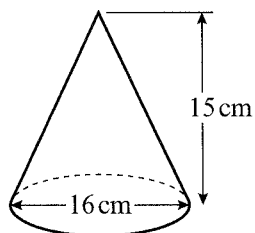
You will need to use problem-solving skills throughout your exam – **be prepared!**

You will need to use Pythagoras' theorem to find the slant height. Sketch the right-angled triangle you need to use.

Curved surface area of cone $= \pi r l$

.................................................cm²  **(4 marks)**

# Similarity and congruence

**1** Here are five shapes.



> **Guided**
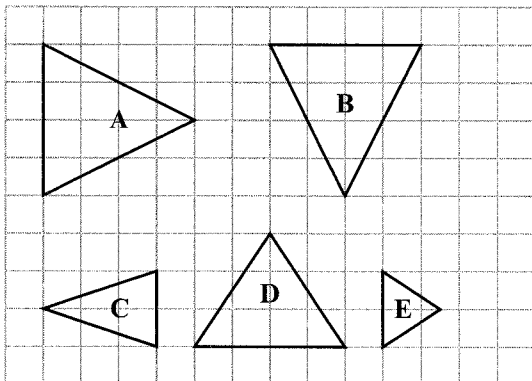
Congruent shapes have exactly the same size and shape.

(a) Write down the letters of two congruent shapes.

.............................. and .............................. **(1 mark)**

Similar shapes are enlargements of one another.

(b) Write down the letters of two similar shapes.

.............................. and .............................. **(1 mark)**

**2** (a) On the grid below, draw a shape that is congruent to shape A.

> **Guided**
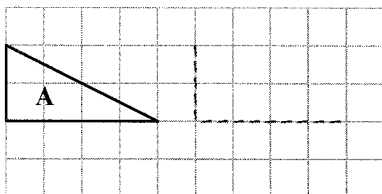


**(1 mark)**

(b) On the grid below, draw a shape that is similar to shape B.
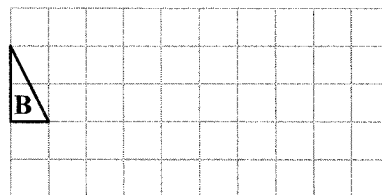


**(1 mark)**

**3** On each grid, draw a shape that is similar to the shaded shape, but not congruent.

(a)



**(2 marks)**

(b)
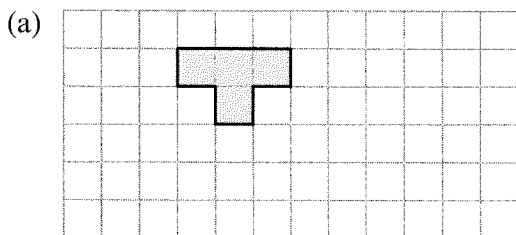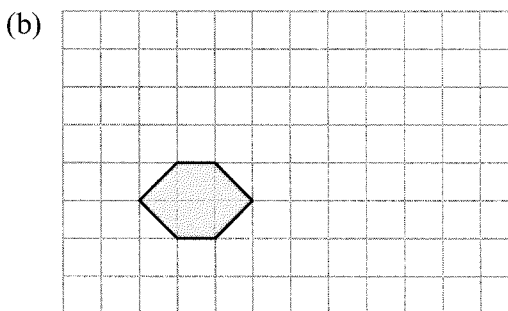


**(1 marks)**

**4** Here are three shapes.
Ravina says, 'A and C are congruent.'
Anjali says, 'A and B are congruent.'
Who is correct?
Explain your answer.

**PROBLEM SOLVED!**

You will need to use problem-solving skills throughout your exam – **be prepared!**
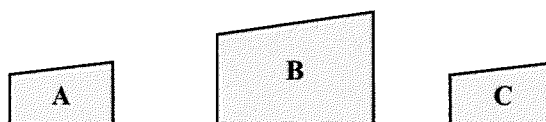


........................................................................................................................... **(1 mark)**

**5** These two cubes are similar.
How many times will the 4 cm cube fit inside the 12 cm cube?



4 cm        12 cm

..........................................

**(2 marks)**

109
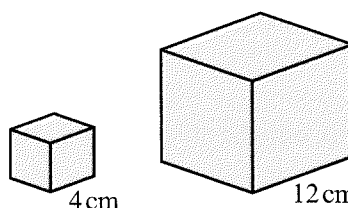
# Similar shapes

**1** The two triangles *ABC* and *PQR* are mathematically similar.
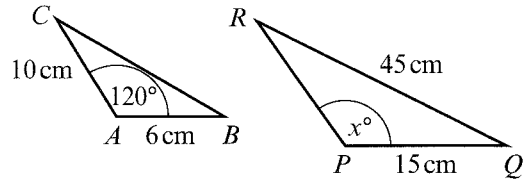
(a) Write down the size of the angle marked *x*.   .........................° **(1 mark)**

(b) Work out the length of *PR*.

$$\frac{PR}{10} = \frac{15}{.............................}$$

$$PR = \frac{15}{.............................} \times .............................$$

$$= ............................. \text{ cm}$$

> Use the fact that corresponding sides are in the same ratio.

**(2 marks)**

(c) Work out the length of *BC*.

......................................... **(2 marks)**

**2**
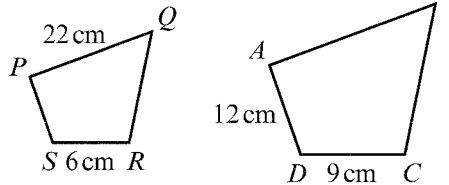
The diagram shows two quadrilaterals that are mathematically similar.

(a) Work out the length of *AB*.

$$\frac{AB}{.............................} = \frac{.............................}{.............................}$$

$$AB = \frac{.............................}{.............................} \times ............................. = ............................. \text{ cm}$$

**(2 marks)**

(b) Work out the length of *PS*.

......................................... **(2 marks)**

**3**
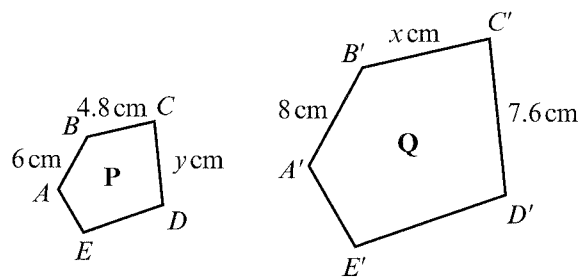
The diagram shows two pentagons, **P** and **Q**, which are mathematically similar.

(a) Work out the value of *x*.

*x* = ......................................... **(2 marks)**

(b) Work out the value of *y*.

*y* = ......................................... **(2 marks)**

# Congruent triangles

**1** Show that triangle *ABC* is congruent to triangle *DEF*.
You must explain your answer.
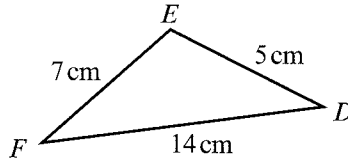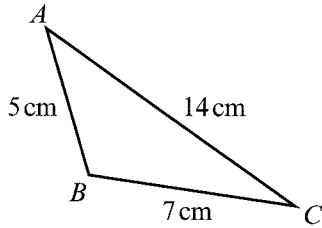


AC = DF

AB = ..........................................

BC = ..........................................

Hence,

.......................................... sides are ..........................................

So the reason is ..........................................

> You can write your reasons as SSS, AAS, SAS or RHS.

**(3 marks)**

**2** Show that triangle *ABC* is congruent to triangle *PQR*.
You must explain your answer.
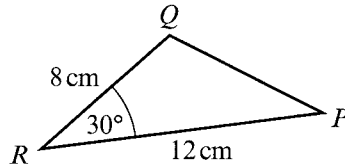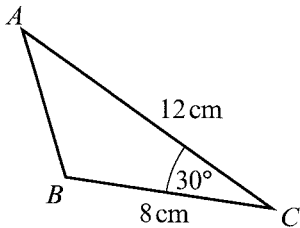


BC = ..........................................

CA = ..........................................

angle BCA = angle ..........................................

△ADC ≡ BCA

So the reason is ..........................................

**(3 marks)**

**3** Is triangle *ABC* congruent to triangle *PQR*? You must explain your answer.
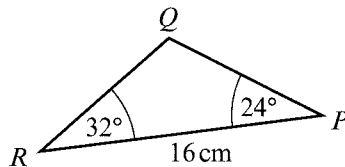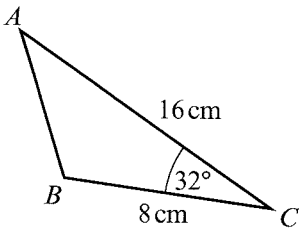


..........................................................................................................................    **(3 marks)**

# Vectors

**1** Write each vector as a column vector.
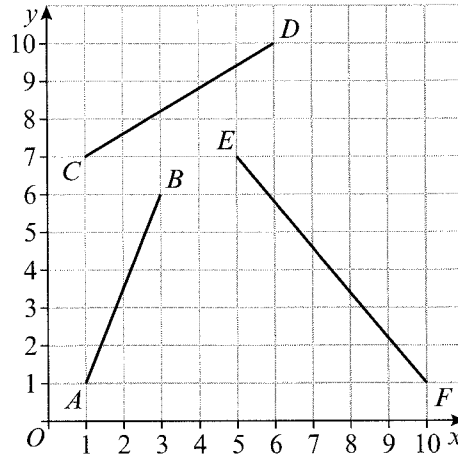


(a) $\overrightarrow{AB} = \begin{pmatrix} 2 \\ \dots \end{pmatrix}$

**(1 mark)**

(b) $\overrightarrow{BA} = \begin{pmatrix} \dots \\ -5 \end{pmatrix}$

**(1 mark)**

(c) $\overrightarrow{CD} = \begin{pmatrix} \dots \\ \dots \end{pmatrix}$

**(1 mark)**

(d) $\overrightarrow{DC} = \begin{pmatrix} \dots \\ \dots \end{pmatrix}$

**(1 mark)**

(e) $\overrightarrow{EF} = \begin{pmatrix} \dots \\ \dots \end{pmatrix}$

**(1 mark)**

(f) $\overrightarrow{FE} = \begin{pmatrix} \dots \\ \dots \end{pmatrix}$

**(1 mark)**

**2** The following diagram shows triangle $ABC$.
Write down the following vectors in terms of **a** and **b**.
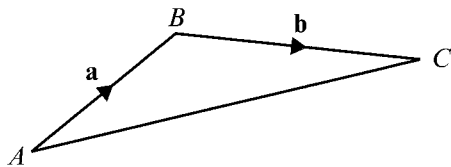


(a) $\overrightarrow{AC}$

**a** + ........................... **(1 mark)**

(b) $\overrightarrow{CA}$

........................... **(1 mark)**

**3** $ABCD$ is a parallelogram.
$AB$ is parallel to $DC$.
$AD$ is parallel to $BC$.
Write down the following vectors
in terms of **p** and **q**.



(a) $\overrightarrow{AC}$

(b) $\overrightarrow{CA}$

(c) $\overrightarrow{DB}$

(d) $\overrightarrow{BD}$

.....................

**(1 mark)**

.....................

**(1 mark)**

.....................

**(1 mark)**

.....................
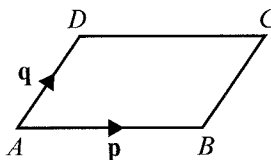
**(1 mark)**

**4**



$\overrightarrow{OB} = 3\mathbf{a} + 2\mathbf{b}$

$\overrightarrow{OA} = 2\mathbf{a} + \mathbf{b}$

Write down the following vectors in terms of **a** and **b**.
Give your answer in its simplest form.

(a) $\overrightarrow{AB}$

(b) $\overrightarrow{BA}$
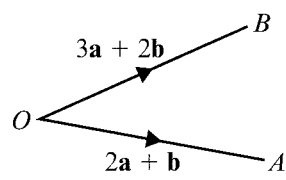
........................... **(2 marks)**

........................... **(2 marks)**

# Problem-solving practice 1

**1** *BEG* and *CFG* are straight lines. *ABC* is parallel to *DEF*. Angle *BEF* = 48°.
Angle *BCF* = 30°.
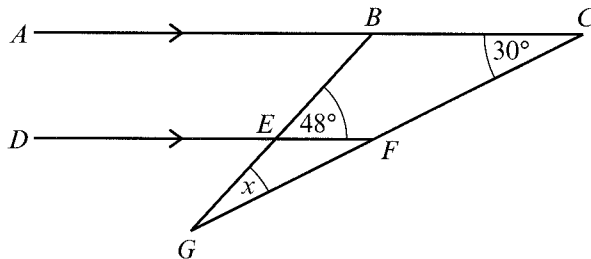
Work out the size of the angle marked $x$.
Give reasons for each step of your working.

.........................................° **(4 marks)**

**2** A rectangular tray has length 60 cm, width 40 cm and depth 2 cm.
It is full of water. The water is poured into an empty cylinder of diameter
18 cm and a height of 20 cm. Will there be any water left in the rectangular tray?
You must show all your working.

**(4 marks)**

**3**
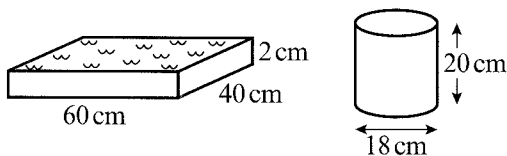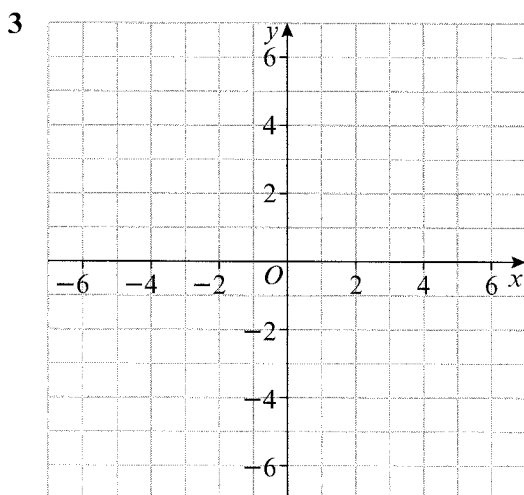
Transformation **A** is a reflection in the line $y = -x$.
Transformation **B** is the rotation 180° about (0, 0).

Alison draws a shape and labels it **P**. She carries out
transformation **A** and labels the image **Q**. She then
transforms **Q** using transformation **B**. She labels her
final image **R**.

Describe a single transformation that will map shape
**P** onto shape **R**.

**(3 marks)**

# Problem-solving practice 2

**4** The diagram shows a circular garden patio with a radius of 8 m. It has two small circles inside the garden patio. The small circles have a radius of 2 m. Kelly wants to gravel the shaded area. She orders 20 bags of gravel. Each bag covers an area of 9 m². Does she order enough bags to cover the shaded area? You must show all your working.
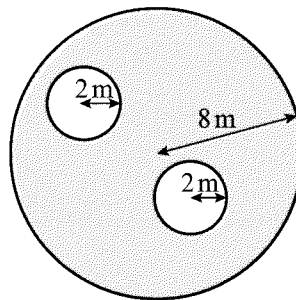


**(5 marks)**

**5** *ABCDEF* is a regular hexagon, *FEHG* and *EXYD* are squares. Angle *HEX = x*.
Work out the value of *x*.
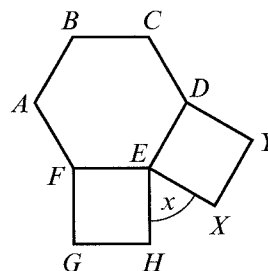


............................................ **(4 marks)**

**6** The diagram represents a vertical flagpole, *AB*. The flagpole is supported by two ropes, *BC* and *BD*, fixed to the horizontal ground at *C* and *D*.
*AB* = 12.8 m, *AC* = 6.8 m, angle *BDA* = 42°.
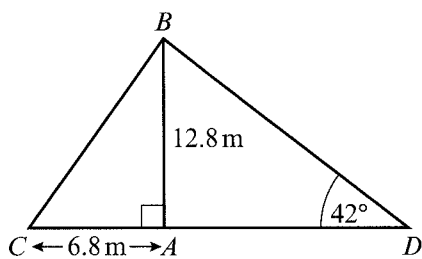


(a) Calculate the size of angle *BCA*.
Give your answer correct to 3 significant figures.

............................................° **(2 marks)**

(b) Sandeep wants to replace rope *BD*. He buys a new rope of length 20 m.
Is it long enough? You must show your working.

**(2 marks)**

**114**
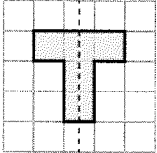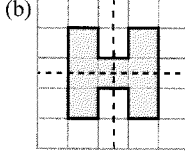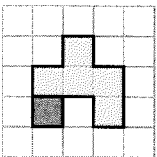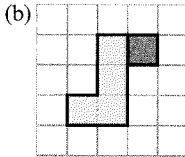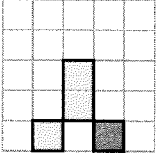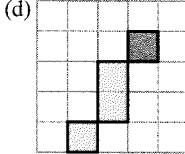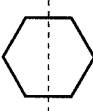
## 70. Problem-solving practice 2

**5** No, he needs four more people

**6** 1000 g

**7** No. She needs $(60 \div 4) \times 15 = 225$ g of almonds and she only has 200 g.

**8** $\dfrac{100 + 6}{100} = 1.06$

£14 000 × (1.06)$^4$ = £17 674.68

Kim has enough money
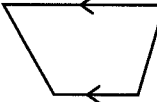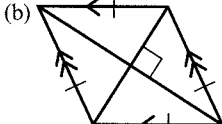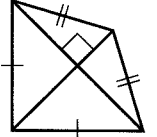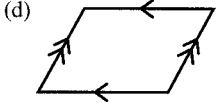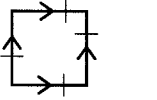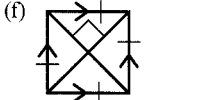
# GEOMETRY & MEASURES

## 71. Symmetry

**1** (a)  (b) 
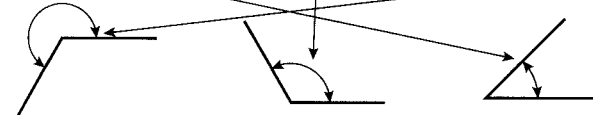
**2** (a) 4      (b) 2 or 3      (c) 1

**3** (a)  (b) 

(c)  (d) 

**4** (a) 6

(b)  (There are other possible lines)

## 72. Quadrilaterals

**1** (a) Rectangle      (b) Trapezium

(c) Parallelogram      (d) Square

(e) Rhombus      (f) Kite

**2** (a)  (b) 

(c)  (d) 

(e)  (f) 

## 73. Angles 1

**1** 

**2** (a) (i) Obtuse angle

(ii) $x°$ is more that 90° but less than 180°

(b) (i) Reflex angle

(ii) $x°$ is more than 180° but less than 360°

**3** (a) (i) 109°

(ii) Angles on a straight line add up to 180°

(b) (i) 146°

(ii) Angles round a point add up to 360°

## 74. Angles 2

**4** 292°

**5** (a) (i) 60°

(ii) The triangle is an equilateral triangle

(b) 150°

**6** (a) 65° because angles on a straight line add up to 180°

(b) 65° because $x$ and $y$ are alternate angles

(c) 65° because $x$ and $z$ are corresponding angles

## 75. Solving angle problems

**1** (a) (i) 42°

(ii) Alternate angles

(iii) 111 because angles on a straight line add up to 180°

(b) (i) 110°

(ii) Corresponding angles
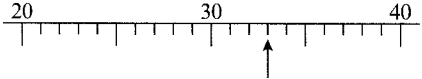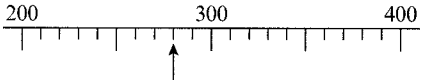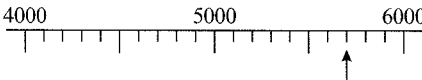
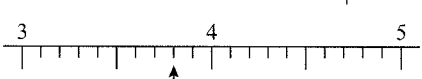(iii) 40°

(iv) Isosceles triangle

**2** 39°

## 76. Angles in polygons
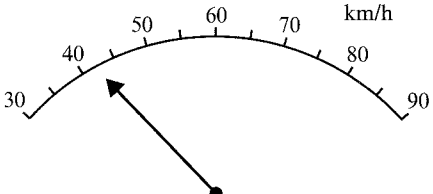
**1** (a) 72°      (b) 60°      (c) 45°

**2** (a) 40°      (b) 9

**3** (a) 12      (b) 10      (c) 20

**4** 135°

**5**    $360° \div 6 = 60°$

$180° - 60° = 120°$

$180° - 120° = 60°$

$\quad 60° \div 2 = 30°$

## 77. Time and timetables

**1** (a) 15:15      (b) 02:25      (c) 23:48

**2** (a) 4.25 am      (b) 12.10 pm      (c) 8.32 pm

**3** 52 minutes

**4** 15:30

**5** (a) E      (b) 111 minutes

(c) 07:45      (d) 09:32

## 78. Reading scales

**1** (a) 23      (b) 340      (c) 5300      (d) 4.6

**2** (a) 

(b) 

(c) 

(d) 

**3** (a) 65 km/h

(b) 

**4** 0.75 kg

## 79. Perimeter and area

**1** (a) (i) 5 cm²      (ii) 12 cm

**2** (a) 9 cm²      (b) 6 cm²

**3** (a) 40 cm      (b) 27 cm      (c) 72 cm      (d) 58 cm

## 80. Area formulae
1 (a) 90 cm²    (b) 36 cm²    (c) 28 cm²    (d) 190 cm²
2 (a) 72 cm²    (b) 392 cm²
3 $h = 5$ cm

## 81. Solving area problems
1 115 cm²
2 No, the local developer needs £108.75 more
3 No, she doesn't have enough tins to paint the wall

## 82. 3D shapes
1 (a) Cube    (b) Cuboid    (c) Cylinder
   (d) Triangular prism    (e) Pyramid    (f) Sphere
2 (a) 150 cm²    (b) 122 cm²    (c) 184 cm²

3

| 3-D shape | Number of faces | Number of edges | Number of vertices |
|---|---|---|---|
| (a) Cube | 6 | 12 | 8 |
| (b) Cuboid | 6 | 12 | 8 |
| (c) Triangular prism | 5 | 9 | 6 |
| (d) Tetrahedron | 4 | 6 | 4 |

4 (a) 96 cm²      (b) She does not have enough tins

## 83. Volumes of cuboids
1 (a) 125 cm³    (b) 360 cm³    (c) 1344 cm³
2 6 cm
3 140 cubes
4 11.67 cm

## 84. Prisms
1 (a) 48 cm³    (b) 144 cm³    (c) 384 cm³
2 (a) 108 cm²    (b) 204 cm²    (c) 366 cm²
3 352 cm³

## 85. Units of area and volume
1 (a) 60 000 cm²    (b) 1500 mm²    (c) 4 000 000 m²
   (d) 50 m²    (e) 600 cm²    (f) 0.8 km²
2 (a) 22 000 000 cm³    (b) 28 000 mm³
   (c) 3 000 000 000 m³    (d) 200 m³
   (e) 50 000 cm³    (f) 0.42 km³
3 (a) 200 litres    (b) 8000 litres    (c) 12 000 litres
4 (a) 45 litres    (b) 96 000 litres

## 86. Translations
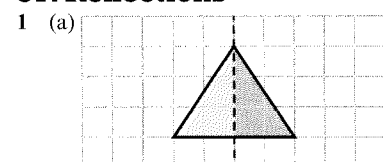1 (a) $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$    (b) $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$    (c) $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

2 (a) and (b)
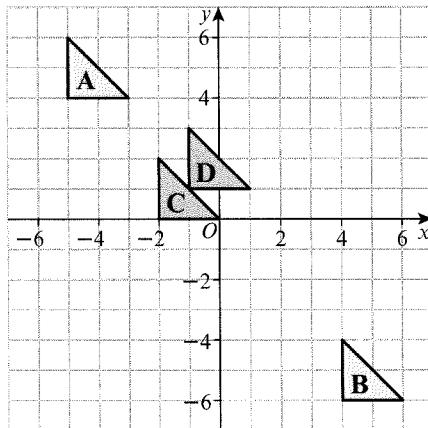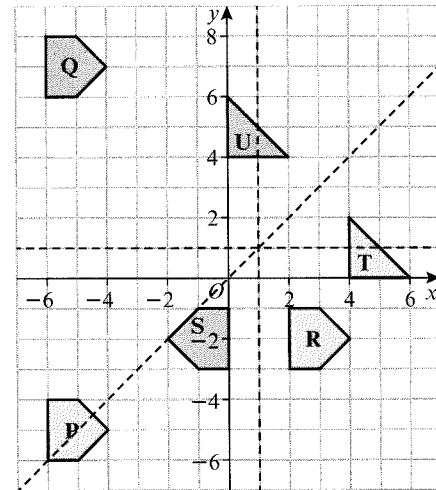


3 (a) translation $\begin{pmatrix} -7 \\ -3 \end{pmatrix}$    (b) translation $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$
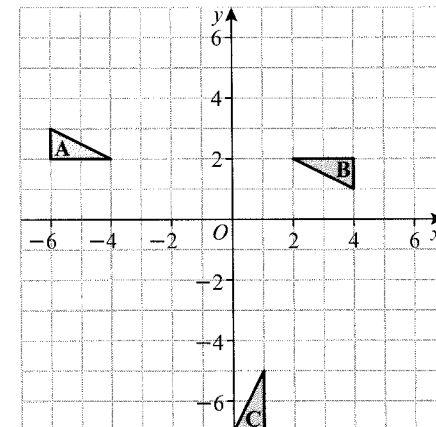
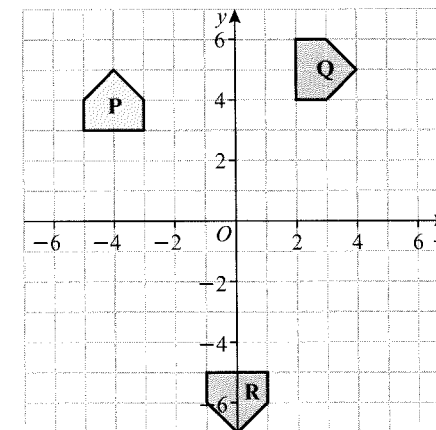## 87. Reflections
1 (a)



(b)



(c)
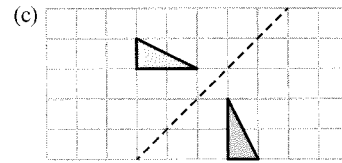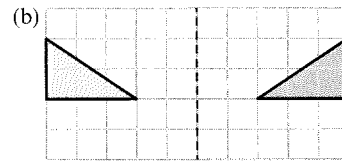


2 (a), (b) and (c)



3 (a) Reflection in the line $y = -1$
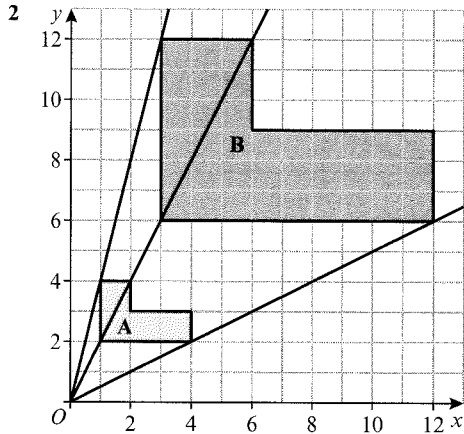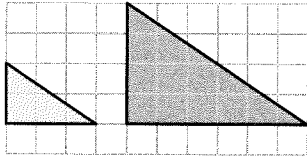   (b) Reflection in the line $y = x$

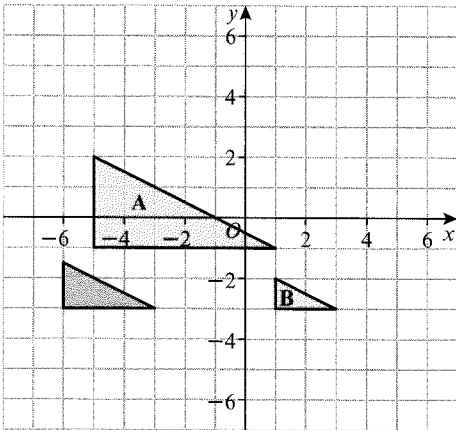## 88. Rotations
1 (a) and (b)



2 (a) and (b)

**3** (a) Rotation 90° about (1, −1) clockwise
(b) Rotation 180° about (0, −1)

## 89. Enlargements
**1** (a) 5
(b)


**2**


**3** (a) Enlargement of scale factor $\frac{1}{3}$ at (4, −4)
(b)


## 90. Pythagoras' theorem
**1** (a) 10.7 cm     (b) 6.75 cm     (c) 15.7 cm
**2** 1347 cm
**3** She is incorrect
**4** No, it cannot be totally immersed

## 91. Line segments
**1** 9.22
**2** 7.07
**3** 10
**4** (a) (1, −2)
(b) diameter = $\sqrt{8^2 + 6^2}$ = 10
hence, radius = 10 ÷ 2 = 5

## 92. Trigonometry 1
**1** (a) 54.3°     (b) 57.8°
**2** 62.8°
**3** 53.0°
**4** She cannot use smooth tiles on her roof as angle $x°$ is greater than 17° (20.4°)

## 93. Trigonometry 2
**5** (a) 14.3 cm     (b) 16.3 cm
**6** 5.4 m
**7** 55.1 m
**8** (a) 21 m     (b) 60.3°

## 94. Solving trigonometry problems
**1**

| | 0° | 30° | 45° | 60° | 90° |
|---|---|---|---|---|---|
| **sin** | 0 | $\frac{1}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{3}}{2}$ | 1 |
| **cos** | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{1}{\sqrt{2}}$ | $\frac{1}{2}$ | 0 |
| **tan** | 0 | $\frac{\sqrt{3}}{3}$ | 1 | $\sqrt{3}$ | − |

**2** (a) $x$ = 9 cm
**3** (a) 30°     (b) 30°
**4** $30\sqrt{3}$

## 95. Measuring and drawing angles
**1** (a) 43°     (b) 138°     (c) 225°
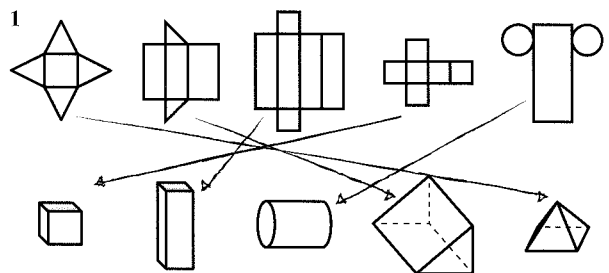**2** (a)

(b)

(c)
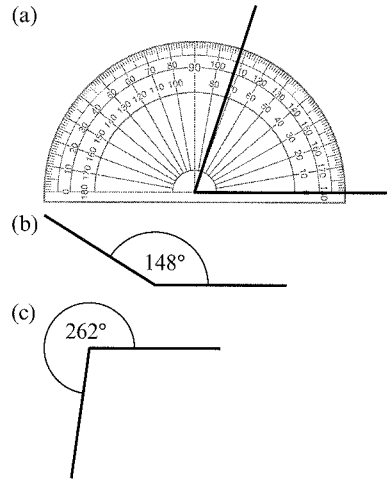

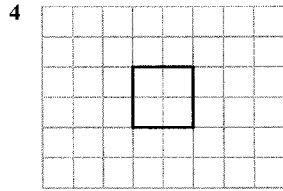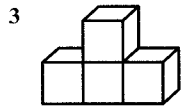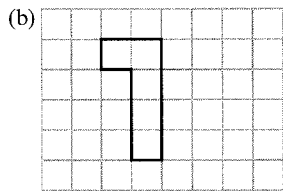**3** (a) 53°, acute     (b) 153°, obtuse     (c) 235°, reflex
**4**
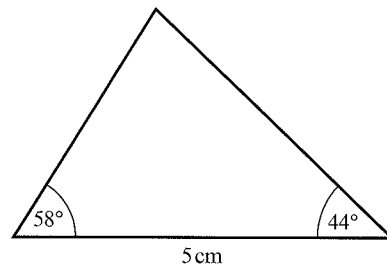

## 96. Measuring lines
**1** (a) 3.2 cm     (b) 4.35 cm     (c) 5.95 cm
**2** (a) A line 52 mm long (±1 mm)
(b) A line 6 cm long (±1 mm)
(c) A line 7.8 cm long (±1 mm)
**3** Cross marked half way between A and B (±1 mm)
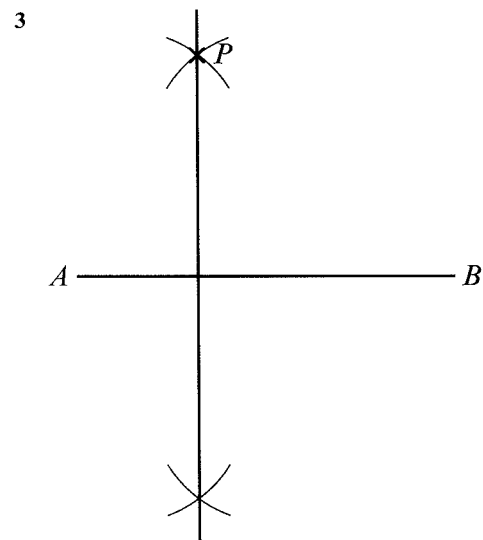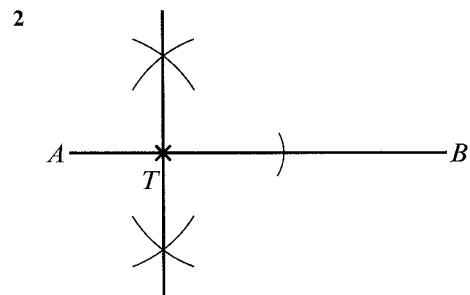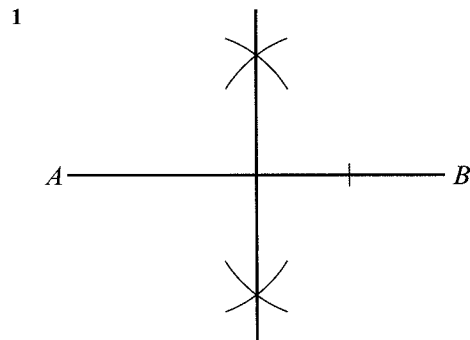**4** 6.4 m
**5** (a) 2 m     (b) 6 m

## 97. Plans and elevations
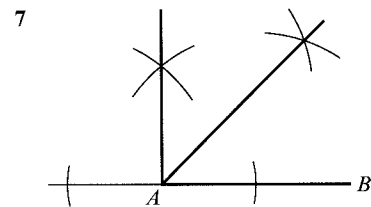**1**


**2** (a)


**151**

(b)



3



4
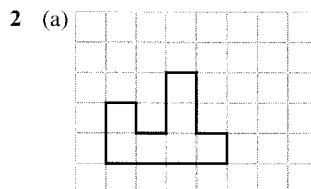


## 98. Scale drawings and maps

| 1 | (a) 350 m | (b) 22.5 km | (c) 78 km |
| 2 | (a) 2.5 km | (b) 12 km | (c) 154 km |
| 3 | (a) 20 cm | (b) 15 cm | (c) 5 cm |
| 4 | (a) 15 m | (b) 15 cm | |

## 99. Constructions 1

1



2



3



## 100. Constructions 2

4



5



6



7



## 101. Loci
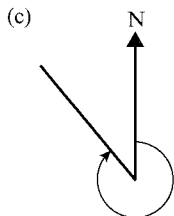
1



2

**3**



P ✕

✕ Q

✕ R

**4**



C

A

B
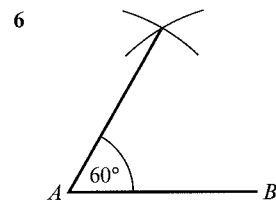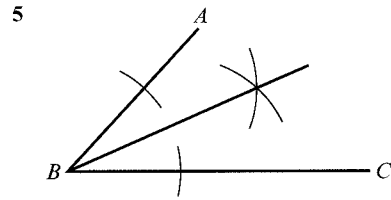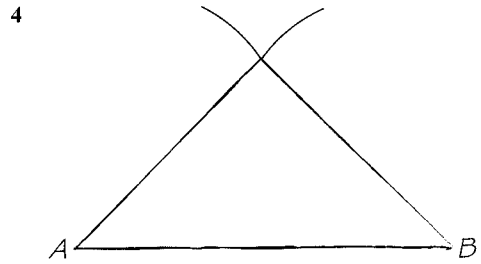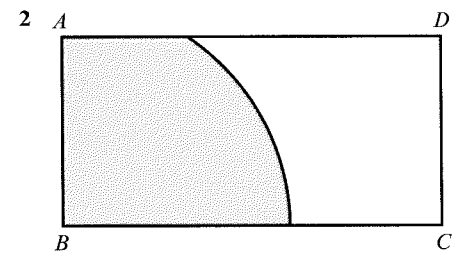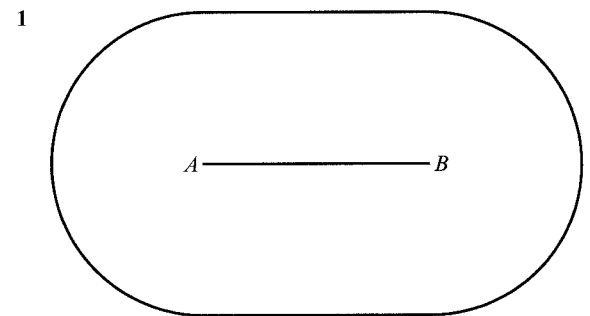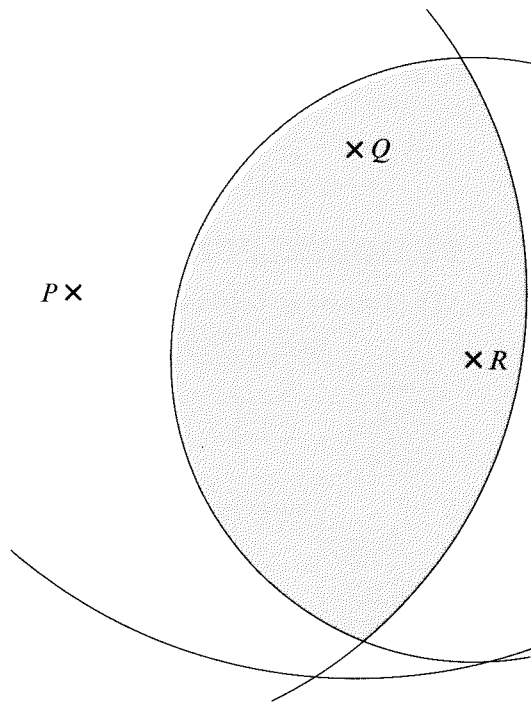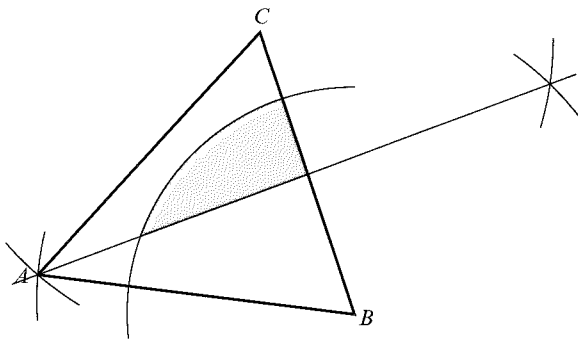
## 102. Bearings

**1** (a) (i) 210° (ii) 30°
  (b) (i) 310° (ii) 130°

**2** (a) N



  (b) N



  (c) N



**3** (a) 16 km (b) 24°

---

(c)



C

N

A   4 cm   B
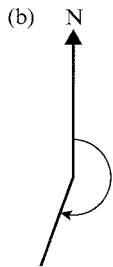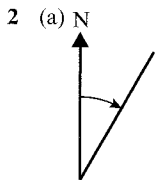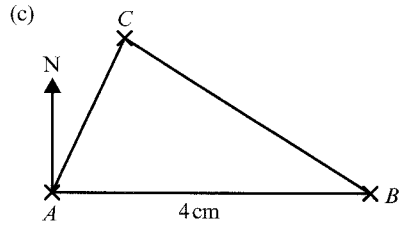
✕ D

## 103. Circles

**1** (a) chords (b) radius (c) diameter
**2** (a) 37.7 cm (b) 50.3 cm
**3** (a) 5.57 cm (b) 14.6 cm
**4** (a) 42.8 cm (b) 72.0 cm
**5** 3140 cm

## 104. Area of a circle

**1** (a) 113 cm² (b) 201 cm² (c) 531 cm²
**2** (a) 113 cm² (b) 308 cm² (c) 1360 cm²
**3** (a) 204 cm² (b) 42.1 cm² (c) 503 cm²

**4** Area A $= \frac{1}{4} \times \pi \times x^2 = \frac{\pi x^2}{4}$

  Area B $= 2 \times \frac{1}{2}\pi \times \left(\frac{x}{2}\right)^2 = \frac{\pi x^2}{4}$

## 105. Sectors of circles

**1** (a) 5.59 cm (b) 34.0 cm (c) 27.2 cm
**2** (a) 24.4 cm (b) 58.5 cm (c) 50.2 cm
**3** (a) 36.3 cm² (b) 214 cm² (c) 145 cm²
**4** $\frac{1}{4} \times \pi \times 12^2 - \frac{1}{2} \times 12 \times 12 = 41.09 \approx 41$

## 106. Cylinders

**1** (a) 704 cm³ (b) 11 300 cm³ (c) 25 400 cm³
**2** (a) 452 cm² (b) 2790 cm² (c) 4810 cm²
**3** (a) cylinder $= \pi \times 15^2 \times 18 = 12\,723$ cm³
   cube $= 24 \times 24 \times 24 = 13\,824$ cm³
   Volume of the cube is greater
  (b) cylinder $= (2 \times \pi \times 15 \times 18) + (2 \times \pi \times 15^2) = 3110.2$ cm²
   cuboid $= 24 \times 24 \times 6 = 3456$ cm²
   The cuboid has the greatest surface area

## 107. Volumes of 3D shapes

**1** (a) 251 cm³ (b) 7240 cm³ (c) 142 cm³
**2** (a) 302 cm³ (b) 905 cm³ (c) 300 cm³
**3** Volume of cylinder $= 240\pi$
  Volume of cone $= 120\pi$
**4** $\pi \times x^2 \times 9 = \frac{4}{3} \times \pi \times 27$ rearranging $x = 2$
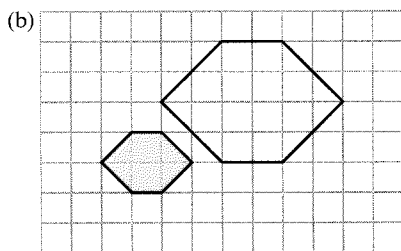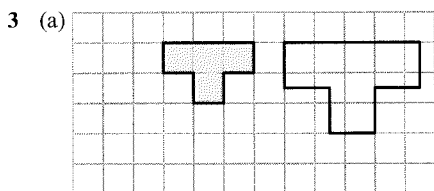
## 108. Surface area

**1** (a) 251 cm² (b) 1810 cm² (c) 462 cm²
**2** (a) 226 cm² (b) 650 cm² (c) 320 cm²
**3** 427 cm²

## 109. Similarity and congruence

**1** (a) A and B (b) D and E
**2** (a)



  (b)

**3** (a)



(b)
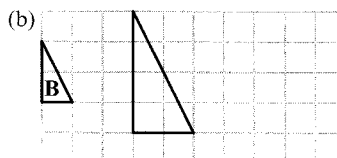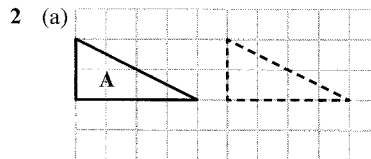


**4** Ravina is correct. A and C are the same shape and size.
B is an enlargement of A.

**5** 27

## 110. Similar shapes
**1** (a) 120°  (b) 25 cm  (c) 18 cm
**2** (a) 33 cm  (b) 8 cm
**3** (a) 6.4 cm  (b) 5.7 cm

## 111. Congruent triangles
**1** Side $AC$ = side $DF$, side $AB$ = $DE$, side $BC$ = $EF$ therefore SSS
**2** $BC$ = $QR$, $CA$ = $PR$, angle $BCA$ = angle $PRQ$ therefore SAS
**3** Side $AC$ = side $RP$, angle $ACB$ = angle $PRQ$, therefore not enough information to state whether congruent or not

## 112. Vectors
**1** (a) $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$  (b) $\begin{pmatrix} -2 \\ -5 \end{pmatrix}$  (c) $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$

(d) $\begin{pmatrix} -5 \\ -3 \end{pmatrix}$  (e) $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$  (f) $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

**2** (a) a + b  (b) −b − a
**3** (a) p + q  (b) −q − p  (c) p − q  (d) q − p
**4** (a) a + b  (b) −a − b

## 113. Problem-solving practice 1
**1** 18°
**2** tray = 60 cm × 40 cm × 2 cm = 4800 cm³
cylinder = $\pi \times 9^2 \times 20$ = 5089 cm³
There will be no water left in the rectangular tray

**3** (a) and (b)
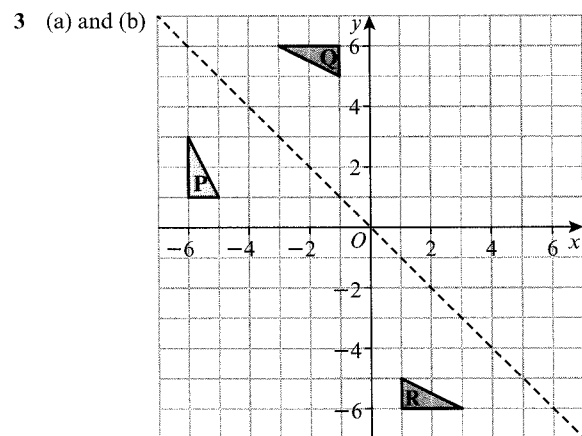


(c) Reflection in the line $y = x$

## 114. Problem-solving practice 2
**4** Yes, she does have enough bags
**5** 60°
**6** (a) 62.0°

(b) $\sin 42° = \dfrac{12.8}{BD}$ therefore $BD$ = 19.1 m

It is long enough

# PROBABILITY & STATISTICS

## 115. Two-way tables
**1**

|  | Bath | Warwick | Lichfield | Total |
|---|---|---|---|---|
| **Boys** | 10 | 14 | 8 | 32 |
| **Girls** | 7 | 11 | 20 | 38 |
| **Total** | 17 | 25 | 28 | 70 |

**2** (a)

|  | Dodgeball | Football | Rounders | Total |
|---|---|---|---|---|
| **Girls** | 12 | 18 | 11 | 41 |
| **Boys** | 6 | 19 | 14 | 39 |
| **Total** | 18 | 37 | 25 | 80 |

(b) 19  (c) 41  (d) 12

**3** (a)

|  | white | blue | red | Total |
|---|---|---|---|---|
| **Motorbikes** | 7 | 9 | 6 | 22 |
| **Cars** | 3 | 8 | 17 | 28 |
| **Total** | 10 | 17 | 23 | 50 |

(b) 22  (c) 28  (d) 20

## 116. Pictograms
**1** (a) 8 hours  (b) 3 hours

(c)

| Monday | O O O O |
|---|---|
| Tuesday | O O O |
| Wednesday | O O ◖ |
| Thursday | O O |
| Friday | O ◖ |

**2** (a) 20 packets  (b) 25 packets

(c)

| Monday | ▢ ▢ ▢ ▢ |
|---|---|
| Tuesday | ▢ ▢ ▢ |
| Wednesday | ▢ ▢ ▱ |
| Thursday | ▢ ▢ ▢ ▢ |
| Friday | ▢ ▢ ▢ |

## 117. Bar charts
**1** (a)



(b) Bulldog  (c) 49