Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4353/02

W16-4353-02

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

A.M. MONDAY, 18 January 2016

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**3**	
3.	**4**	
4.	**8**	
5.	**5**	
6.	**3**	
7.	**3**	
8.	**6**	
9.	**5**	
10.	**4**	
11.	**4**	
12.	**6**	
13.	**4**	
14.	**3**	
15.	**8**	
16.	**8**	
17.	**3**	
18.	**3**	
19.	**5**	
Total	**90**	

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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.

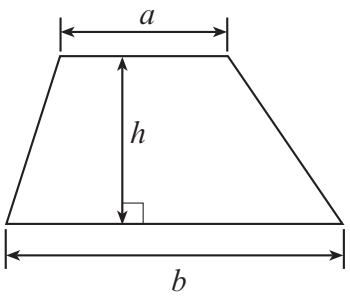
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

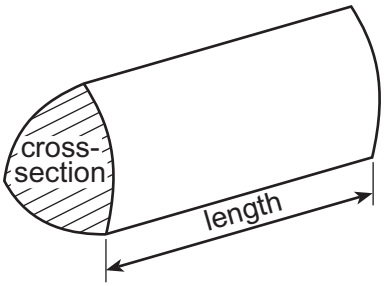
You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **4**.

Formula List

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

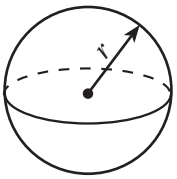


Volume of prism = area of cross-section × length



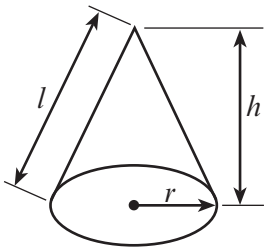
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

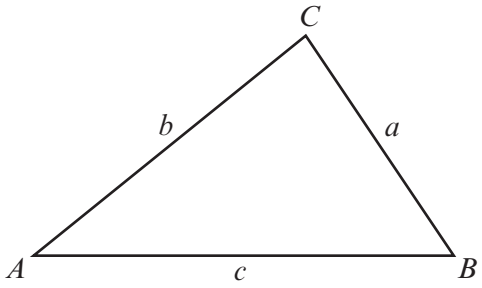


In any triangle ABC

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)* Evaluate $\frac{10{\cdot}3 - 6{\cdot}4}{2{\cdot}9 \times 0{\cdot}8}$. Give your answer correct to 1 decimal place. [2]

(b) Factorise $12ab + 20a$. [2]

(c) Solve the equation $\frac{5}{x} = 15$. [1]

5

2. William and Rushan earned £45 by washing cars.
They agreed to share the money in the ratio of the time they each spent washing cars.
William washed cars from 10:15 a.m. to 11:45 a.m.
Rushan washed cars from 1:45 p.m. to 4:45 p.m.
How much did each person receive? [3]

William receives £ ..... Rushan receives £ .....

3

Turn over.

Examiner only

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

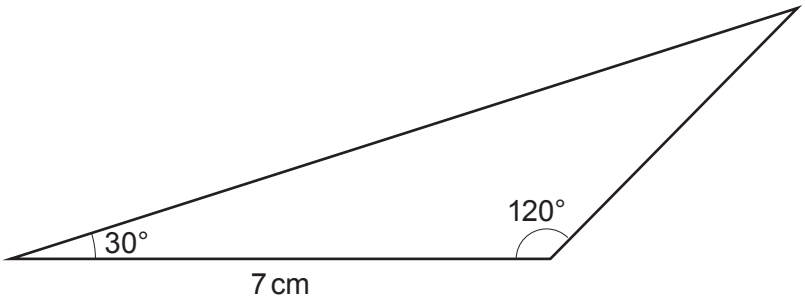


Diagram not drawn to scale

4

Examiner only

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

Cellan buys a season ticket each year to watch Swardiff Rovers football club play all their home matches.
The season ticket payment options for next year are given below.

- Normal price is £510
- Pay before the end of January and get a discount of $\frac{1}{12}$ off the normal price
- If you pay by credit card, a charge of 1·6% will be added

Cellan decides to pay before the end of January to get the discount.
He pays using his credit card.
How much less than the normal price does he pay?
You must show your working. [8]

8

Turn over.

Examiner only

5. The diagram shows a regular pentagon joined to a quadrilateral.

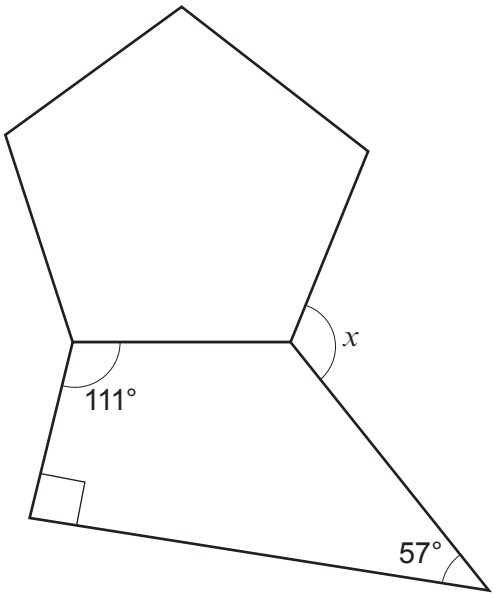


Diagram not drawn to scale

Calculate the size of angle x. [5]

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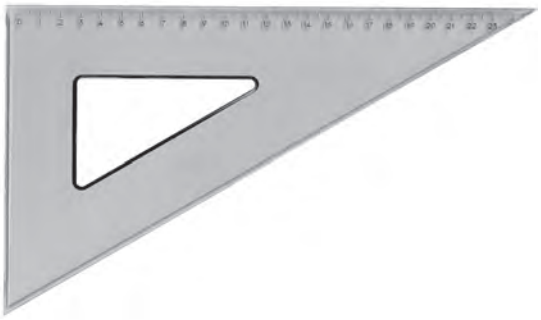
Examiner only

6. Solve the equation $8y - 3 = 2(2y + 8)$. [3]

3

7. Elwyn is a carpenter.
He normally uses a tool called a try square to measure angles of 90°.



One day, Elwyn forgets to pack his try square.
In his van, Elwyn has three wooden rods of length 8 cm, 15 cm and 17 cm.
Show, using calculations, that he can create an angle of 90° by joining the ends of these rods to form a triangle. [3]

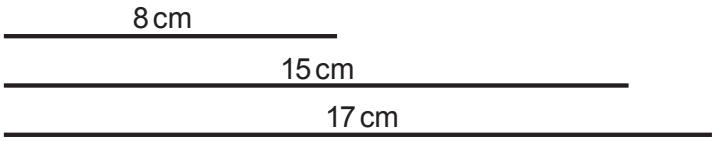


Diagram not drawn to scale

3

Turn over.

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Examiner only

8. An office manager recorded the number of photocopies made by her staff every day in September. The table below shows a summary of her results.

Number of photocopies per day	Number of days
0 – 99	4
100 – 199	9
200 – 299	14
300 – 399	1
400 – 499	2

(a) Calculate an estimate of the mean number of photocopies made per day in September. [4]

(b) Complete the following statement:

"My answer is only an estimate because I have assumed .....

....."

[1]

(c) Describe a more accurate method the office manager could have used to calculate the mean number of photocopies made per day in September. [1]

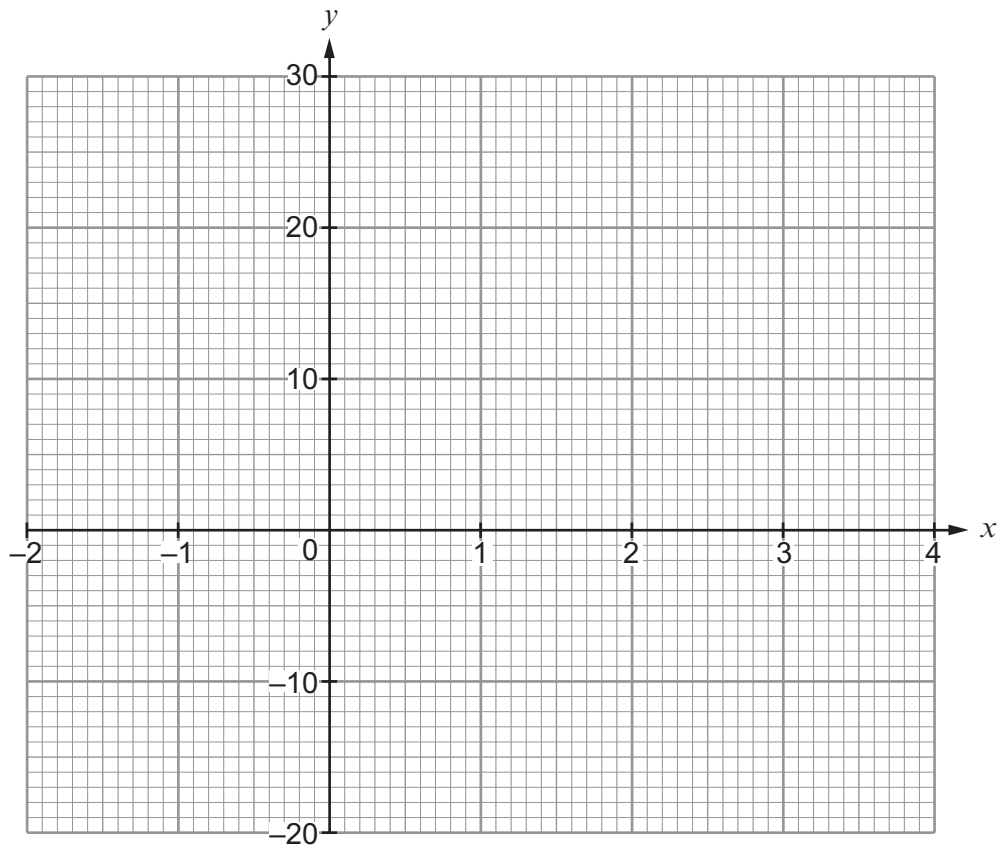
6

Examiner only

9. *(a)* Complete the table below that shows some of the values of $y = 2x^2 - 5x + 1$ for values of x from –2 to 4. [2]

x	–2	–1	0	1	2	3	4
$y = 2x^2 - 5x + 1$	19	.....	1	–2	.....	4	13

(b) On the graph paper below, draw the graph of $y = 2x^2 - 5x + 1$ for values of x from −2 to 4. [2]



(c) Use your graph to solve the equation $2x^2 - 5x + 1 = 0$. [1]

Examiner only

10. A square overlaps a circle to form the shape shown below.
The radius of the circle and the sides of the square each measure 3 cm.
The centre of the circle, *O*, coincides with a vertex of the square.

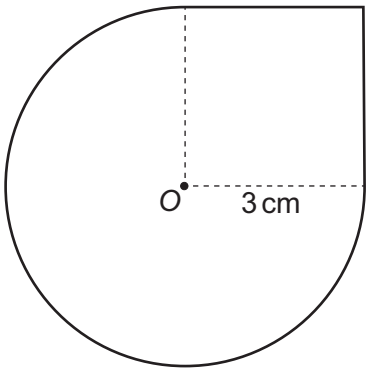


Diagram not drawn to scale

Calculate the area of the shape that has been formed. [4]

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Examiner only

11. Anne is standing a horizontal distance of 150 m away from the base of a vertical tower.

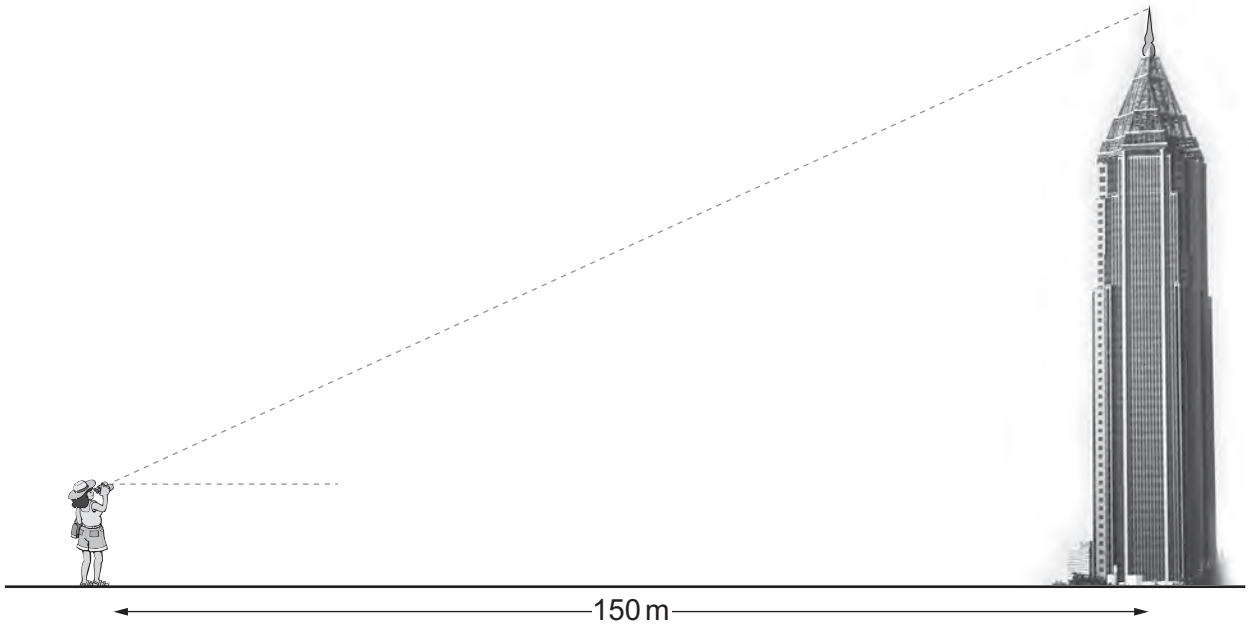

Diagram not drawn to scale

When she views the top of the tower through a pair of binoculars, the angle of elevation of the top of the tower is 39°.
The binoculars are held 1·7 m above the ground.
Calculate the vertical height of the tower. [4]

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4

Turn over.

Examiner only

12. *(a)* Calculate $(3{\cdot}7 \times 10^2) + (4{\cdot}1 \times 10^4)$. Give your answer in standard form. [2]

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(b) An estimate of the number of cells in a human body can be found by dividing the average volume of a human body by the average volume of a human cell.

	Average value
Volume of a human body	$0{\cdot}07\,m^3$
Volume of a human cell	$6{\cdot}8 \times 10^{-10}\,cm^3$

Use the above information to calculate an estimate of the number of cells in a human body.
Give your answer in standard form, correct to 3 significant figures. [4]

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Examiner only

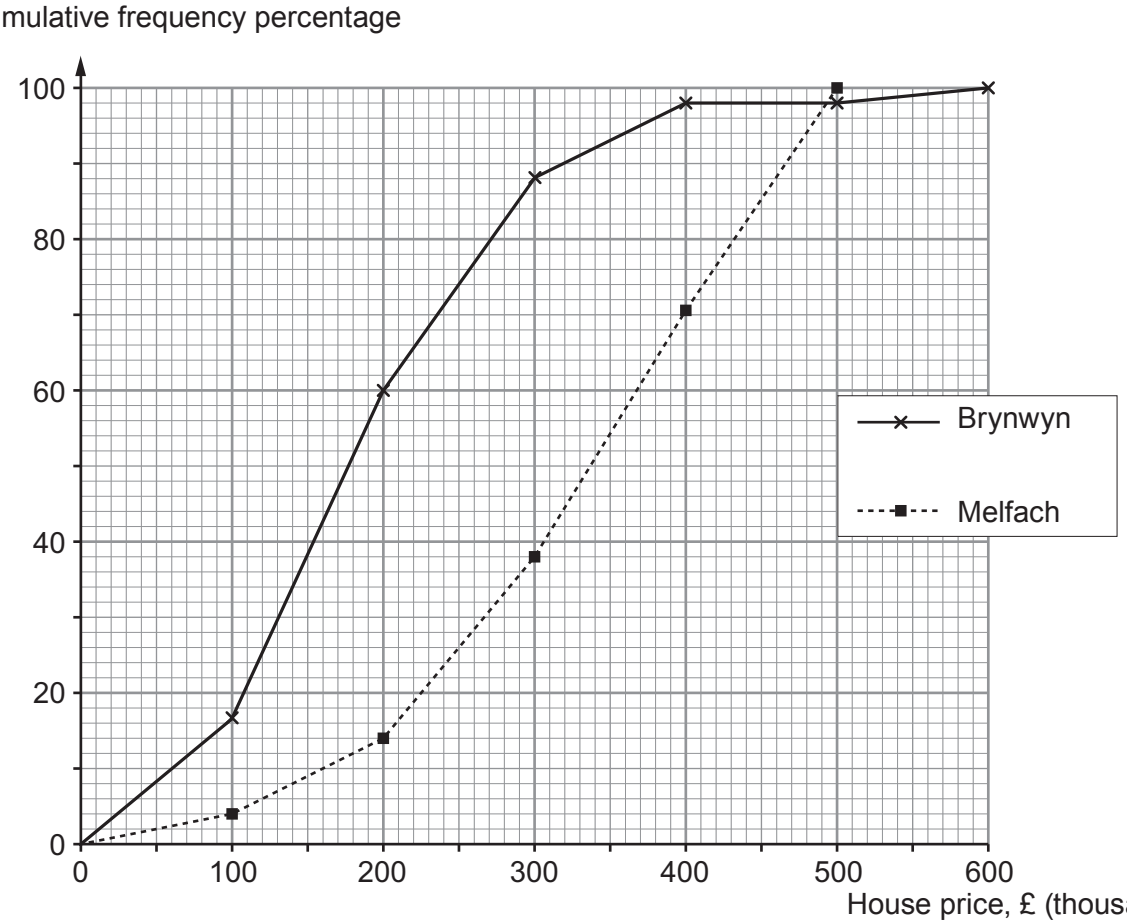
13. Solve the equation $\frac{2x+3}{4} - \frac{7x}{10} = \frac{4}{5}$. [4]

4

Turn over.

Examiner only

14. The cumulative frequency diagram shows the house prices in two villages, Brynwyn and Melfach, in December 2015.
The cumulative frequencies have been calculated as **percentages** of the total number of houses in each village.



(a) Which village has the higher median house price?
Give a reason for your answer. [1]

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(b) What percentage of houses in Melfach cost less than £200 000? [1]

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(c) Explain why it is not possible to use the diagram to decide which village has more houses costing less than £200 000. [1]

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3

Examiner only

15. *(a)* Factorise the expression $x^2 + 8x - 20$, and hence solve the equation $x^2 + 8x - 20 = 0$. [3]

(b) A stone is thrown from the top of a cliff. After t seconds, its height above sea level, h, is given by the formula $h = 70 + 4t - 5t^2$.

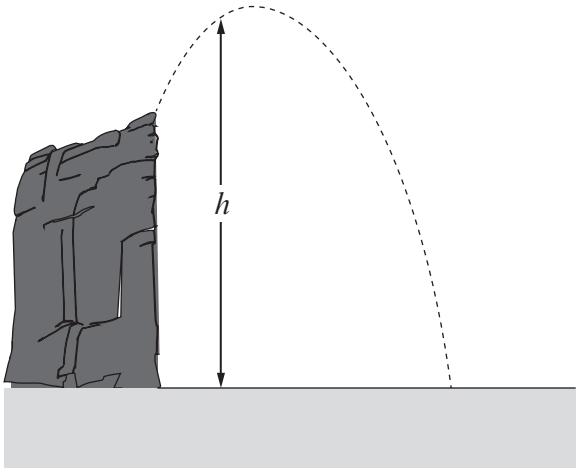

Diagram not drawn to scale

Find the value of t when the stone hits the sea.
Give your answer correct to 2 decimal places. [5]

Examiner only

16. *(a)* Calculate the length *BC* in the triangle below. [3]

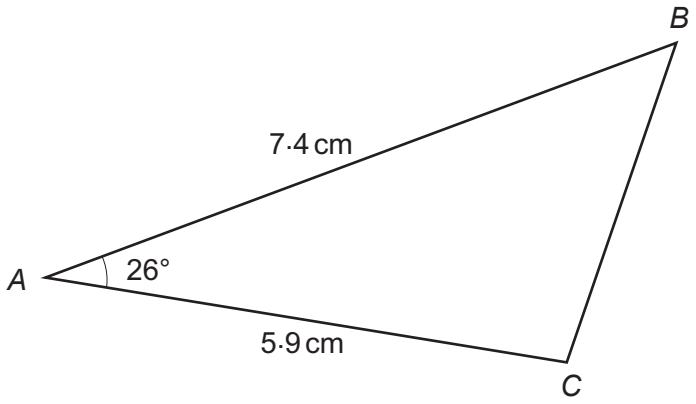

Diagram not drawn to scale

Examiner only

(b) Calculate the area of the triangle below. [5]

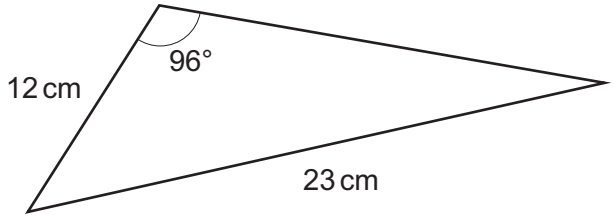

Diagram not drawn to scale

8

Examiner only

17. The following grouped frequency table shows the heights, in centimetres, of pupils in a Year 7 class.

Height (cm)	Frequency	Frequency density
$100 < h \leqslant 110$	4	0·4
$110 < h \leqslant 115$	9	
$115 < h \leqslant 120$	13	
$120 < h \leqslant 130$	5	
$130 < h \leqslant 150$	4	

Complete the frequency density column in the table, and draw a histogram to show the distribution of the heights of the pupils. [3]

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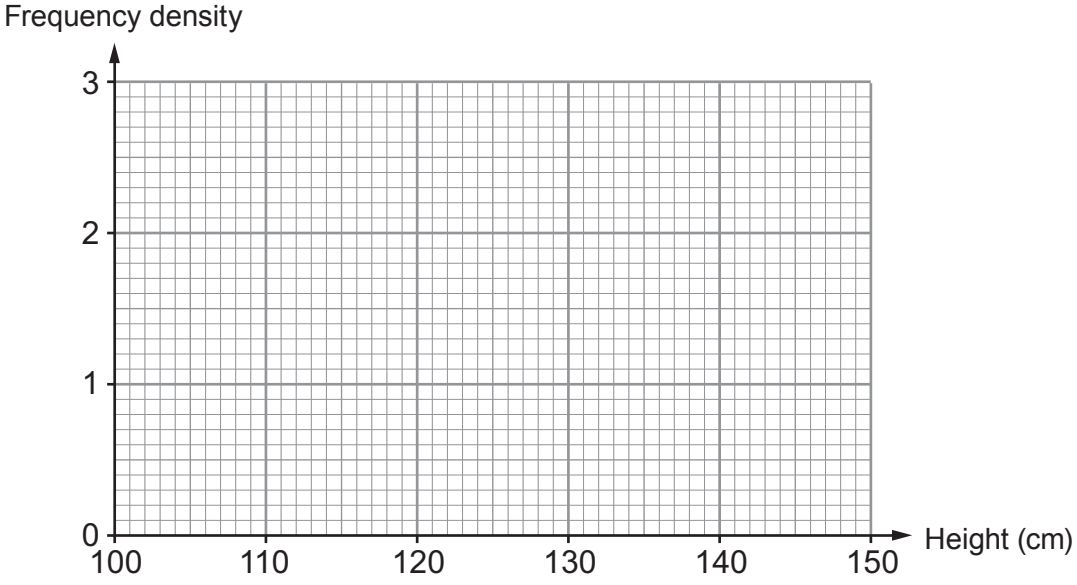

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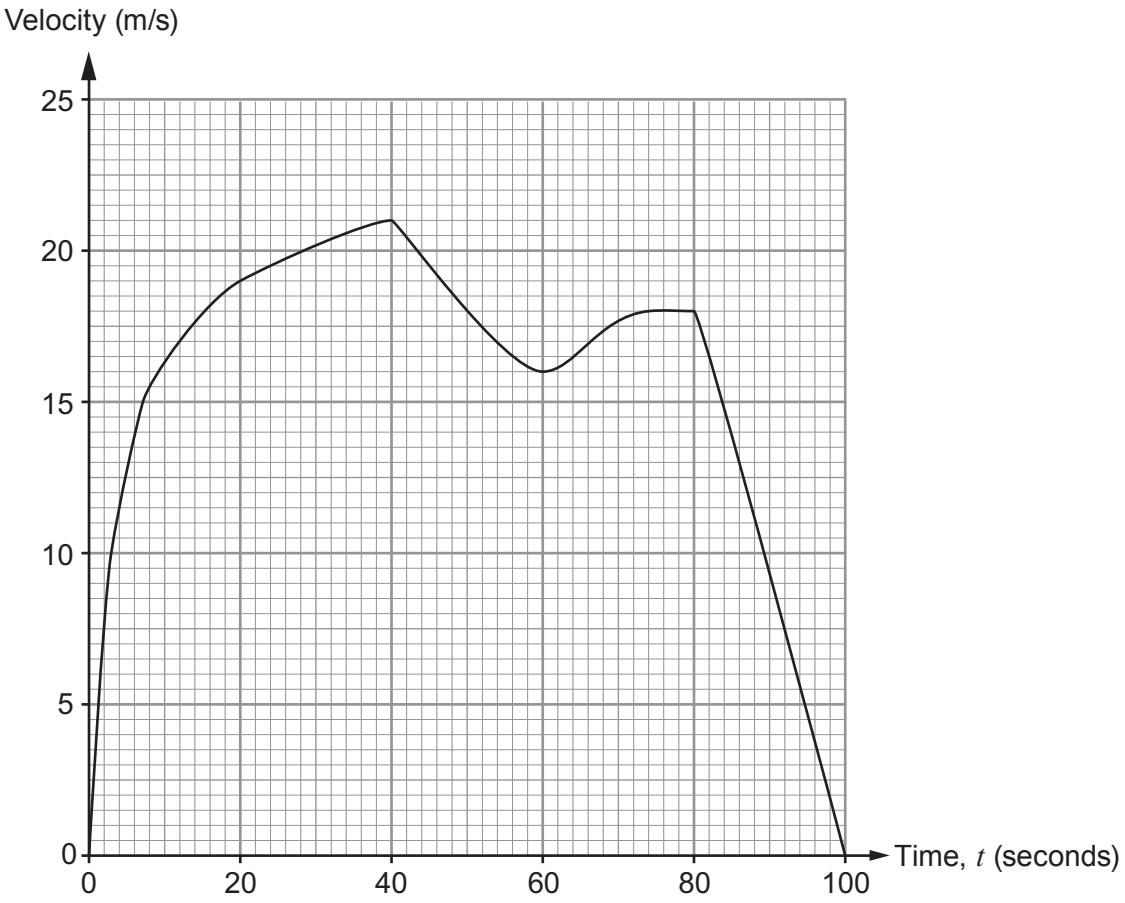
Examiner only

18. This velocity-time graph is for a short car journey, starting at time $t = 0$.



By using the ordinates $t = 0$, $t = 20$, $t = 40$, $t = 60$, $t = 80$ and $t = 100$, calculate an estimate of the distance travelled by the car during this journey. [3]

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Turn over.

Examiner only

19. A frustum of a cone is the shape that is left when a small cone is cut from a larger cone. The frustum shown has a top face of diameter 20 cm and a bottom face of diameter 30 cm. The height of the frustum is 40 cm.

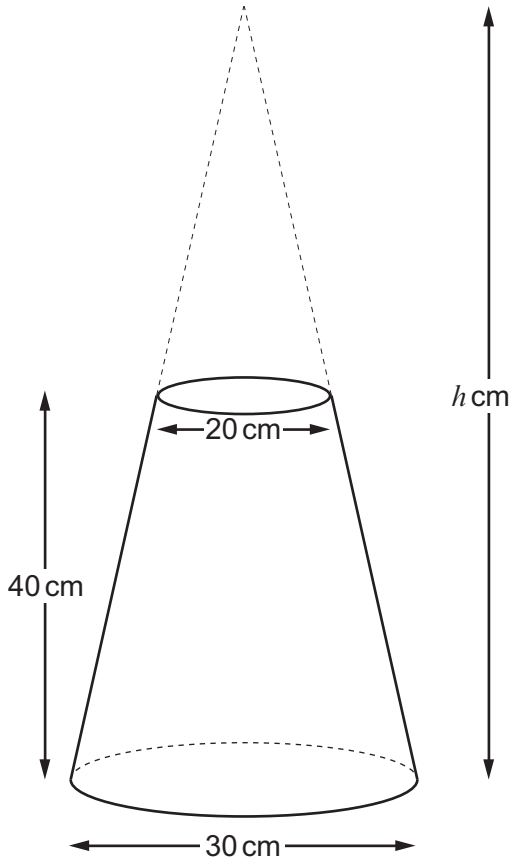

Diagram not drawn to scale

(a) Calculate the height, h, of the large cone. [3]

Examiner only

(b) Calculate the volume of the frustum. [2]

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