

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education
November 2006



MATHEMATICS (SPECIFICATION A)
Higher Tier
Paper 1 Non-calculator

3301/1H

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Tuesday 7 November 2006 9.00 am to 11.00 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • mathematical instruments <p>You must not use a calculator.</p>	
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For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
TOTAL	
Examiner's Initials	

Time allowed: 2 hours

Instructions

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this booklet.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. This must be tagged securely to this answer booklet.

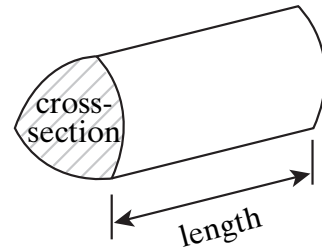
Advice

- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

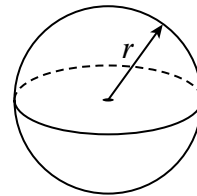
You may need to use the following formulae:

Volume of prism = area of cross-section \times length



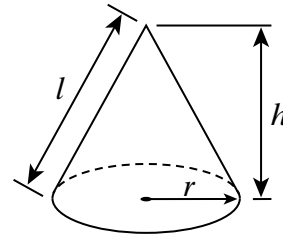
Volume of sphere = $\frac{4}{3} \pi r^3$

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



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

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

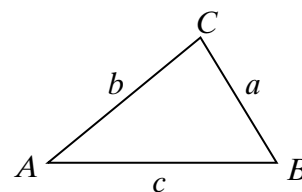


In any triangle ABC

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

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

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



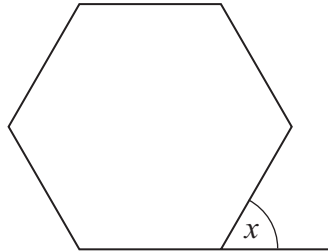
The Quadratic Equation

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

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

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

- 1 (a) The diagram below shows a regular hexagon.
One side has been extended and the **exterior** angle is x .



Not drawn accurately

Explain why angle x is 60° .

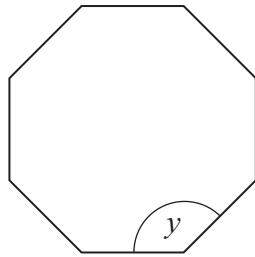
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(1 mark)

- (b) This diagram shows a regular octagon.
One of its **interior** angles is y .



Not drawn accurately

Calculate the value of y .

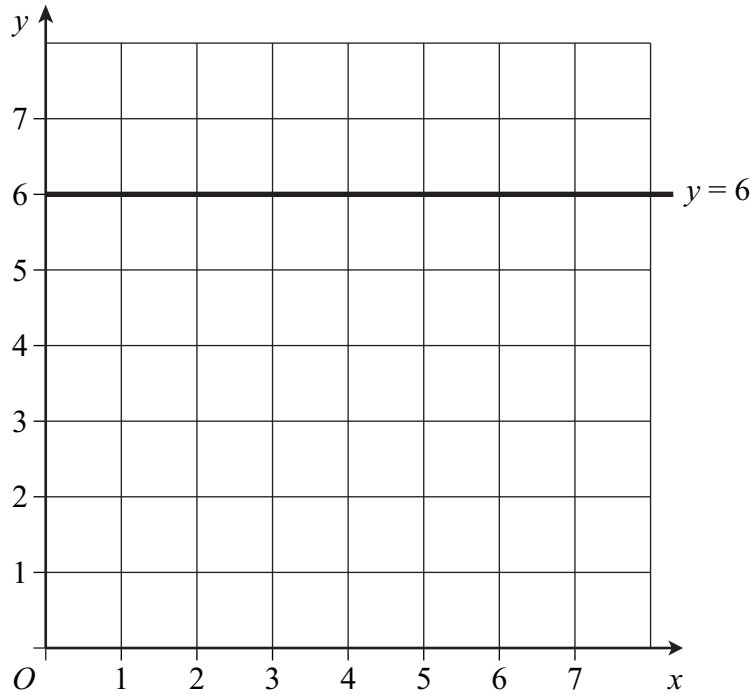
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Answer $y = \dots\dots\dots$ degrees (3 marks)

- 2 The line $y = 6$ is drawn on a centimetre square grid.



- (a) The point P lies on the line $y = 6$
 P is equal in distance from both the x -axis and the y -axis.

Mark and label P on the grid.

(1 mark)

- (b) The point Q also lies on the line $y = 6$
 Q is twice the distance from the x -axis as it is from the y -axis.

Mark and label Q on the grid.

(1 mark)

- (c) Calculate the area of triangle OPQ , where O is the origin.
 State the units of your answer.

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Answer (3 marks)

3 A recipe for 12 small cakes uses 240 g of flour.
 A bag contains 3 kg of flour.
 What percentage of the flour in the bag is used to make 30 small cakes?

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Answer % (4 marks)

4 (a) Poppy the dog has two meals a day.
 At each meal Poppy eats $\frac{2}{5}$ of a tin of dog food.
 On Monday morning there are 5 tins of dog food in the cupboard.
 Is this enough dog food to feed Poppy for one week?
 You **must** show your working.

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(3 marks)

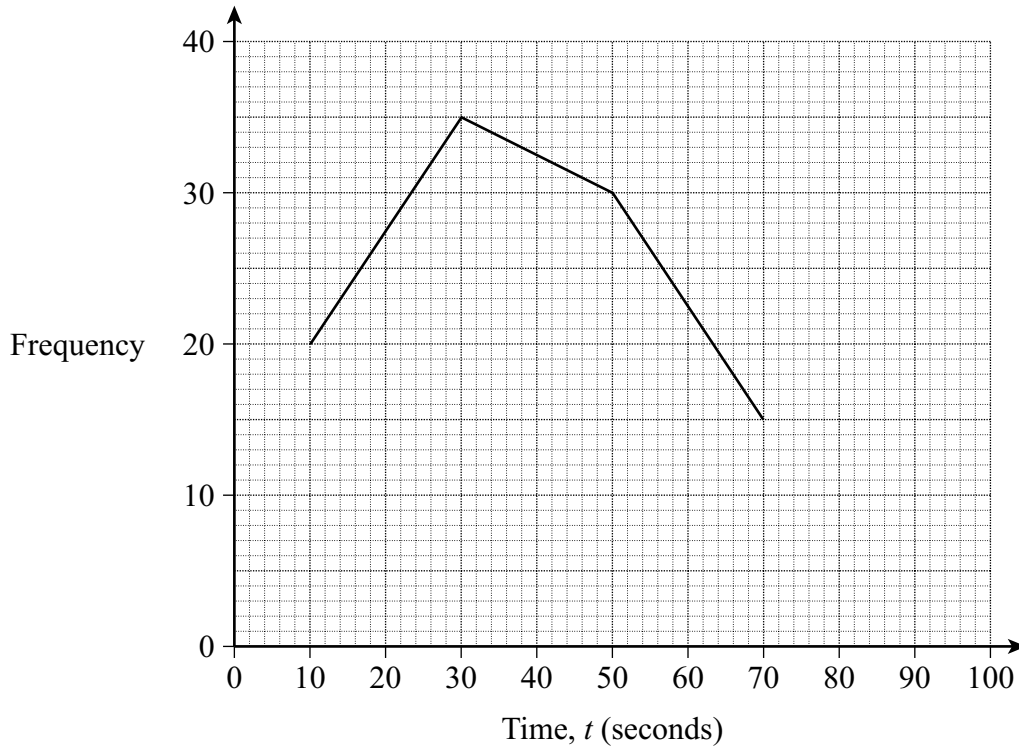
(b) Work out $4\frac{2}{3} \div 1\frac{3}{4}$

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Answer (3 marks)

Turn over 

5 The frequency polygon shows the times taken by 100 girls to solve a puzzle.



(a) The table shows the times taken by 100 boys to solve the same puzzle.

Time, t (seconds)	Frequency
$0 < t \leq 20$	24
$20 < t \leq 40$	30
$40 < t \leq 60$	36
$60 < t \leq 80$	10

Draw a frequency polygon to show this information on the diagram above.

(2 marks)

(b) Use the midpoints of the class intervals to calculate an estimate of the mean time taken by the boys to solve the puzzle.

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Answer seconds (3 marks)

6 The table shows Emma's spelling test scores for 8 weeks.

Week	1	2	3	4	5	6	7	8
Score	5	6	6	6	7	6	6	7

Emma's first two 5-point moving average scores are shown in this table.

Week	1	2	3	4	5	6	7	8
Score	5	6	6	6	7	6	6	7
5-point moving average			6.0	6.2				

Complete the table to show **all** the possible 5-point moving average scores.
You **must** show your working.

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(3 marks)

7 You are given that $n = 2^2 \times 5$

Write $40n$ as the product of its prime factors.

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Answer (2 marks)

8 (a) (i) Solve $\frac{x}{3} - 2 = 5$

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Answer $x =$ (2 marks)

(ii) Solve $4x - 11 = 2(x + 3)$

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Answer $x =$ (3 marks)

(b) Expand and simplify $3(2x - 1) + 2(3x + 5)$

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Answer (2 marks)

(c) (i) Expand and simplify $(y + 5)(y - 1)$

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Answer (2 marks)

(ii) When y is an odd number, explain why $(y + 5)(y - 1)$ is an even number.

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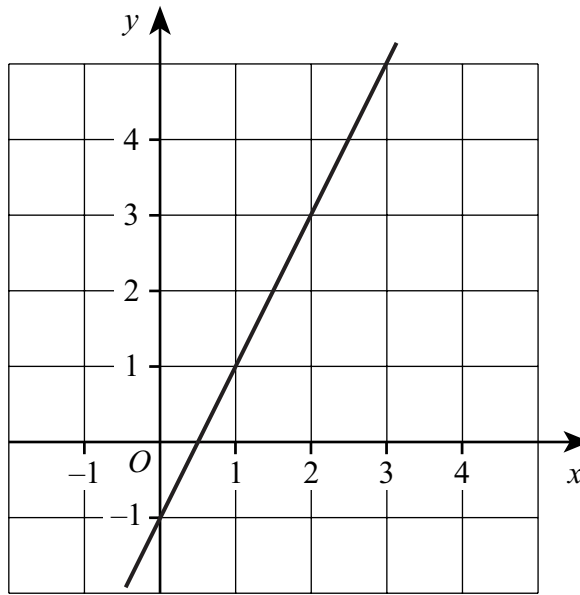
(1 mark)

(d) Factorise $2xy - 6y^2$

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Answer (2 marks)

9 The diagram shows the graph of the equation $y = ax + b$



Find the values of a and b .

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Answer $a = \dots\dots\dots$, $b = \dots\dots\dots$ (3 marks)

10 In each of these expressions x , y and z represent lengths.
 State whether each expression could represent a length (L), an area (A), a volume (V), none of these (N).

$xy + yz$ could represent

$xy(y^2 + z)$ could represent

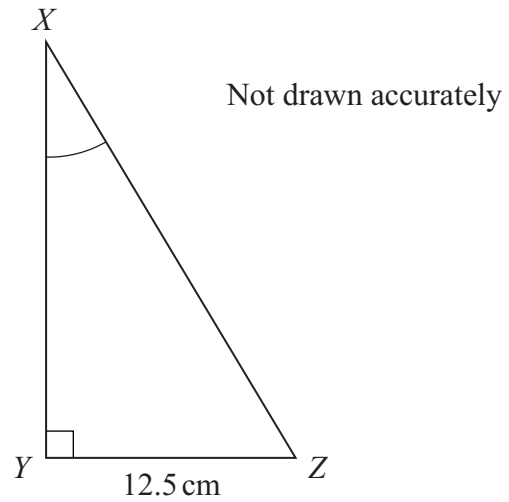
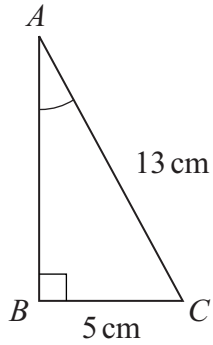
$x + y + z$ could represent

$xy^2 + z^3$ could represent

(4 marks)

Turn over

- 11 ABC and XYZ are similar triangles with right angles at B and Y .
 $AC = 13$ cm, $BC = 5$ cm and $YZ = 12.5$ cm



Work out the length of XY .

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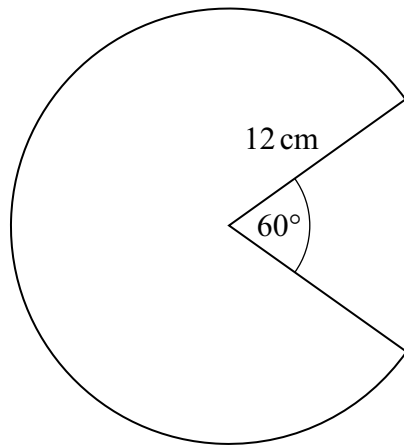
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Answer cm (5 marks)

- 12 A sector of 60° is cut out of a circle of radius 12 cm.
The diagram shows the remaining shape.



Not drawn accurately

- (a) Calculate the area of the remaining shape.
Give your answer in terms of π .

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Answer cm^2 (2 marks)

- (b) Calculate the perimeter of the remaining shape.
Give your answer in terms of π .

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Answer cm (3 marks)

- 13 A gym has 300 members.
The members are classified by age as follows

Age (years)	16–25	26–35	36–45	46–55	over 55
Number of people	86	95	47	44	28

A stratified sample of 50 is planned.
Calculate the number of people that should be sampled from each age group.

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Answer 16–25

26–35

36–45

46–55

over 55

(3 marks)

- 14 Evaluate

(a) $36^{\frac{1}{2}} \times 4^{-1}$

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Answer *(3 marks)*

(b) $1000^{-\frac{2}{3}}$

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Answer *(2 marks)*

15 Write each of these in the form $p\sqrt{3}$, where p is an integer.

(a) $\sqrt{6} \times \sqrt{50}$

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Answer (2 marks)

(b) $\sqrt{48} + \sqrt{75}$

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Answer (2 marks)

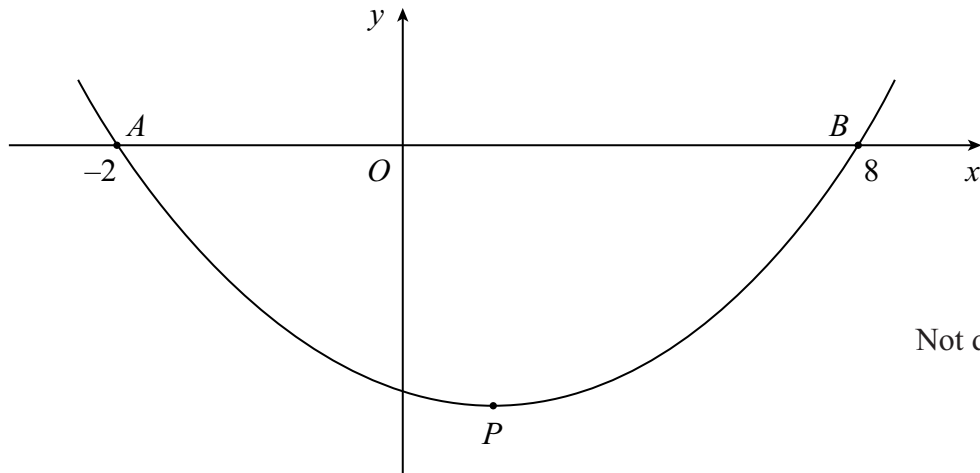
(c) $\frac{18}{\sqrt{3}}$

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Answer (2 marks)

Turn over for the next question

16 The diagram shows a graph of the form $y = x^2 + qx + r$



- (a) The graph crosses the x -axis at $A (-2, 0)$ and $B (8, 0)$
Show that this is the graph of $y = x^2 - 6x - 16$

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(2 marks)

- (b) Point P is the lowest point of the graph.
What are the coordinates of P ?

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Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ (2 marks)

- (c) Solve the equation $(x + 3)^2 - 6(x + 3) - 16 = 0$

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Answer (3 marks)

17 Simplify $\frac{2x^2 - 9x - 18}{x^2 - 36}$

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Answer (4 marks)

18 A car is due to have three safety tests.

The probability that the brakes will fail is $\frac{1}{4}$

The probability that the steering will fail is $\frac{1}{10}$

The probability that the lights will fail is $\frac{1}{5}$

These three events are independent.

Calculate the probability that the car fails **only one** of the three tests.

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Answer (4 marks)

Turn over 

- 19 (a) Show that $\frac{4}{x} = 9 - 2x$ can be written as $2x^2 - 9x + 4 = 0$

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(2 marks)

- (b) Part of the graph of $y = \frac{4}{x}$ is shown on the grid opposite.

Draw a straight line on the grid which will enable you to solve the equation

$$2x^2 - 9x + 4 = 0$$

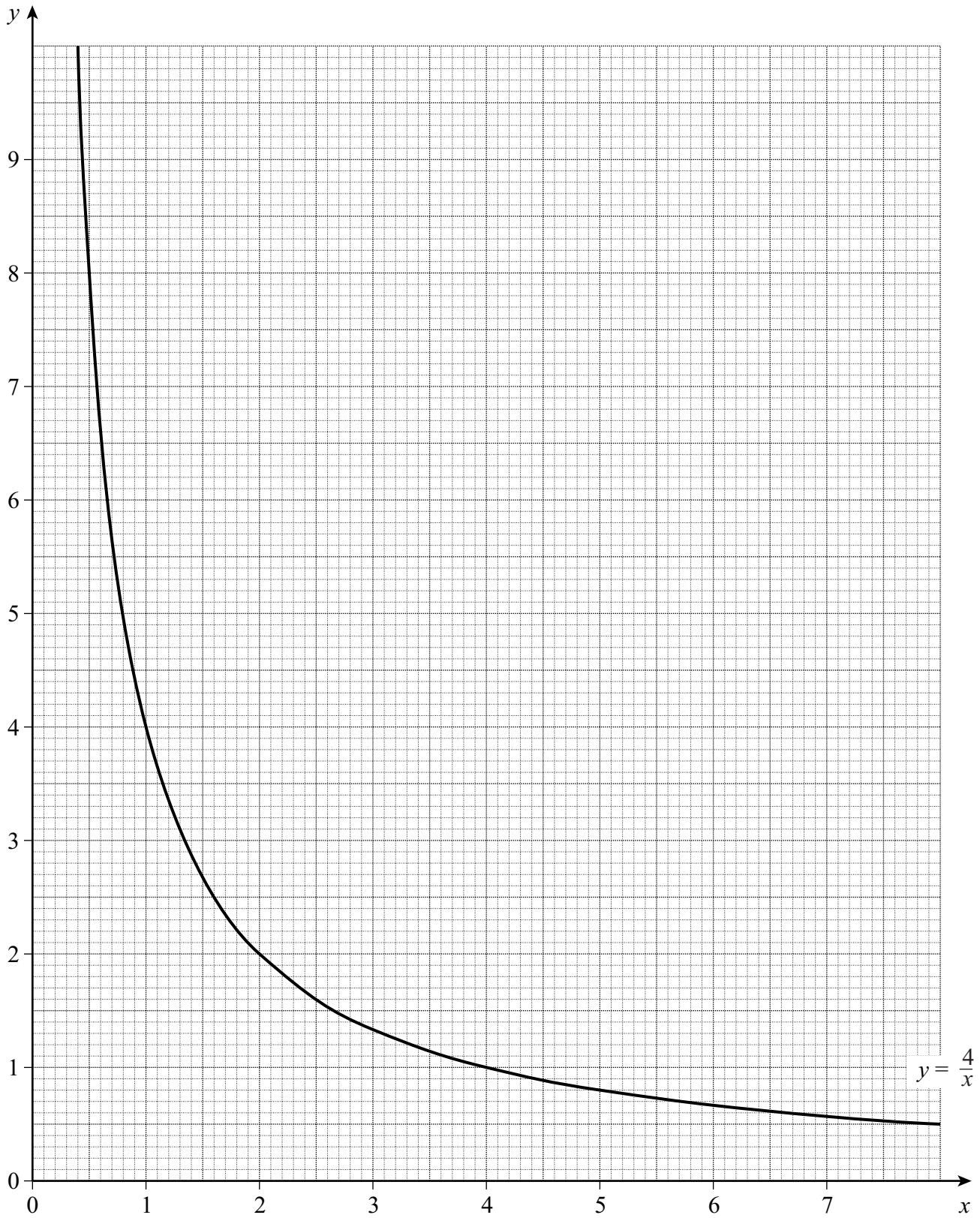
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(3 marks)

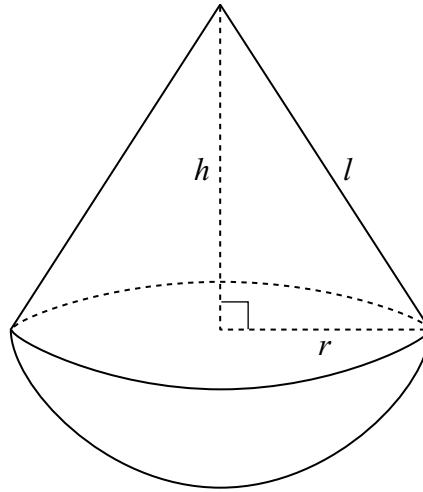
- (c) Hence, or otherwise, solve the equation $2x^2 - 9x + 4 = 0$

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Answer (2 marks)



- 20** The diagram shows a solid made from a cone and a hemisphere.
 The radius of both shapes is r .
 The slant height of the cone is l .
 The perpendicular height of the cone is h .



The curved surface area of the cone and the curved surface area of the hemisphere are equal.

- (a) Show that $l = 2r$

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(2 marks)

- (b) Find the perpendicular height, h , of the cone in terms of r .

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Answer $h =$

(2 marks)

- (c) Find the ratio of the volumes of the cone and the hemisphere.
Give your answer in surd form.

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Answer (2 marks)

END OF QUESTIONS

There are no questions printed on this page