WJEC CBAC

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 20 January 2014

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **5**(a).

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	9	
2.	6	
3.	3	
4.	4	
5.	7	
6.	2	
7.	3	
8.	5	
9.	5	
10.	4	
11.	5	
12.	4	
13.	4	
14.	6	
15.	8	
16.	4	
17.	4	
18.	7	
Total	90	

Formula List

Area of trapezium $= \frac{1}{2}(a + b)h$
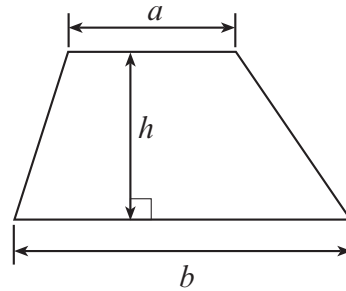
Volume of prism = area of cross-section × length
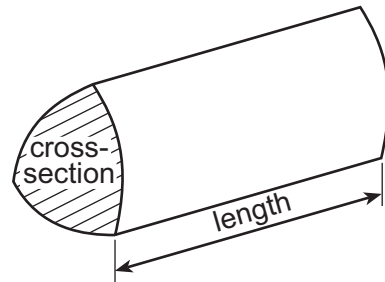
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
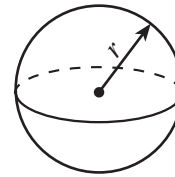
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$
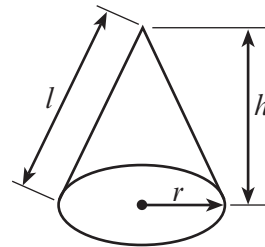
In any triangle ABC

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

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

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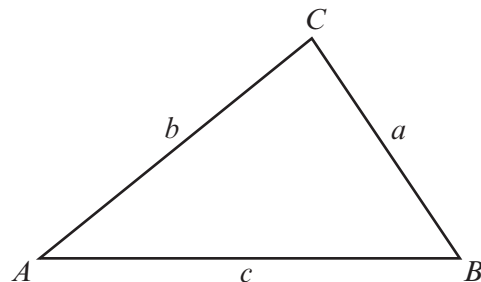
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

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

1. *(a)* Factorise $12y + 20y^2$. [2]

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(b) Given that $x = 20$, $y = -3$ and $z = 5$, evaluate $3x + y^2z$. [2]

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(c) Solve the equation $\dfrac{4x}{5} = 20$. [2]

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(d) Solve the equation $6x - 19 = 2x + 12$. [3]

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2. The table shows the engine sizes of six cars and the distance they each travel per litre of petrol.

Engine size, in litres	1·0	2·2	1·4	2·0	2·5	1·7
Distance travelled per litre, in km	12·0	7·4	10·6	7·6	5·8	8·2

(a) Draw a scatter diagram to display this data. [2]

Distance travelled per litre, in km
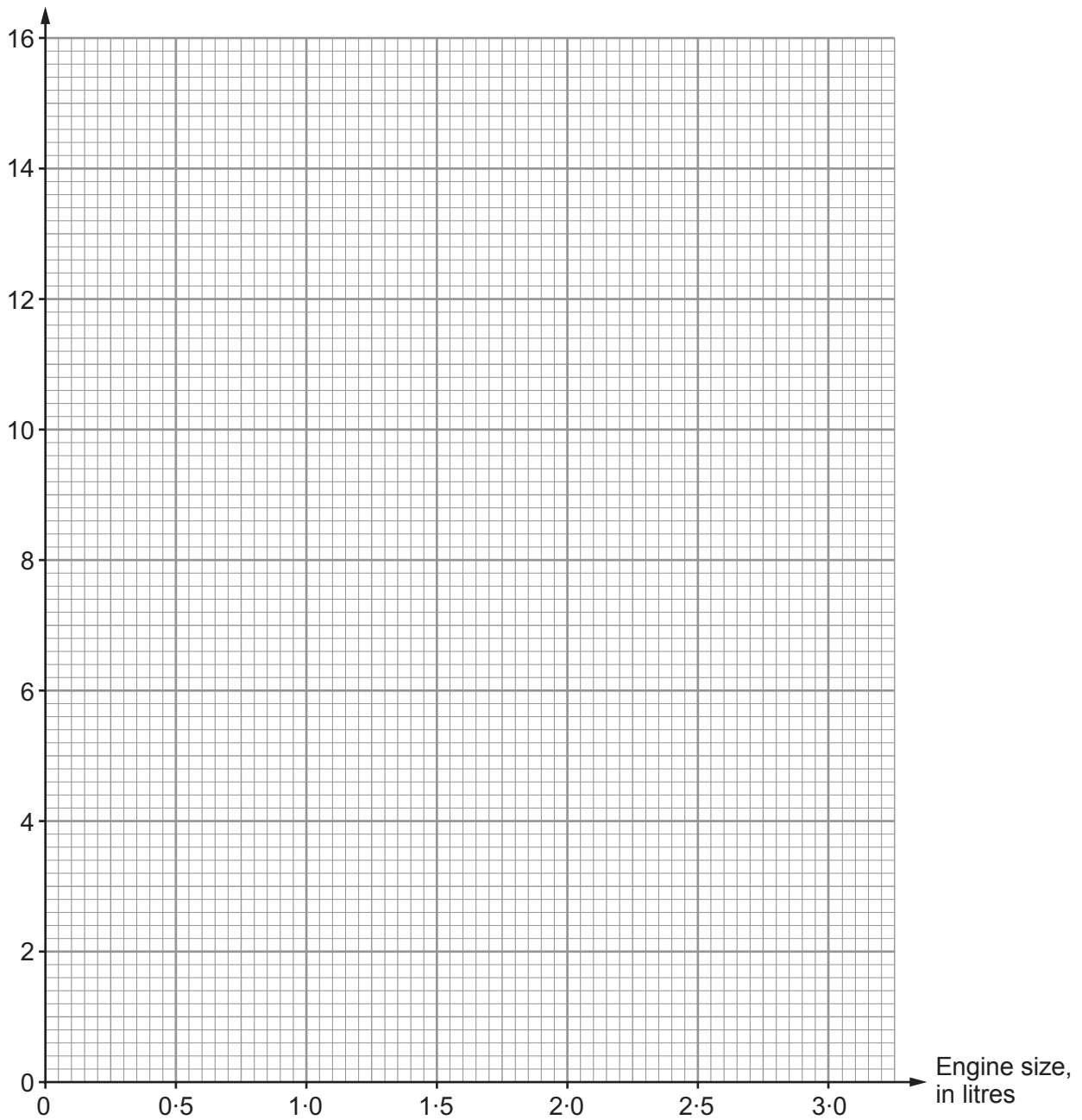
(b) Describe the relationship between engine size and distance travelled per litre shown by your scatter diagram. [1]

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(c) The mean engine size of the six cars is 1·8 litres.
The mean distance travelled per litre of petrol is 8·6 km.
Draw a line of best fit on your scatter diagram. [2]

(d) Another car has an engine of size 1·6 litres.
Use your line of best fit to estimate the distance it would travel per litre of petrol. [1]

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3. A car travels 90 miles in 2 hours 30 minutes. Calculate the average speed of the car in mph. [3]

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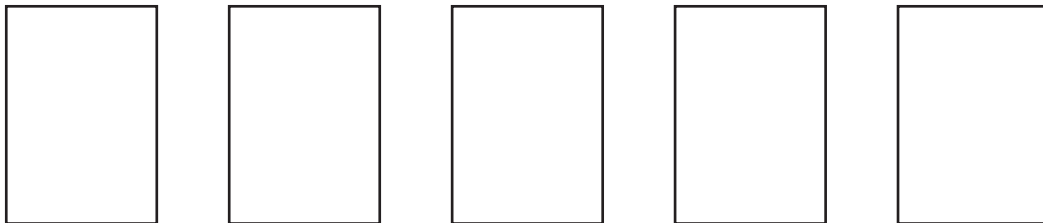
Five **single digit numbers** need to be written on the cards above.
The median, mode, mean and range of the numbers must all be 5.
Write a possible set of **single digit numbers** on the cards, in ascending order. [4]

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5. Alan, Ben and Carwyn are three brothers.
Alan has 3 children, Ben has 2 children and Carwyn has 1 child.

(a) *You will be assessed on the quality of your written communication in this part of the question.*

Alan, Ben and Carwyn's parents win £5700.
They decide to share this money between Alan, Ben and Carwyn, in the ratio of the number of children that they each have.
How much money does each brother receive?
You must show all your working. [5]

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(b) Alan is happy with this suggestion.
Carwyn argues that it is unfair and that the money should be divided equally between the three brothers.
Will this way of sharing the money affect Ben's share? Show your working. [2]

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6. The diagram shows a coin inside a large circular ring.
The centre of the coin is shown.
The coin is rolled around the inside of the ring, so that it is always in contact with the ring.
Sketch the locus of the centre of the coin as it is rolled around the inside of the ring.   [2]

Turn over.
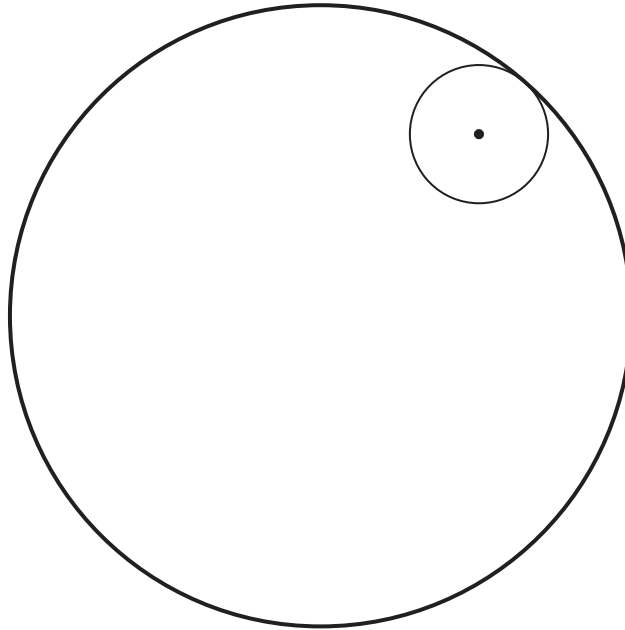
7.
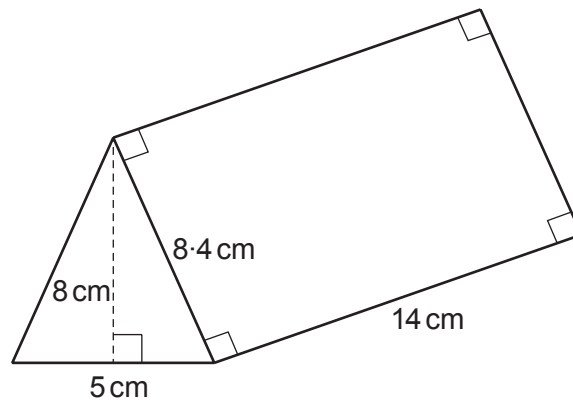
Diagram not drawn to scale

Calculate the volume of the triangular prism shown.
State the units of your answer. [3]

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8. The diagram shows a square drawn inside a regular hexagon.
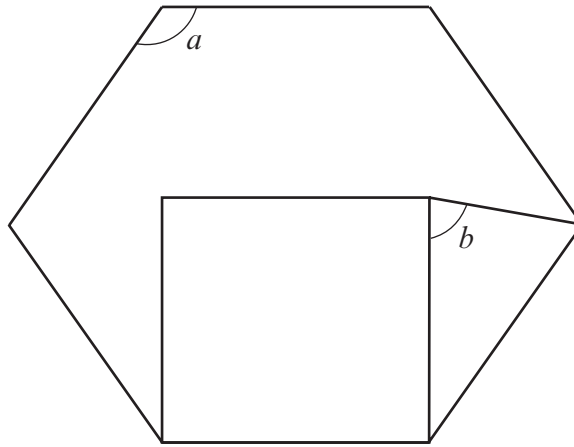
Diagram not drawn to scale

(a) Calculate the size of angle a. [2]

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a = ... °

(b) Calculate the size of angle b. [3]

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b = ... °

9. The length of the rectangle below is 2 cm longer than the width.
The area of the rectangle is 70 cm^2.
Use the method of trial and improvement to find the width, correct to 1 decimal place.   [5]

Diagram not drawn to scale

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10. The diagram shows two similar triangles *ABC* and *LMN*.
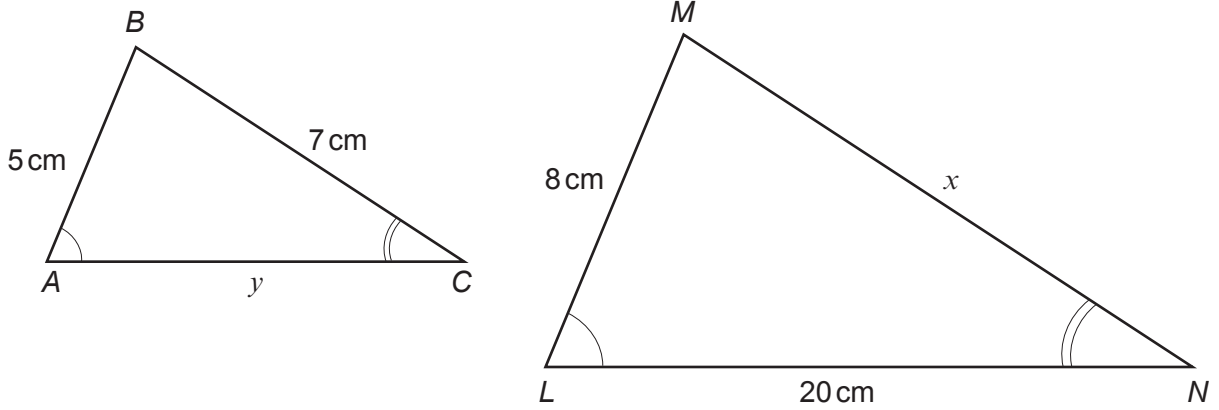
Diagrams not drawn to scale

(a)   Calculate the length x.   [2]

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(b)   Calculate the length y.   [2]

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11. *(a)* Find the value of $(2 \times 10^{-2}) + (3 \times 10^{-1})$. Give your answer in standard form. [2]

(b) Siwan runs a 20 km race. Her average stride length for the race is 125 cm. Calculate the number of strides Siwan takes to run the 20 km race. Give your answer in standard form. [3]

12. A ship sails 80 km due south from a port *P* to a point *Q*. It then sails 45 km due west to a point *R*.
The diagram below shows the journey of the ship.
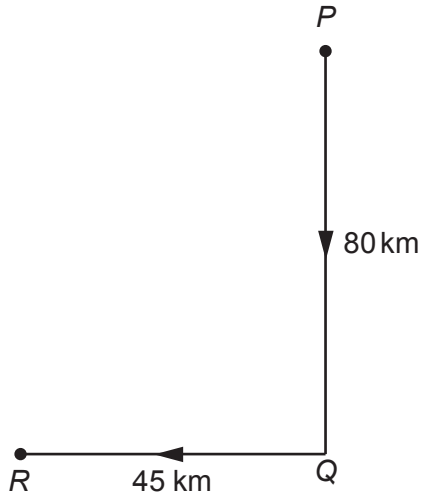
Diagram not drawn to scale

On what bearing does the ship now need to sail to travel directly back to port *P*? [4]

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13. Two cricketers, Sunil and Kevin, keep a record of their batting scores over a season. The cumulative frequency diagram below shows their batting scores over this season.

Cumulative frequency
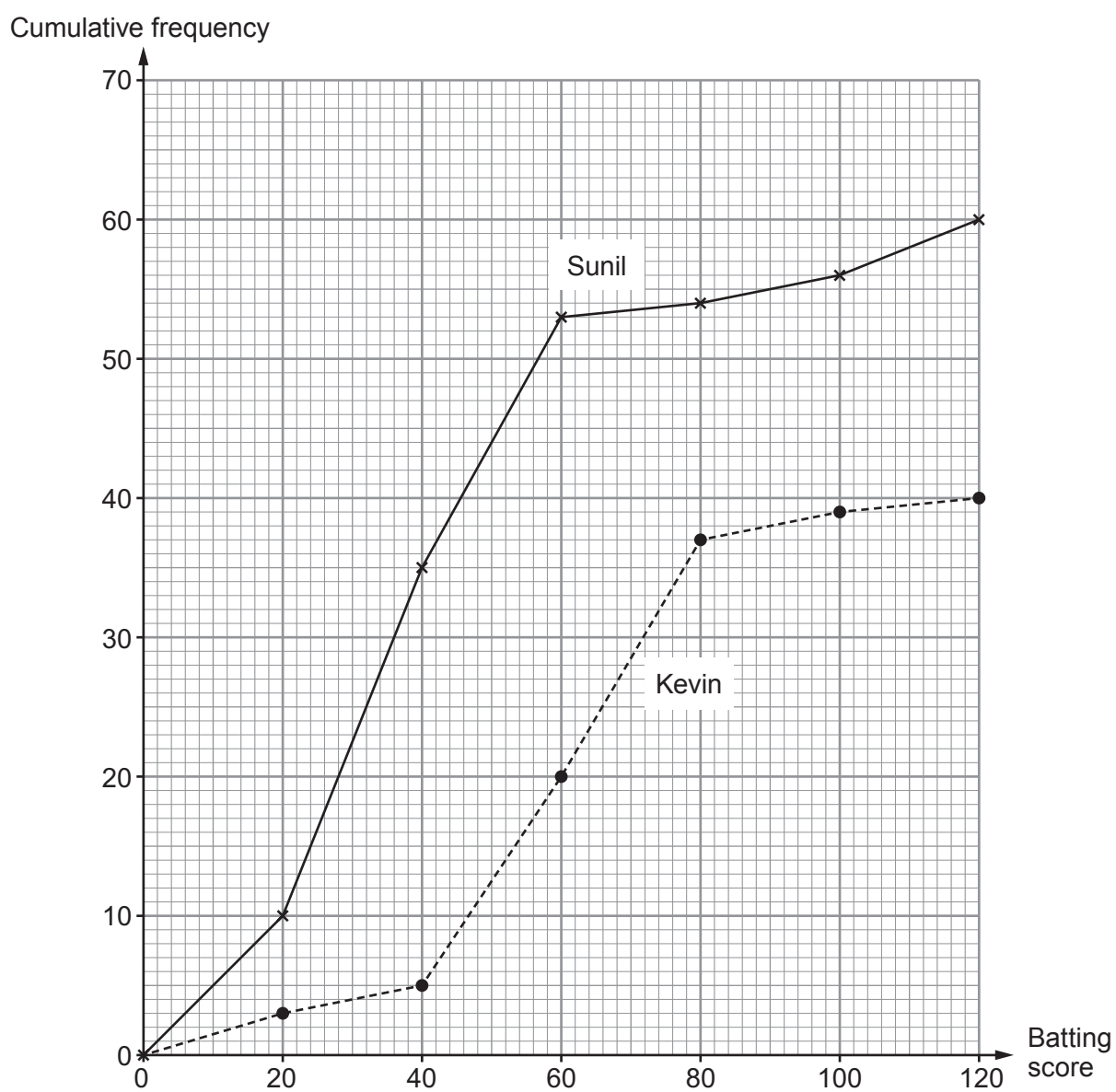
(a) Find the interquartile range for Sunil. [2]

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(b) Who has the higher average batting score, Sunil or Kevin? Give a reason for your answer. [2]

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14. When a ball is dropped, the distance it drops, d, is directly proportional to the square of its time of flight, t.
It is found that a ball takes 1 second to drop 4·9 metres.

(a) Find an expression for d in terms of t. [3]

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(b) Complete the following table. [3]

Distance, d, in metres	4·9		28·2
Time of flight, t, in seconds	1	2	

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15. *(a)* (i) Show that $(x + 2)^2 + 3(x + 1) - 11$ can be simplified to $x^2 + 7x - 4$. [2]

(ii) Solve the equation $x^2 + 7x - 4 = 0$, giving your answers correct to 2 decimal places. [3]

(b) Factorise the expression $5x^2 + 22x - 15$ and hence solve the equation $5x^2 + 22x - 15 = 0$. [3]

16. *(a)* On the axes below, sketch the graph of $y = \cos x$, for values of x from 0° to 360°. [2]

y

1

0

180°

360°

x

−1
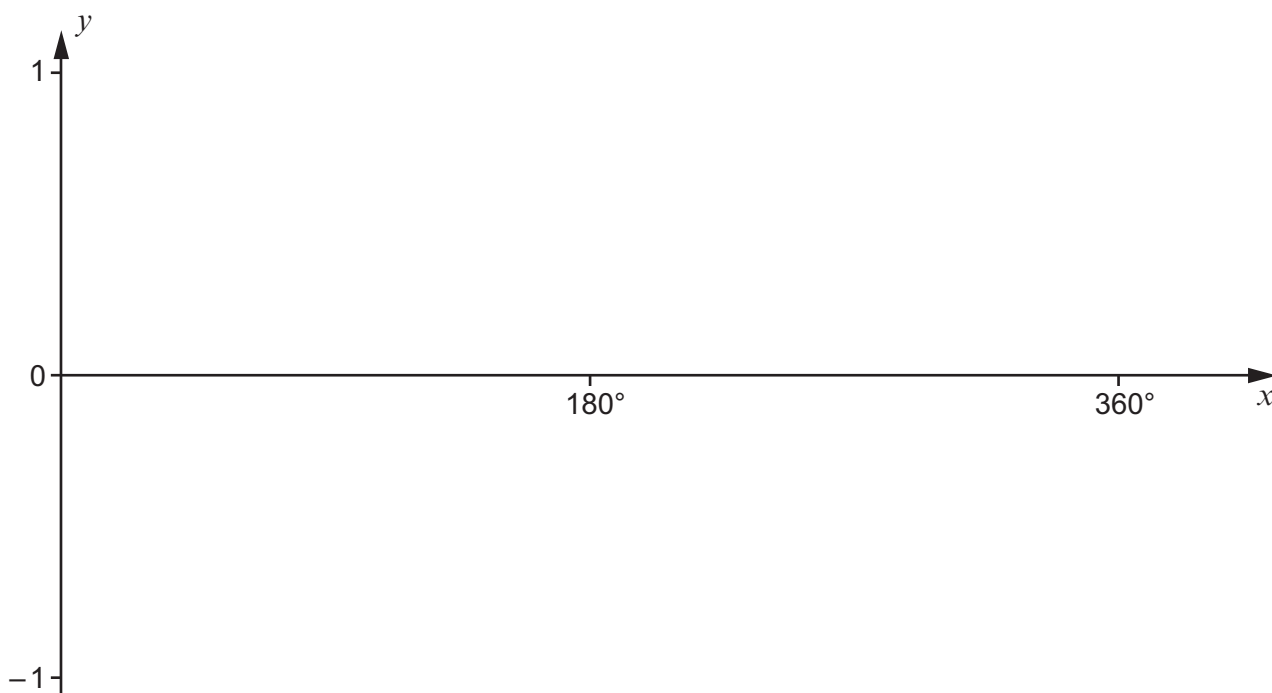
(b) Find all the solutions of the following equation in the range 0° to 360°. [2]

$$\cos x = -0 \cdot 4$$

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17. The histogram below shows the ages of the people staying in a hotel one weekend.

Frequency density
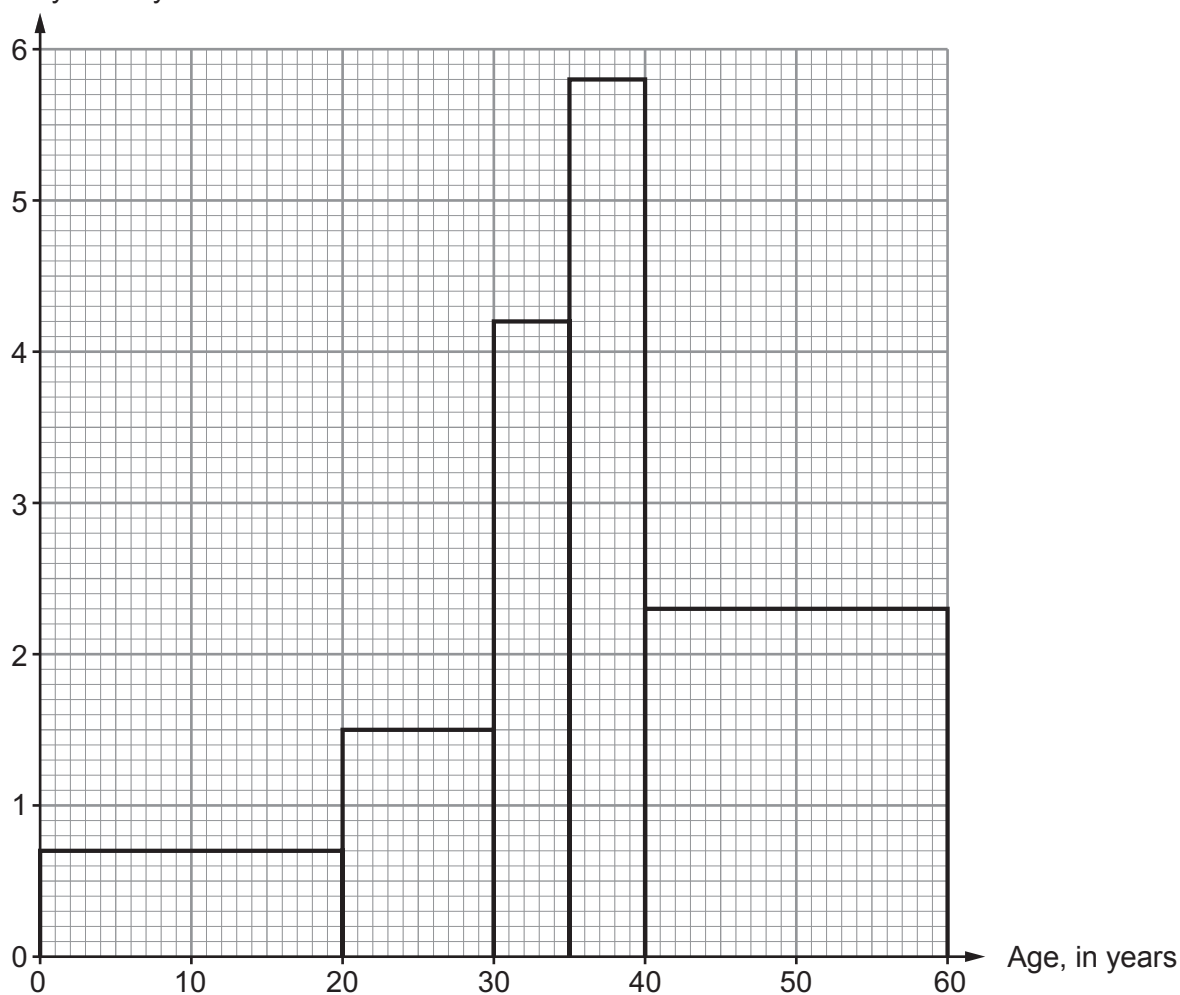
Age, in years

(a) Use the histogram to complete the grouped frequency table below. [2]

Age in years	$0 \leqslant a < 20$	$20 \leqslant a < 30$	$30 \leqslant a < 35$	$35 \leqslant a < 40$	$40 \leqslant a < 60$
Frequency					

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(b) Calculate an estimate of the number of people whose ages are less than 24 years old. [2]

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18.

B

75°

9·9 cm

D

7·2 cm

4·9 cm

24°

A

C

Diagram not drawn to scale

Calculate the area of the quadrilateral *ABCD*.   [7]

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END OF PAPER