OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE IN SECONDARY EDUCATION

MATHEMATICS SYLLABUS A

J512/03

Paper 3
(Higher Tier)

CUP/T58164

Candidates answer on the question paper

OCR Supplied Materials:
None

Other Materials Required:
- Geometrical instruments
- Tracing paper (optional)

Friday 9 January 2009
Morning

Duration: 2 hours

J 5 1 2 0 3

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Show your working. Marks may be given for a correct method even if the answer is incorrect.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- This document consists of **20** pages. Any blank pages are indicated.

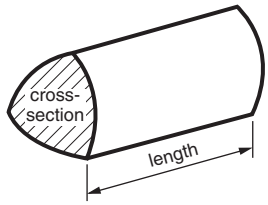
WARNING

No calculator can be used for this paper

FOR EXAMINER'S USE

Formulae Sheet: Higher Tier

Volume of prism = (area of cross-section) × length

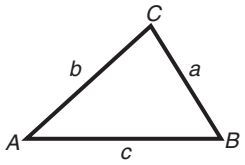


In any triangle *ABC*

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

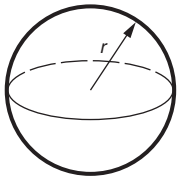
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$



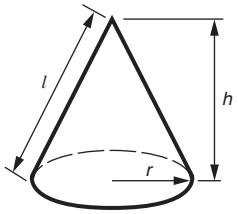
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$,
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

PLEASE DO NOT WRITE ON THIS PAGE

1 Linda works in a sandwich factory.

(a) She makes 30 sandwiches every hour.

How long does it take her to make 220 sandwiches?
Give your answer in hours and minutes.

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(a) _____ hours _____minutes **[3]**

(b) Linda's wage is £360 a week.
She receives a 5% wage rise.

Work out Linda's new weekly wage.

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(b) £ _____ **[3]**

(c) Linda makes cheese sandwiches and chicken sandwiches in the ratio 2 : 3.
She makes 200 sandwiches altogether.

How many of these are cheese sandwiches?

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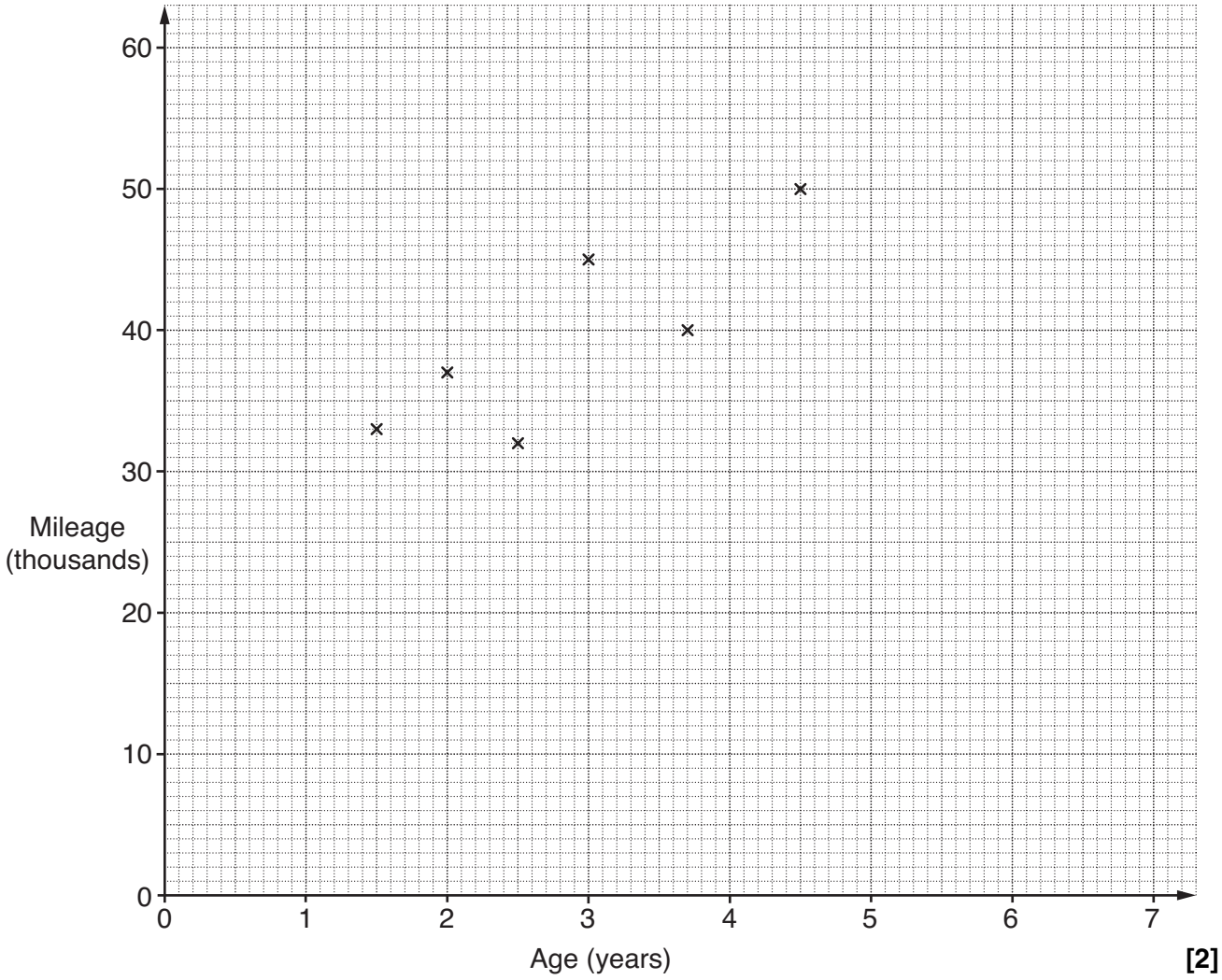
(c) _____ **[2]**

2 As part of a project, Robert records the ages and mileages of some cars.
His results are recorded in this table.

Age (years)	1.5	2	2.5	3	3.7	4.5	5.2	5.5	6	6.5	7
Mileage (thousands)	33	37	32	45	40	50	56	54	58	57	60

(a) Complete the scatter diagram. The first 6 points have already been plotted.



[2]

(b) Describe the strength and type of correlation shown in your diagram.

(b) _____ **[2]**

(c) (i) Draw a line of best fit for these data. **[1]**

(ii) Another car is 3.5 years old.

Use your line of best fit to estimate the mileage of this car.

(c)(ii) _____ thousand miles **[1]**

3 **(a)** $P = 5x - 2y$

Work out the value of P when $x = 3$ and $y = -4$.

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(a) _____ **[2]**

(b) $Q = 2x + 5$

Work out the value of x when $Q = 13$.

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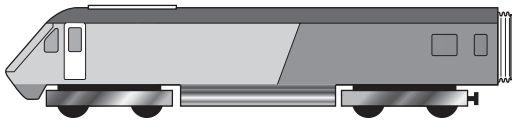
(b) _____ **[2]**

4 A model of a railway engine is made to a scale of 2 cm to 1 m.



(a) The length of the railway engine is 24 metres.

Work out the length of the model.

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(a) _____ cm **[2]**

(b) The height of the model is 8 cm.

Work out the height of the railway engine.

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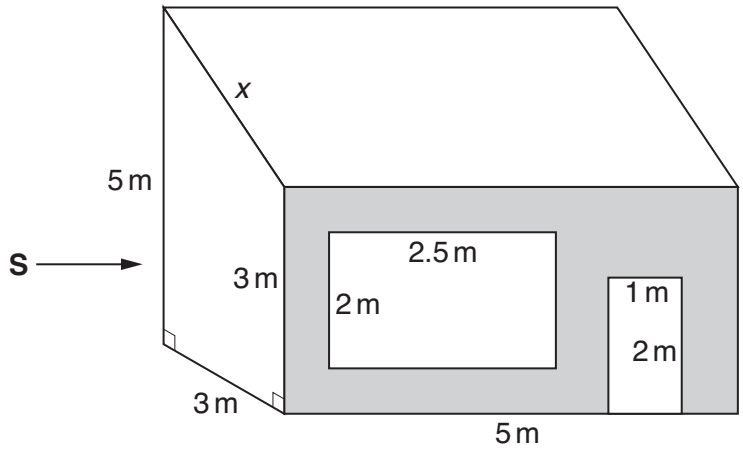
(b) _____ m **[2]**

5 The diagram shows a small shop.
The front of the shop, the window and the door are all rectangles.



(a) Work out the shaded area of the front of the shop.
Give the units of your answer.

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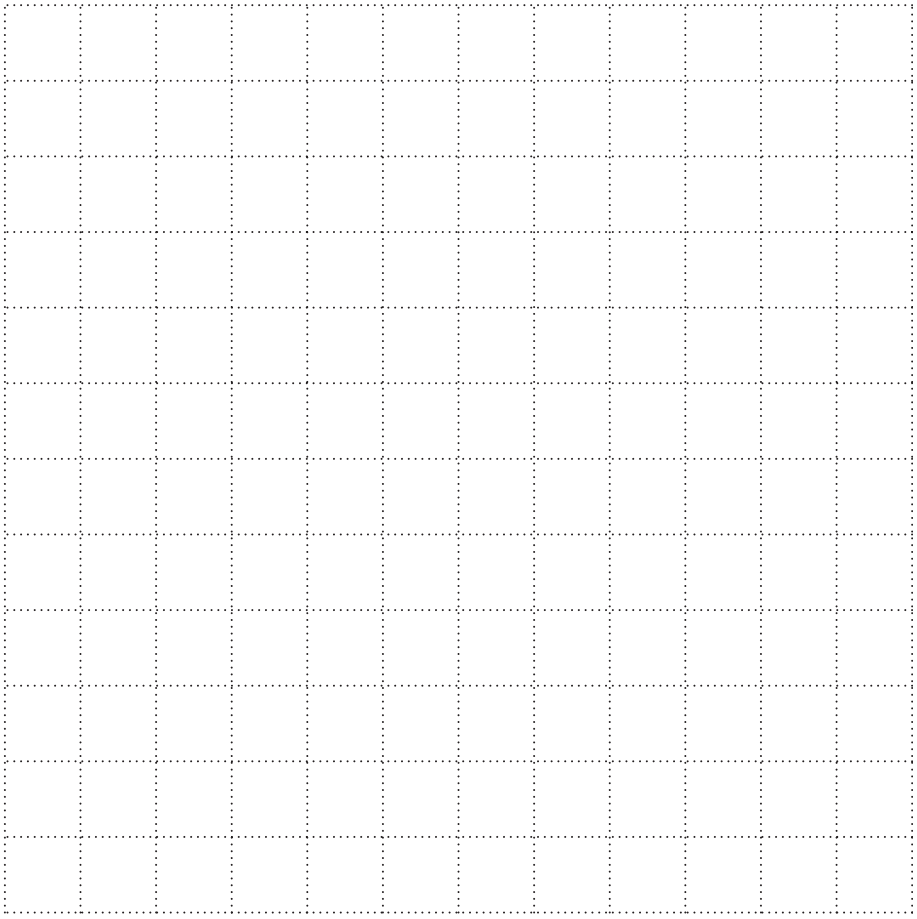
(a) _____ **[3]**

(b) On the centimetre grid, draw the side elevation of the shop (the view from **S**). Use a scale of 2 cm for 1 m.



[2]

(c) Use your drawing in part **(b)** to find the width of the roof, *x*.

(c) _____ m **[1]**

6 **(a)** Simplify.

$$2xy - 3xy + 4xy$$

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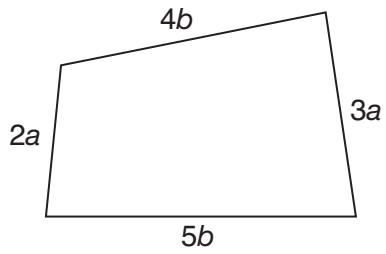
(a) _____ **[1]**

(b) Find an expression for the perimeter of this shape.
Give your answer as simply as possible in terms of a and b.



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(b) _____ **[2]**

(c) Multiply out and simplify.

$$3(2x + 5) + 2(4x - 1)$$

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(c) _____ **[2]**

7 **Estimate** the answer to this calculation.

$$\frac{112 \times 5.8}{0.47}$$

Show clearly the values you use.

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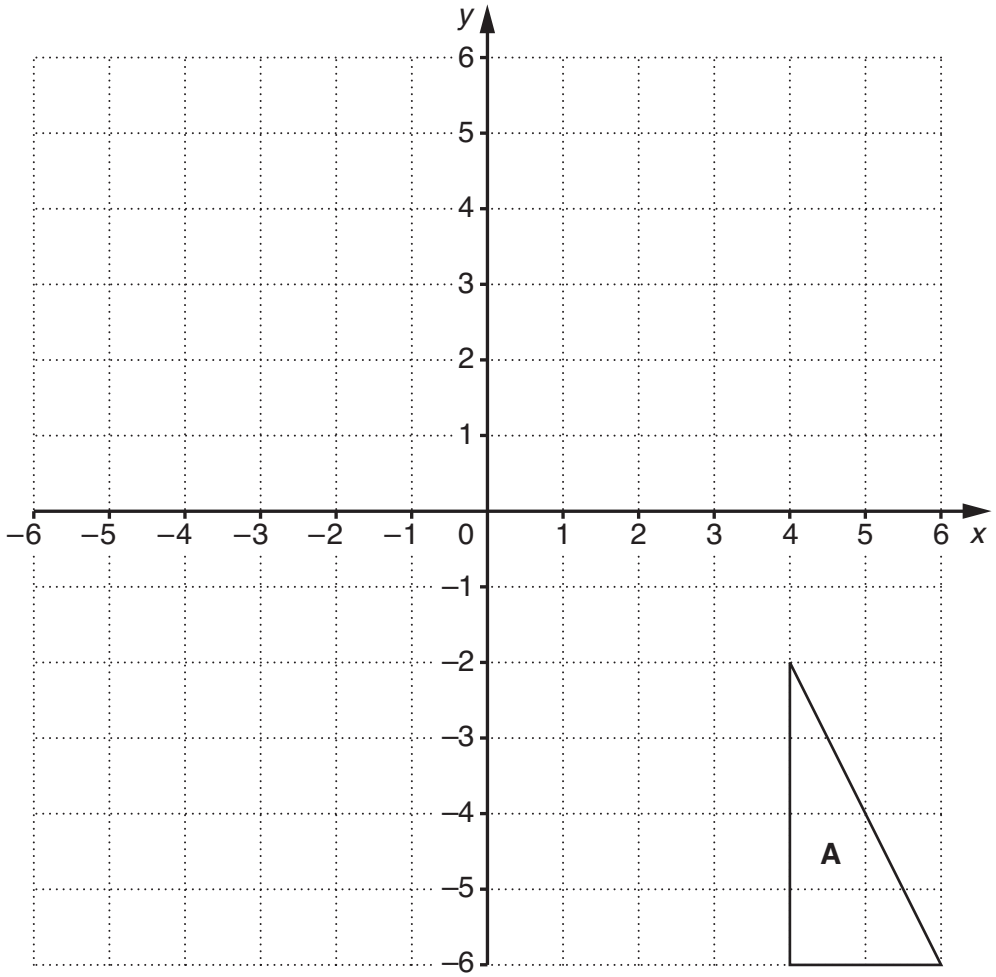
_____ **[2]**

8



(a) Translate triangle **A** by $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$.

Label the image **P**. **[2]**

(b) Enlarge triangle **A** by scale factor $\frac{1}{2}$ using centre (0, 0).

Label the image **Q**. **[2]**

9 **(a)** Show that the equation $x^3 - 10x + 7 = 0$ has a solution between 2 and 3.

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_____ **[3]**

(b) Solve.

$$3(2x - 1) > 12$$

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(b) _____ **[3]**

10 **(a)** Write each of the following in standard form.

(i) 455 000

(a)(i) _____ **[1]**

(ii) 0.000 038

(ii) _____ **[1]**

(iii) 29×10^8

(iii) _____ **[1]**

(b) Work out.

$$\frac{8 \times 10^{12}}{2 \times 10^3}$$

Give your answer in standard form.

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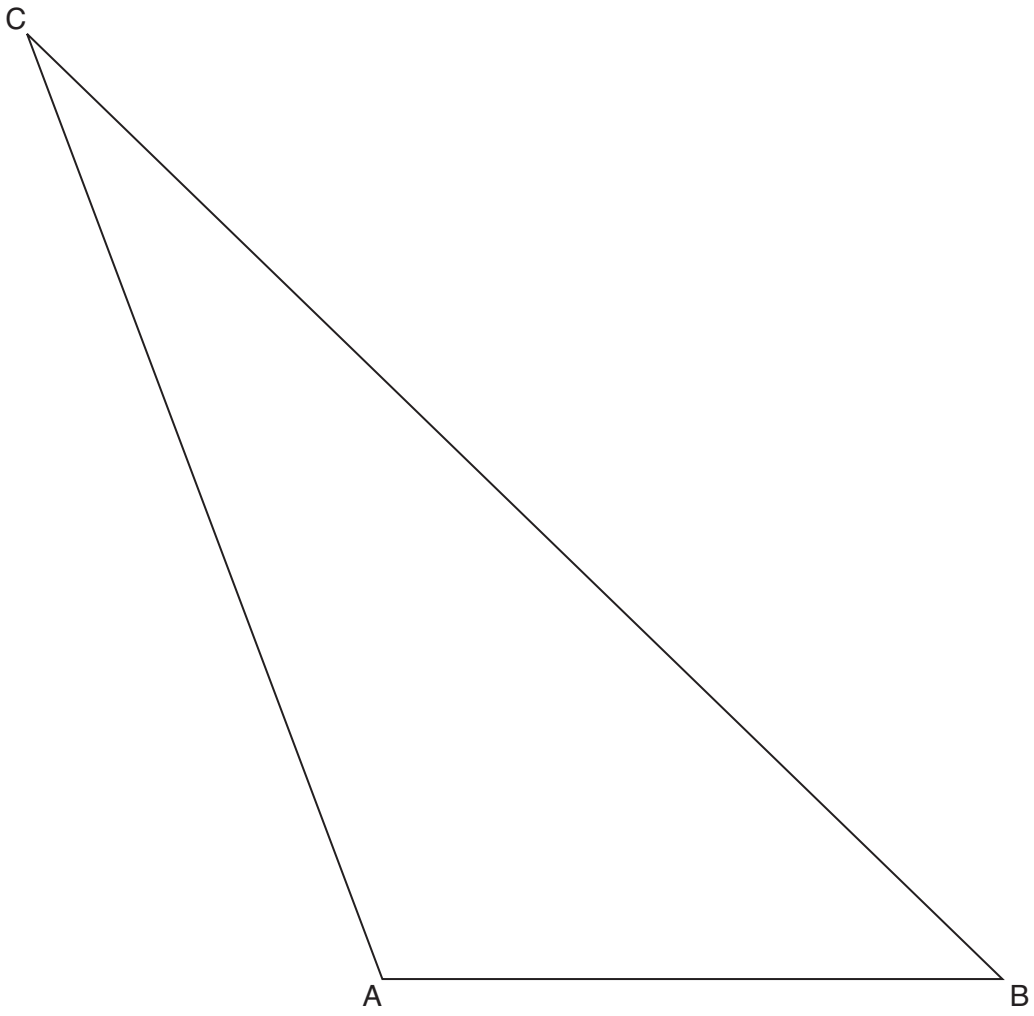
(b) _____ **[2]**

11 *Use ruler and compasses for your constructions in this question.*
Leave in your construction lines.

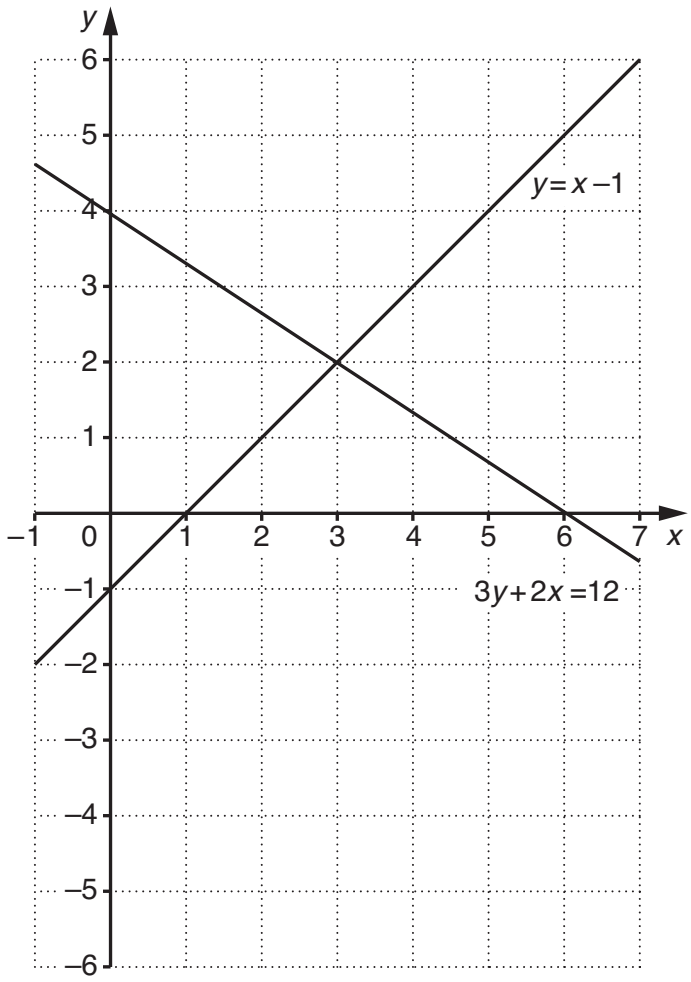
Find and indicate clearly the points which satisfy both of these conditions:

- they are the same distance from BA and BC;
- they are 3.5 cm from A.



[5]

12



(a) Use the diagram to solve these simultaneous equations.

$$3y + 2x = 12$$
$$y = x - 1$$

(a) $x =$ _____ $y =$ _____ **[1]**

(b) By drawing another straight line on the diagram, solve these simultaneous equations.

$$y = x - 1$$
$$y = 2x - 5$$

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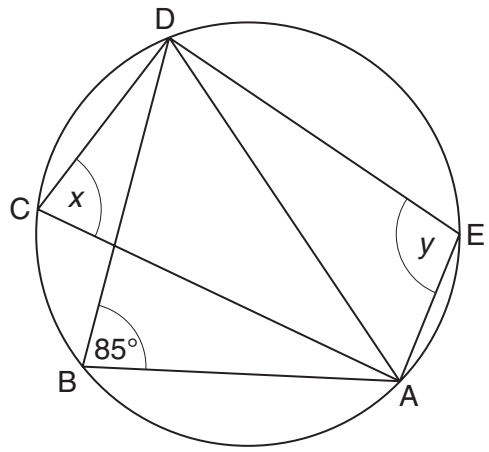
(b) $x =$ _____ $y =$ _____ **[3]**

13 A, B, C, D and E are points on the circumference of a circle.
Angle ABD = 85°.



NOT TO SCALE

(a) Explain why AD is **not** a diameter of the circle.

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_____ **[1]**

(b) Find angle *x*.
Give a reason for your answer.

x = _____ ° because _____

_____ **[2]**

(c) Work out angle *y*.
Give a reason for your answer.

y = _____ ° because _____

_____ **[2]**

14 A shopkeeper recorded the amount of money spent by each of 100 customers.
This table summarises the data.

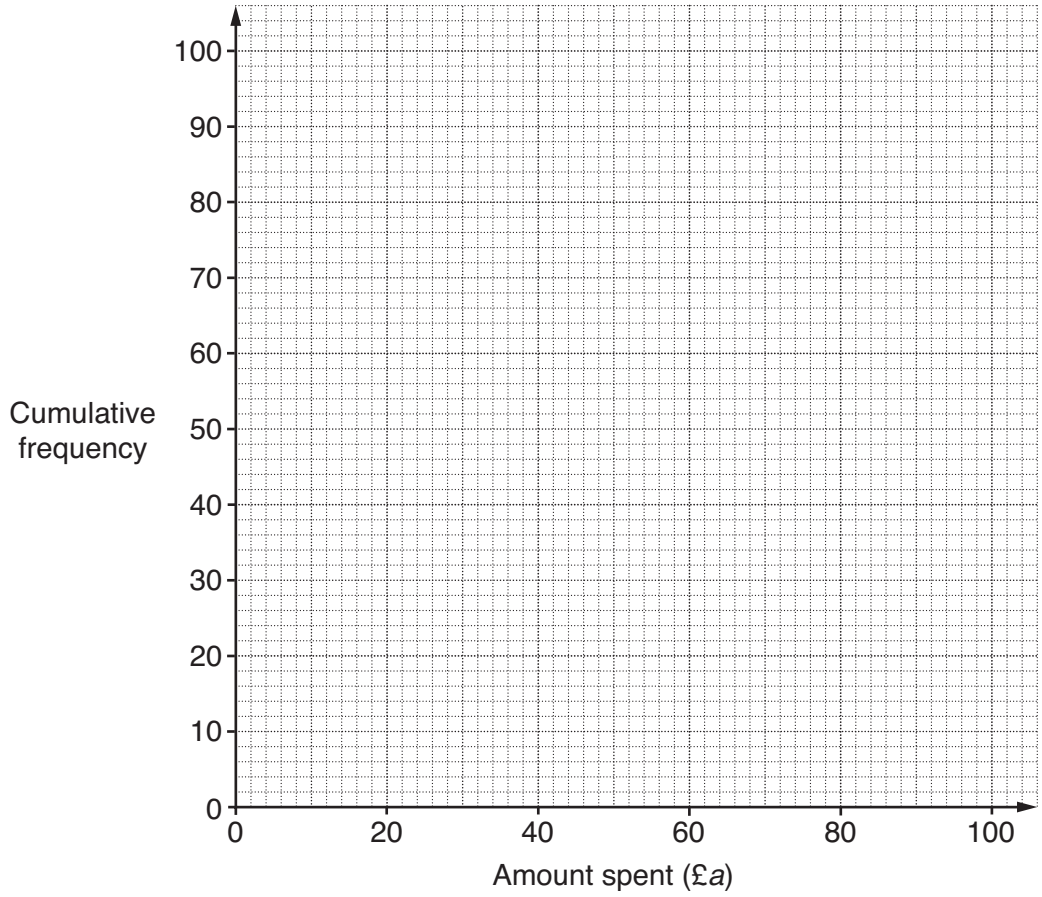
Amount spent (£a)	$0 < a \leqslant 20$	$20 < a \leqslant 40$	$40 < a \leqslant 60$	$60 < a \leqslant 80$	$80 < a \leqslant 100$
Number of customers (frequency)	34	25	10	19	12

(a) Complete the cumulative frequency table.

Amount spent (£a)	$a \leqslant 20$	$a \leqslant 40$	$a \leqslant 60$	$a \leqslant 80$	$a \leqslant 100$
Cumulative frequency	34				100

[1]

(b) On this grid, draw a cumulative frequency graph for these data.



[3]

(c) Use your graph to find the median amount spent.

(c) £ _____ **[1]**

15 (a) (i) Factorise.

$x^2 + 7x + 12$

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(a)(i) _____ **[2]**

(ii) Hence, solve this equation.

$x^2 + 7x + 12 = 0$

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(ii) _____ **[1]**

(b) Factorise.

$x^2 - 4y^2$

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(b) _____ **[2]**

(c) Expand and simplify.

$(3x + 2)(2x - 5)$

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(c) _____ **[3]**

16 Simplify.

(a) $\sqrt{2} \times \sqrt{50}$

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(a) _____ **[2]**

(b) $\sqrt{2} + \sqrt{50}$

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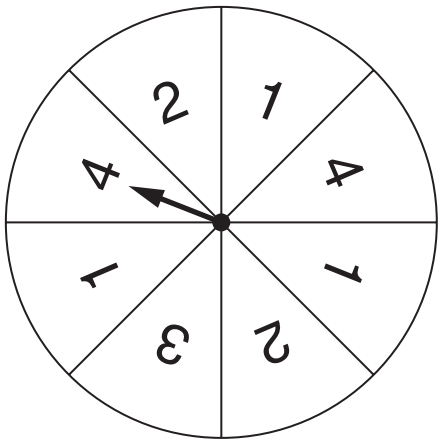
(b) _____ **[2]**

17 The diagram shows a fair spinner with numbers as shown.



Work out the probability of getting exactly one 4 in two spins.

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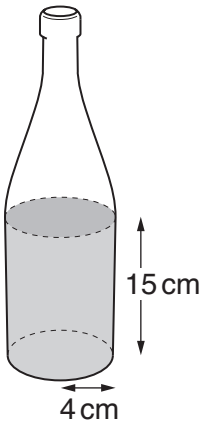
_____ **[3]**

18 The hemispherical bowl of a small glass has internal radius 3 cm.

The lower part of a bottle is a cylinder of internal radius 4 cm.
It contains fruit juice to a depth of 15 cm.



How many of these glasses can be completely filled using all the fruit juice in this bottle?
Leave π in your calculations.

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_____ **[5]**

19 In an experiment, the temperature of a liquid is measured as it cools.
This is the formula that gives the temperature, T °C, of the liquid m minutes after the start of the experiment.

$$T = 60 \times 2^{-m} + 25$$

(a) Work out the temperature of the liquid at the start of the experiment.

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(a) _____ °C **[2]**

(b) Work out the temperature of the liquid 2 minutes after the start of the experiment.

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(b) _____ °C **[2]**

20 Solve algebraically these simultaneous equations.

$$3x + 2y = 7$$
$$y = x^2 - 2x + 3$$

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_____ **[7]**

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