Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

MATHEMATICS (UNITISED SCHEME)

UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 11 November 2013

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 **6**.

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

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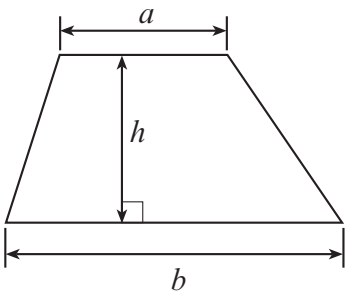
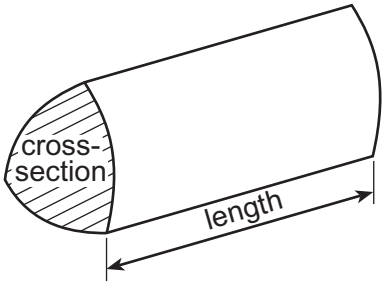
Formula List

Area of trapezium = $\frac{1}{2}(a + b)h$

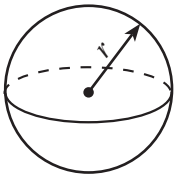


Volume of prism = area of cross-section × length



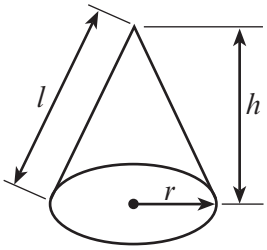
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl

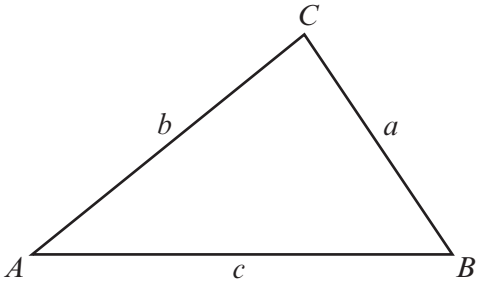


In any triangle ABC

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 = $\frac{1}{2}ab\sin C$



The Quadratic Equation

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

where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Examiner only

1. *(a)* Factorise $x^2 - 6x$. [1]

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(b) Solve $7x + 13 = 3x + 5$. [3]

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Turn over.

Examiner only

2. A sportswear manufacturer has designed a logo to go on all its clothing.
The design of the logo is shown below.

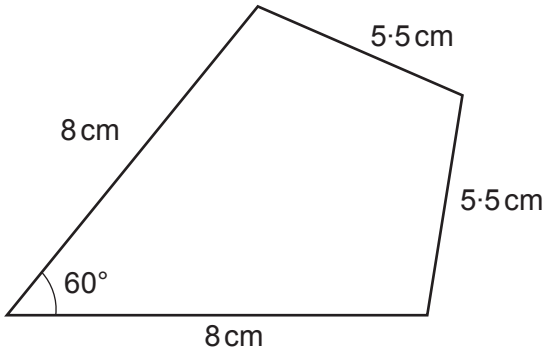

Diagram not drawn to scale

Using a ruler and a pair of compasses, construct an accurate diagram of the logo.
You must show all your construction lines.
One line has already been drawn for you. [4]

8 cm

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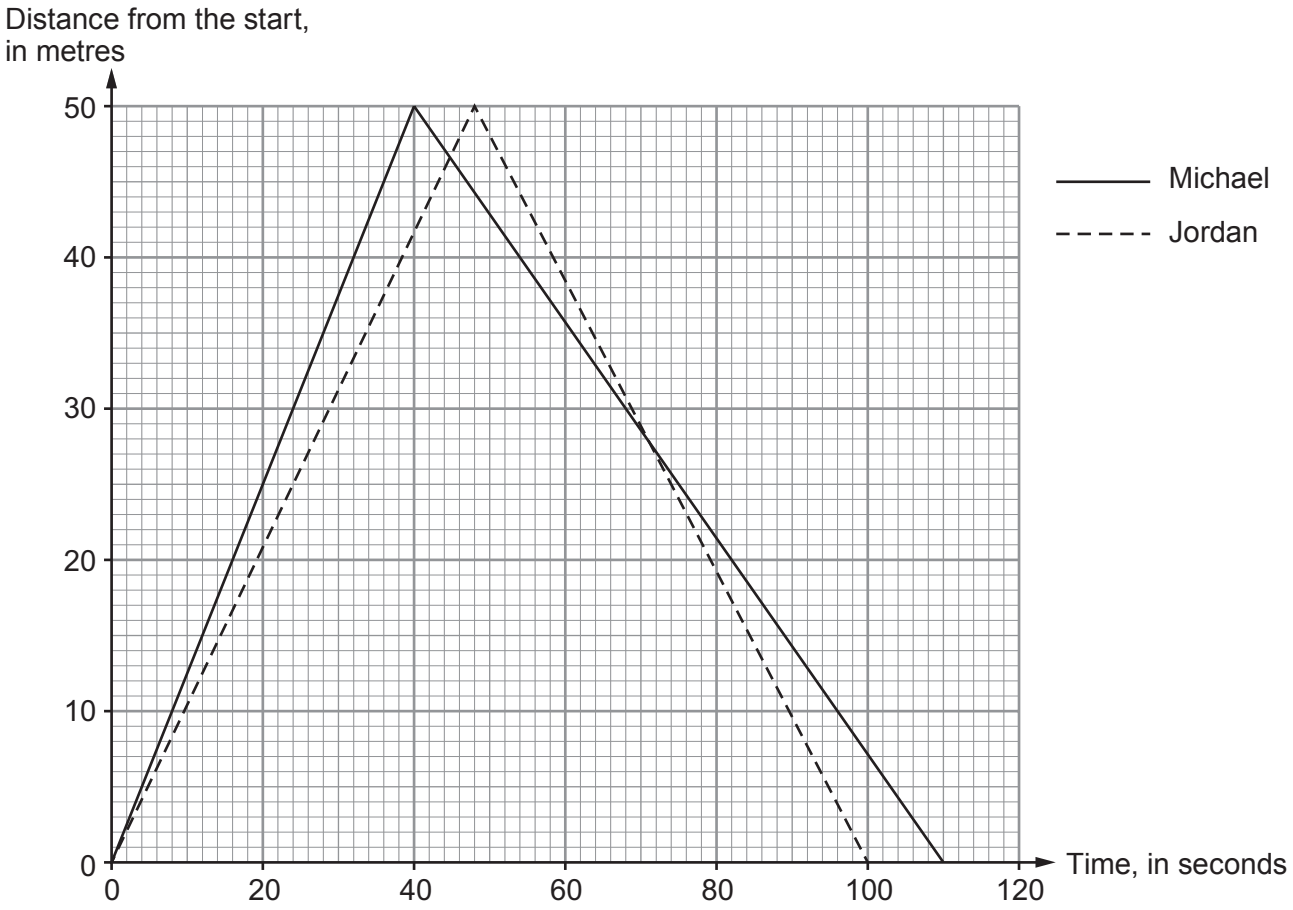
3. Two swimmers, Michael and Jordan, have a race over two lengths of a swimming pool. The travel graph for the race is shown below.



(a) Who was in the lead during the first length of the race? Use the graph to explain your answer. [1]

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(b) What was Michael's average speed for the first length of the race? Give the units of your answer. [3]

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(c) For what length of time were Michael and Jordan swimming in opposite directions? [1]

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Examiner only

4. Anil wants to paint the outside of his house.
The diagram shows one of the sides of Anil's house.
The width of this side is 7 m and the vertical height is 9·5 m.

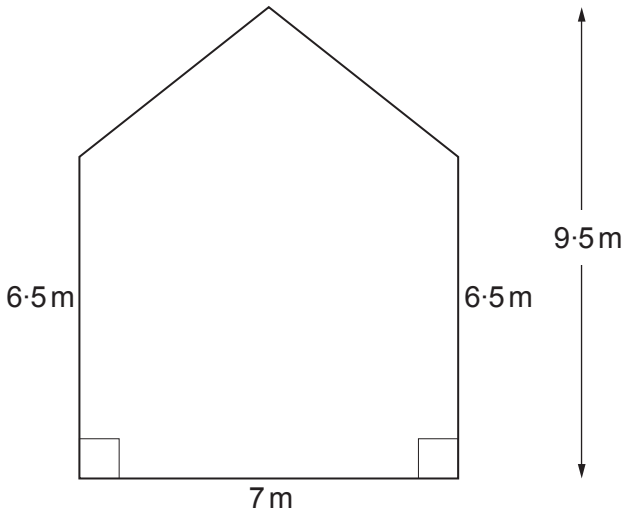

Diagram not drawn to scale

(a) Calculate the area of this side of Anil's house. [3]

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(b) A tin of paint covers an area of 15 m^2.
How many tins of paint does Anil need to buy in order to paint this side of his house? [2]

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Examiner only

5. Ffion's Pizzeria serves two sizes of circular pizza of the same thickness.

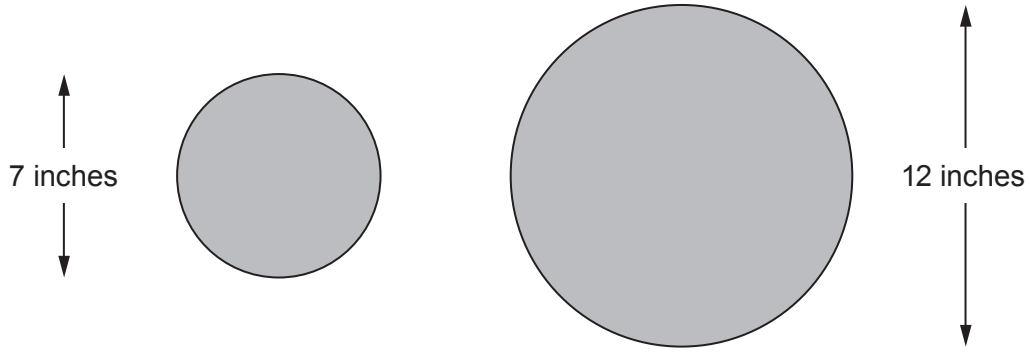

Diagram not drawn to scale

The small pizza has a diameter of 7 inches and costs £4.
The large pizza has a diameter of 12 inches and costs £10.

(a) Calculate the area of the top of the large pizza. [2]

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(b) By considering the area of the top of each pizza, decide which pizza is the better value for money. [4]

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Turn over.

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6. *You will be assessed on the quality of your written communication in this question.*

A steel manufacturer makes high quality stainless steel by mixing composite steel, chromium and nickel in the ratio 7 : 2 : 1.
The costs of the materials are shown in the table below.

Material	Cost per kg
Composite steel	50p
Chromium	£1.90
Nickel	£12.70

Calculate the total cost of the materials needed to make 500 kg of high quality stainless steel.
You must show all your working. [7]

Examiner only

7. A solution to the equation $x^3 + 3x = 90$ lies between 4 and 5.
Use the method of trial and improvement to find this solution correct to 1 decimal place. [4]

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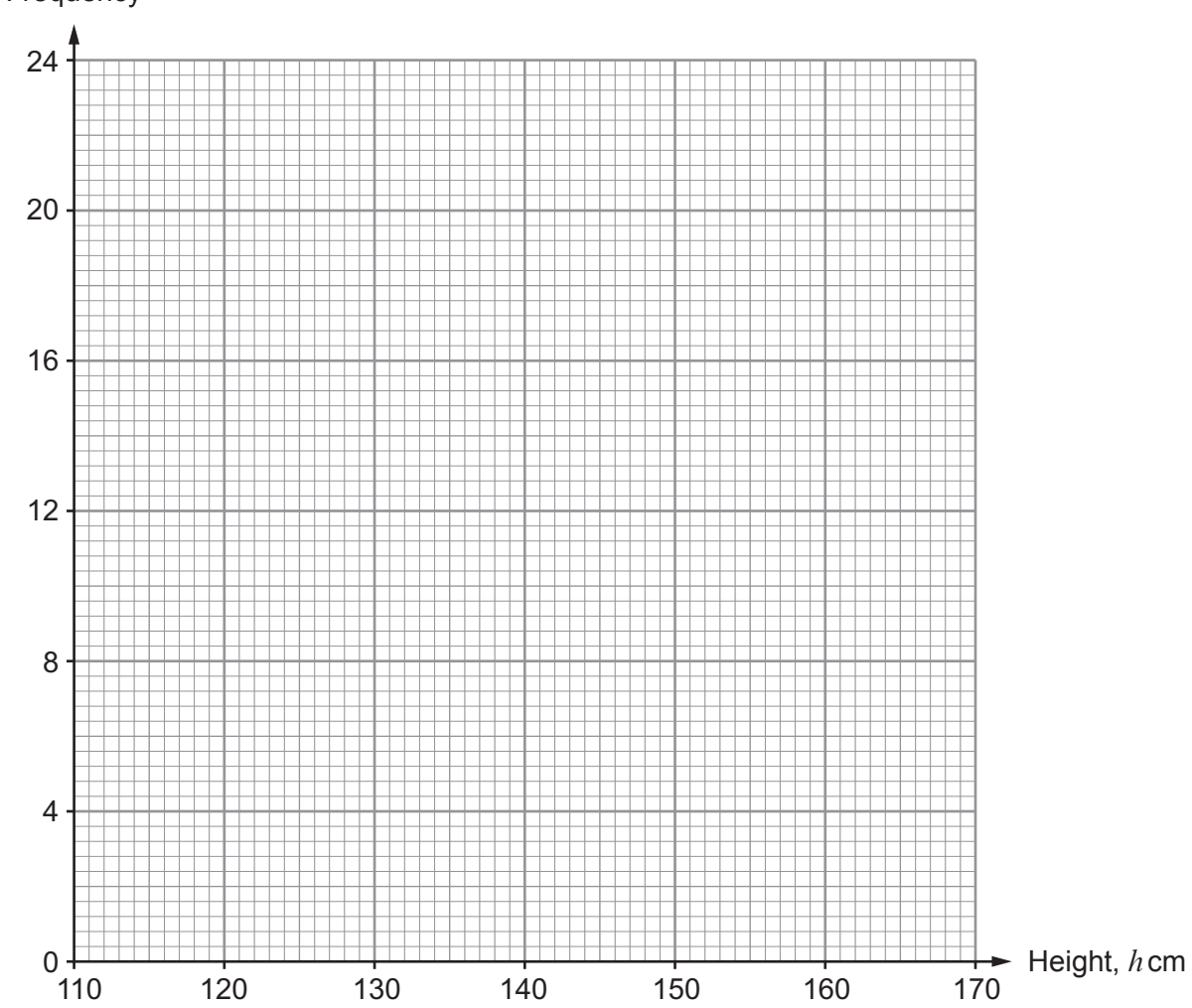
Turn over.

Examiner only

8. The heights, in centimetres, of 55 children are shown in the grouped frequency table below.

Height, h cm	Frequency
$120 < h \leqslant 130$	2
$130 < h \leqslant 140$	8
$140 < h \leqslant 150$	13
$150 < h \leqslant 160$	22
$160 < h \leqslant 170$	10

(a) Draw a frequency polygon for the heights of the children. [2]



Examiner only

(b) Calculate an estimate of the mean height of the children. [4]

Turn over.

Examiner only

9. *(a)* Find the value of $(2{\cdot}4 \times 10^3) \times (6{\cdot}2 \times 10^5)$.
Give your answer in standard form, to 2 significant figures. [2]

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(b) A stack of 500 sheets of paper has a thickness of 4·8 cm.
Calculate the thickness of 1 sheet of paper in **millimetres**.
Give your answer in standard form. [2]

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10. *(a)* Calculate the length of *AC* in the triangle below. [3]

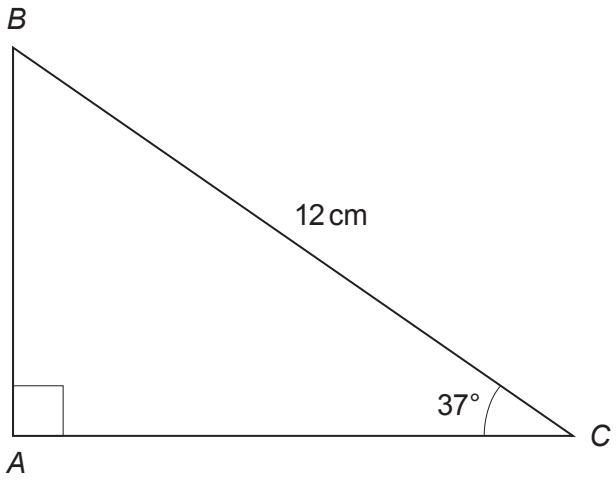

Diagram not drawn to scale

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Examiner only

(b) The diagram below shows a rhombus with diagonals of length 18 cm and 13 cm. The diagonals bisect each other at right angles. [4]

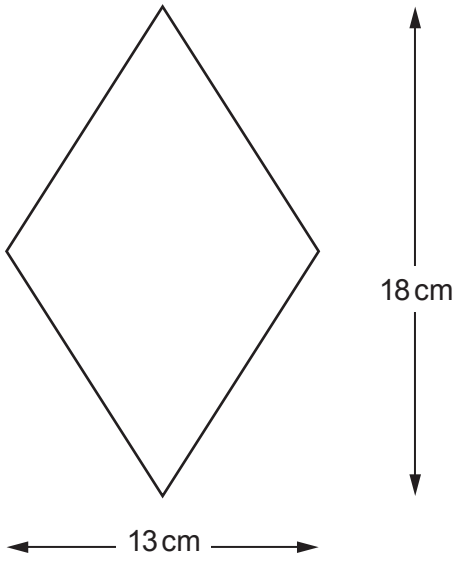

Diagram not drawn to scale

Calculate the perimeter of the rhombus.

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Examiner only

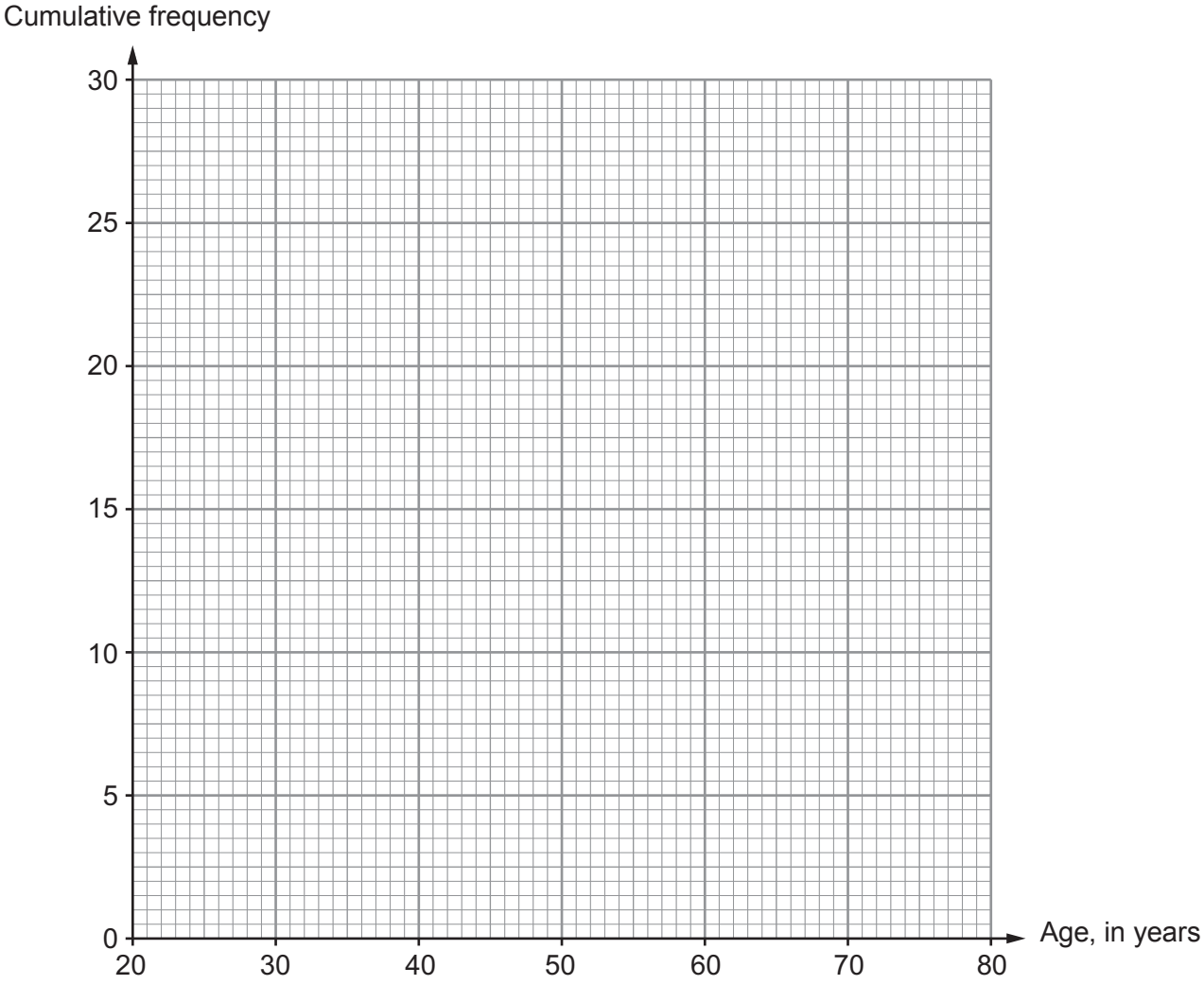
11. A bus company carried out a survey to find out the ages of the passengers travelling on a particular route on a Tuesday.
Here are the results for the 10 a.m. bus.

Age, a years	Frequency
$20 \leqslant a < 30$	4
$30 \leqslant a < 40$	2
$40 \leqslant a < 50$	1
$50 \leqslant a < 60$	4
$60 \leqslant a < 70$	12
$70 \leqslant a < 80$	7

(a) Complete the cumulative frequency table below. [1]

Age, a years	< 20	< 30	< 40	< 50	< 60	< 70	< 80
Cumulative frequency	0						

(b) Draw a cumulative frequency diagram showing the ages of the passengers on the bus. [3]



Examiner only

(c) Use your cumulative frequency diagram to estimate the median and interquartile range of the ages. [3]

Median = ... Interquartile range = ...

(d) The median age for the 4 p.m. bus on the Tuesday was lower than the median age for the 10 a.m. bus.
Give a possible reason for this. [1]

12. Solve the following equation. [4]

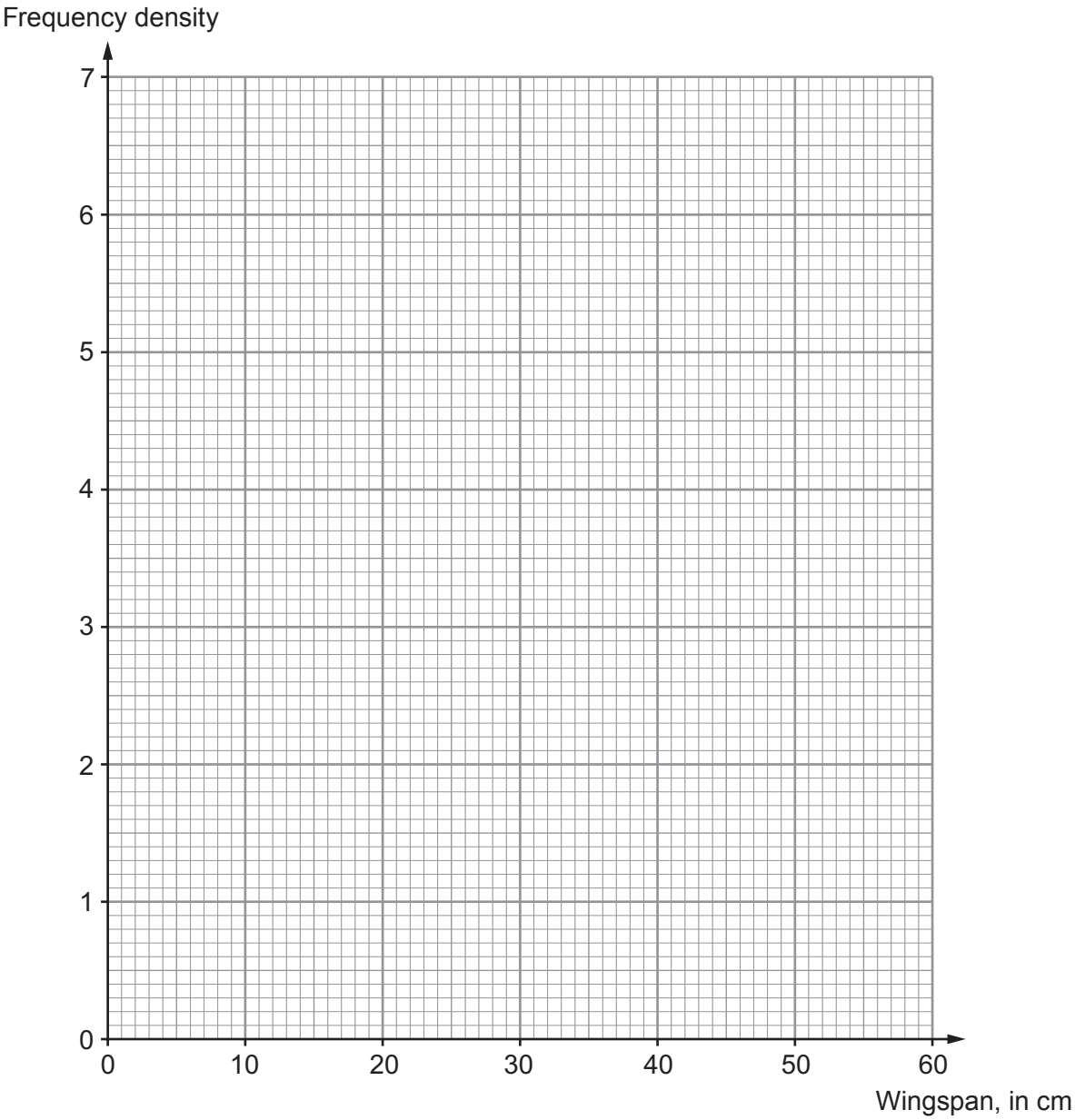
$$\frac{x-1}{2}+\frac{4x-6}{3}=\frac{1}{4}$$

Examiner only

13. *(a)* The table shows the wingspan, in cm, of the birds in a local bird sanctuary.

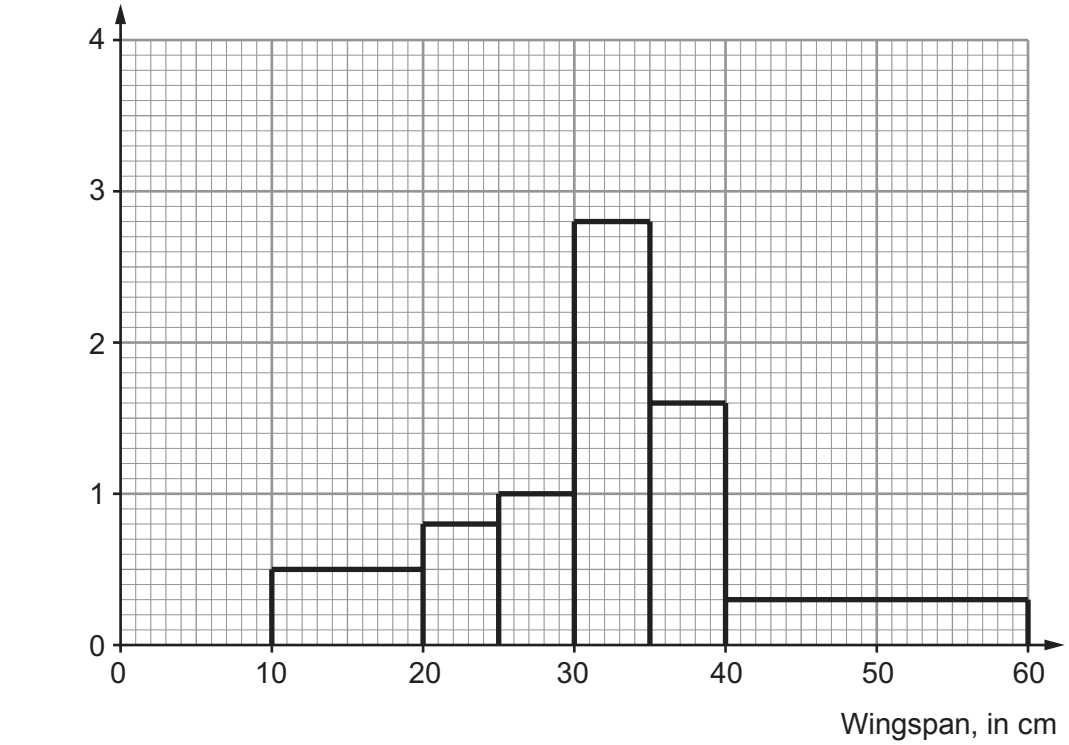
Wingspan, x cm	Frequency	Frequency density
$10 < x \leqslant 20$	18	
$20 < x \leqslant 30$	26	
$30 < x \leqslant 35$	30	
$35 < x \leqslant 45$	22	
$45 < x \leqslant 60$	30	

Complete the frequency density column in the table and draw a histogram for the wingspan of the birds on the graph paper below. [3]



Examiner only

(b) The histogram for the wingspan of the parrots in the sanctuary is shown below.



Use the histogram to calculate an estimate for the median wingspan of the parrots in the sanctuary. [4]

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Examiner only

14. Factorise the expression $3x^2 - 37x + 12$ and hence solve the equation $3x^2 - 37x + 12 = 0$. [3]

Examiner only

15. In the parallelogram *FGHJ*, *FG* = 9·5 cm and $F\hat{G}H$ = 125°.

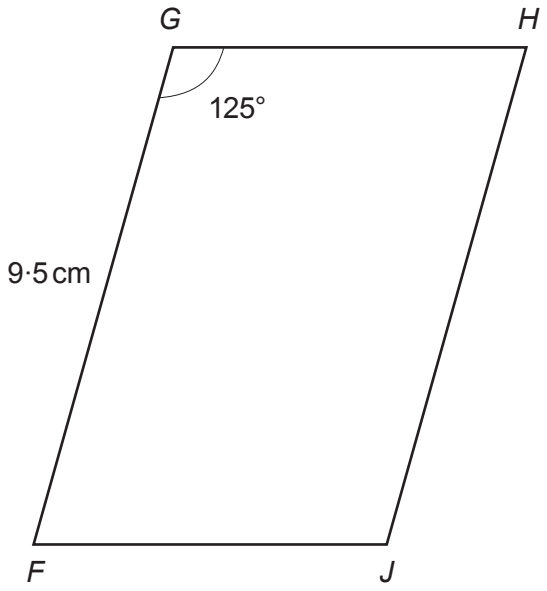

Diagram not drawn to scale

The area of the parallelogram is 36·5 cm^2.
Calculate the length of the diagonal *FH*. [7]

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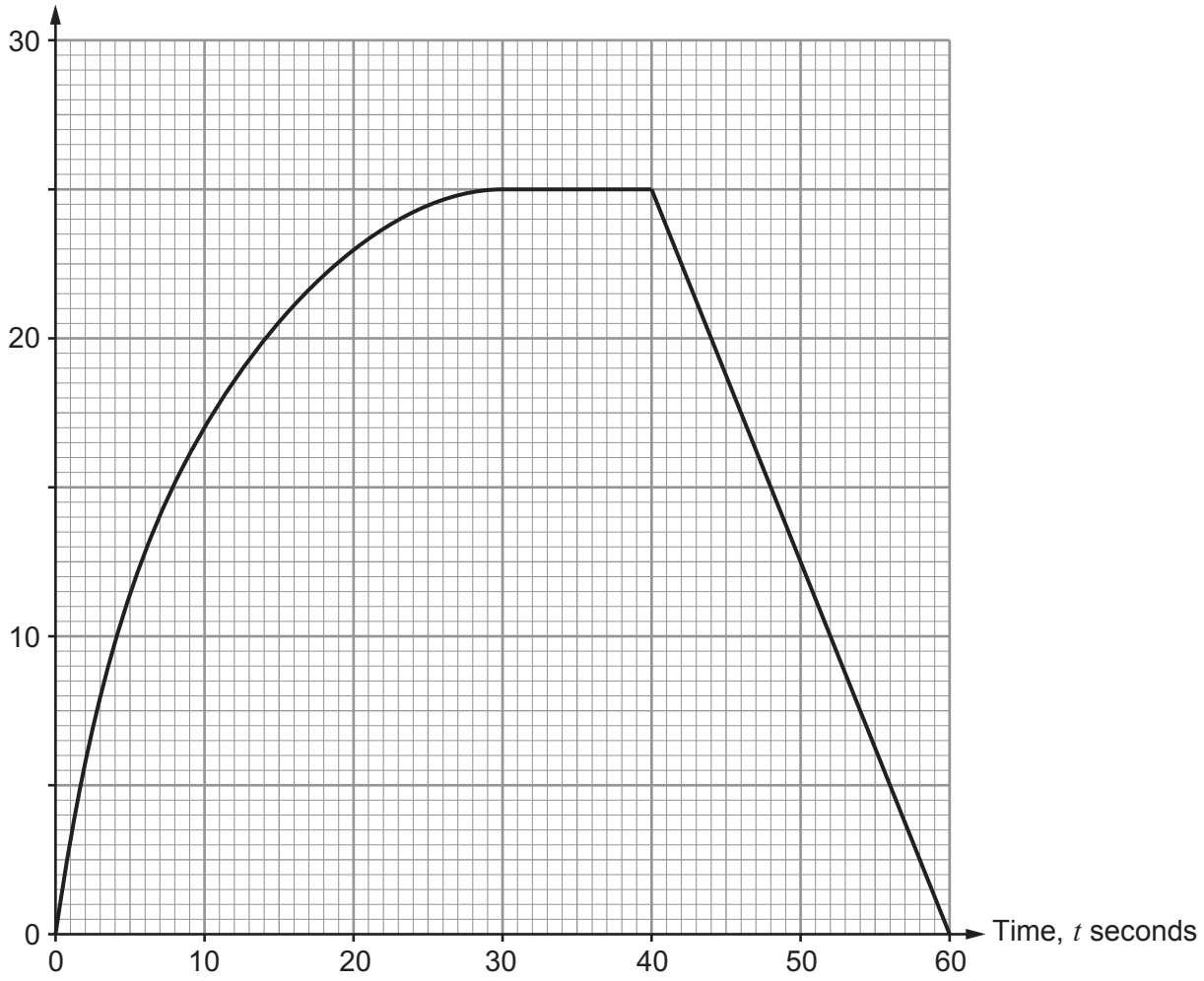
16. A car travels between two sets of traffic lights, starting at time $t = 0$.
The graph shows the velocity of the car in metres per second.



(a) Calculate an estimate for the acceleration of the car when $t = 20$. [3]

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Examiner only

(b) Calculate an estimate of the area bounded by the curve, the time axis and the line $t = 30$. Use the trapezium rule with ordinates $t = 0$, $t = 10$, $t = 20$ and $t = 30$. [3]

(c) Calculate an estimate of the average speed of the car for the entire 60 second journey. [3]

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