

Surname						Other Names					
Centre Number						Candidate Number					
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General Certificate of Secondary Education
June 2006



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

3301/1H

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Monday 5 June 2006 1.30 pm to 3.30 pm

<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	
20	
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.

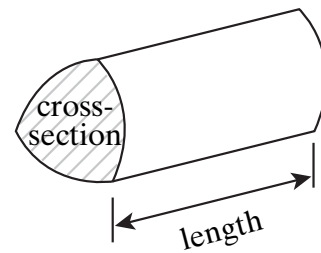
Advice

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

Formulae Sheet: Higher Tier

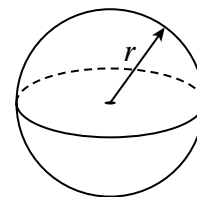
You may need to use the following formulae:

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



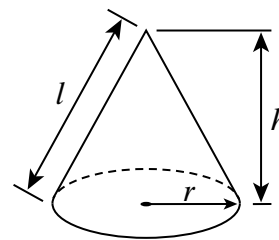
Volume of sphere = $\frac{4}{3} \pi r^3$

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



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

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

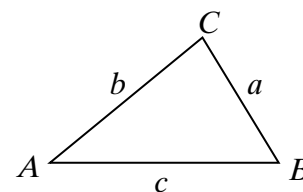


In any triangle ABC

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



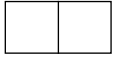
The Quadratic Equation

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

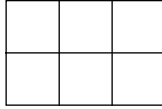
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

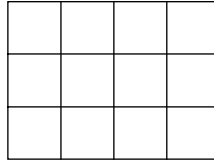
1 The diagrams show a sequence of rectangles.



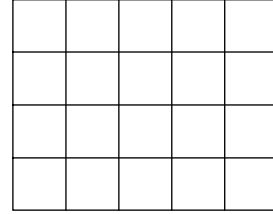
Area = 2
Diagram 1



Area = 6
Diagram 2



Area = 12
Diagram 3



Area = 20
Diagram 4

(a) Write down an expression for the area of Diagram n .

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Answer (2 marks)

(b) A rectangle in the sequence has an area of 110 cm^2 .
What is its perimeter?

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.....
.....

Answer cm (2 marks)

Turn over for the next question

- 2 (a) Expand and simplify $7(x - 2y) - 3(2x - y)$

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Answer (2 marks)

- (b) Solve $\frac{24 - x}{5} = 3$

.....

Answer $x =$ (2 marks)

- (c) (i) Factorise $y^2 - 5y + 6$

.....

Answer (2 marks)

- (ii) Hence solve the equation $y^2 - 5y + 6 = 0$

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Answer (1 mark)

- (d) Simplify $\frac{2(x + 3)^2}{8(x + 3)}$

.....

Answer (2 marks)

(e) Simplify $(2m^3p)^4$

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Answer (2 marks)

3 (a) Work out the reciprocal of 1.5
Give your answer as a fraction in its simplest form.

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Answer (2 marks)

(b) Use approximations to estimate the value of $\sqrt{\frac{9.98}{0.203}}$

You **must** show your working.

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Answer (3 marks)

(c) Work out $4\frac{1}{5} - 1\frac{2}{3}$

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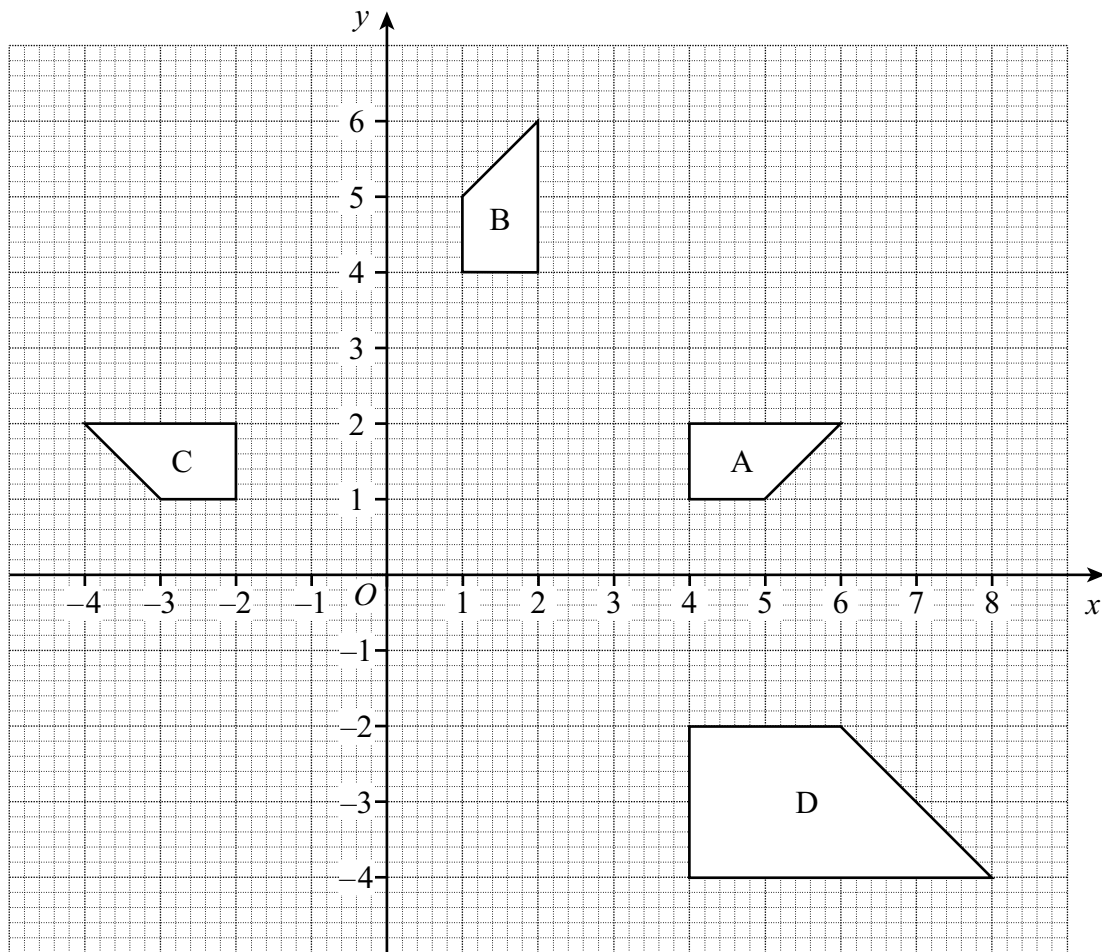
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Answer (3 marks)

4 The diagram shows four shapes, A, B, C and D.



(a) Describe fully the single transformation that takes shape A onto shape B.

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(2 marks)

(b) Describe fully the single transformation that takes shape B onto shape C.

.....

(3 marks)

(c) Describe fully the single transformation that takes shape C onto shape D.

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(3 marks)

5 (a) Which one of $\frac{5}{6}$, $\frac{7}{8}$ and $\frac{9}{10}$ is a recurring decimal?

Show clearly how you made your decision.

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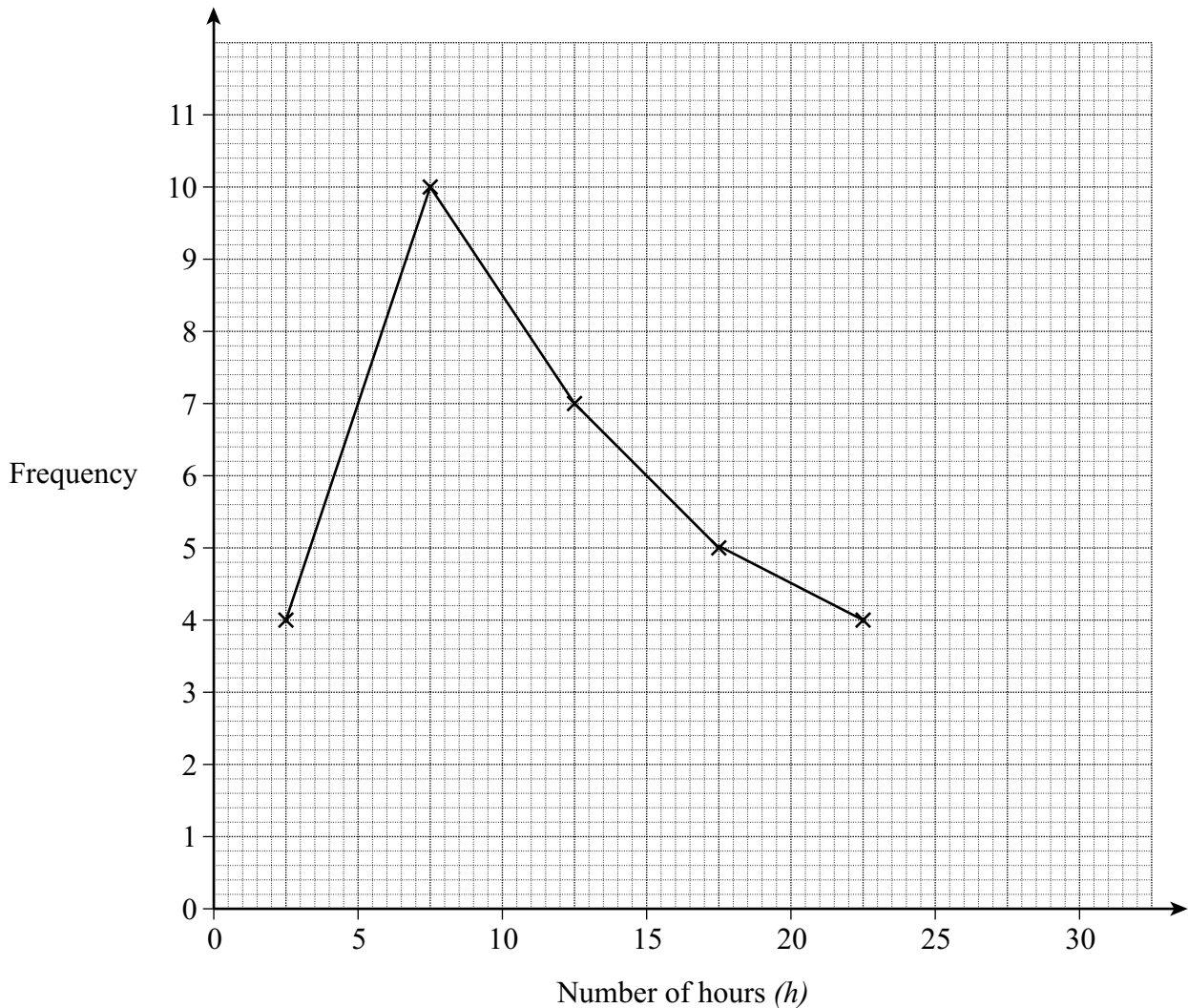
Answer (2 marks)

(b) Change $\frac{3}{11}$ to a recurring decimal.

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Answer (2 marks)

- 6 The frequency polygon shows the number of hours of television watched each week by 30 teachers.



- (a) The number of hours of television watched each week by 30 students is shown below.

Number of hours (h)	Frequency
$0 < h \leq 5$	1
$5 < h \leq 10$	2
$10 < h \leq 15$	7
$15 < h \leq 20$	9
$20 < h \leq 25$	7
$25 < h \leq 30$	4

On the same grid draw a frequency polygon to show this information.

(2 marks)

- (b) Give **two** comparisons between the number of hours of television watched by these teachers and students.

Comparison 1

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.....

Comparison 2

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(2 marks)

- 7 (a) The ratio 35 000 000 : 50 can be written in the form $n : 1$
Work out the value of n .
Give your answer in standard form.

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Answer $n =$ (2 marks)

- (b) Solve the equation $y \times 10^6 = 3.5 \times 10^3$
Give your answer in standard form.

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Answer $y =$ (2 marks)

8 Match each of the **shaded** regions to one of these inequalities.

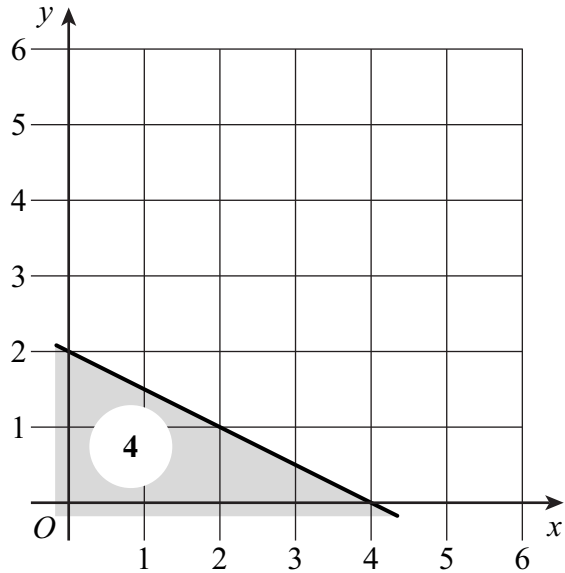
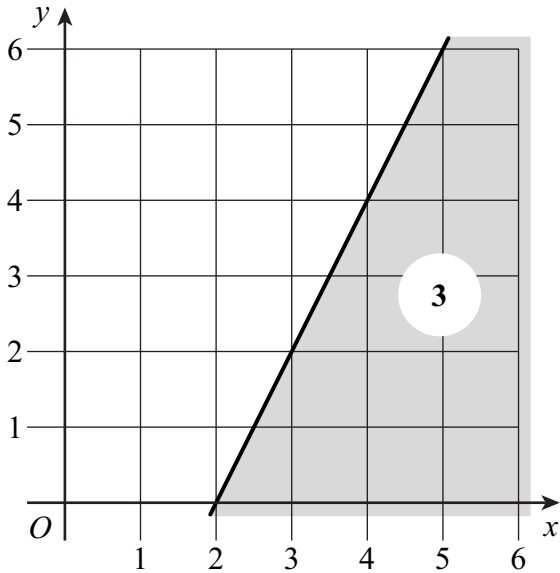
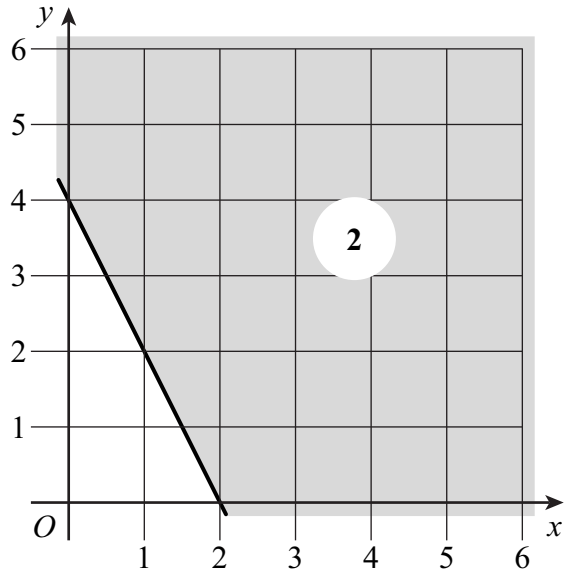
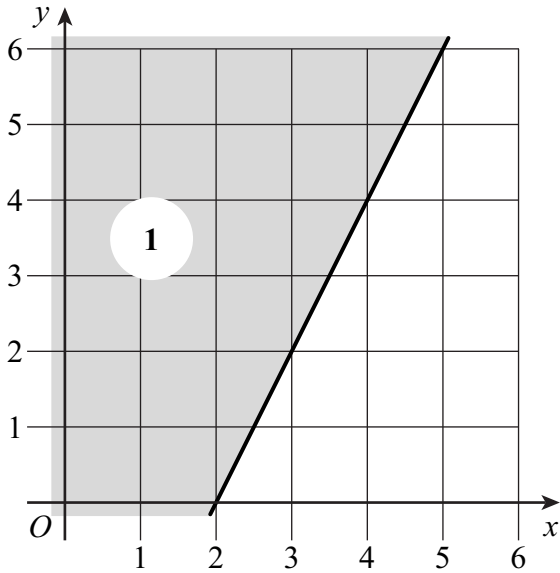
A $y \leq -\frac{1}{2}x + 2$

B $y \leq \frac{1}{2}x + 2$

C $y \geq -2x + 4$

D $y \geq 2x - 4$

E $y \leq 2x - 4$



Region 1

Region 2

Region 3

Region 4

(4 marks)

9 Make u the subject of the formula $s = \frac{1}{2}(u + v)t$

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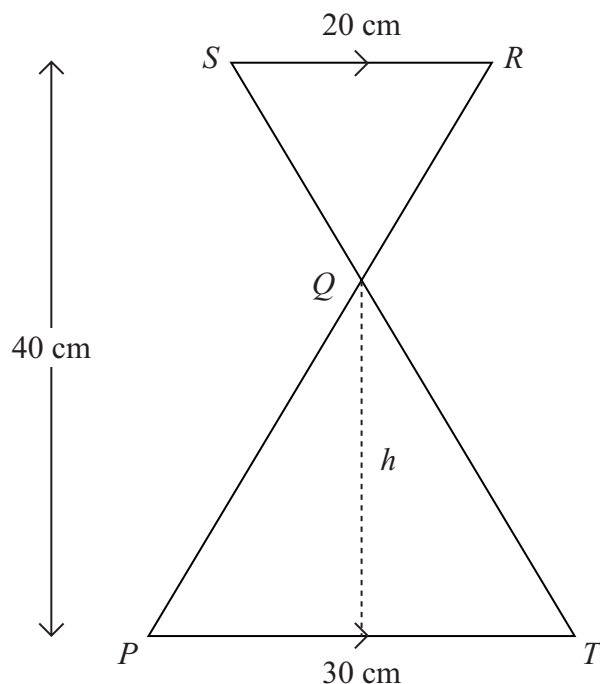
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Answer $u =$ (3 marks)

10 In the diagram SR is parallel to PT .
 SQT and RQP are straight lines.
 $SR = 20$ cm and $PT = 30$ cm
 The total height of the two triangles is 40 cm.



Not drawn accurately

Use similar triangles to calculate the height, h cm, of triangle PQT .

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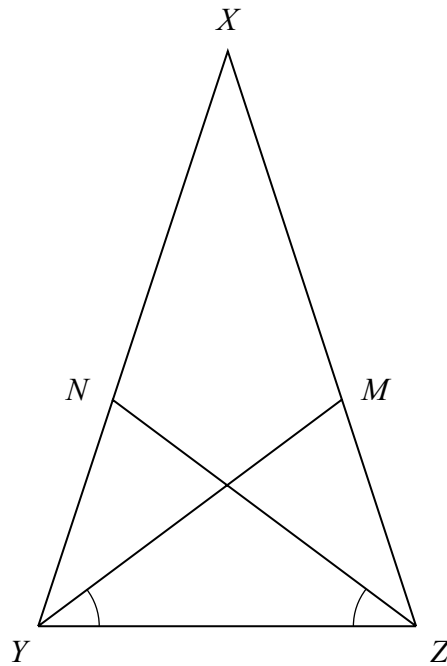
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Answer $h =$ cm (3 marks)

- 12 XYZ is an isosceles triangle in which $XZ = XY$
 M and N are points on XZ and XY such that angle $MYZ =$ angle NZY



Prove that triangles YMZ and ZNY are congruent.

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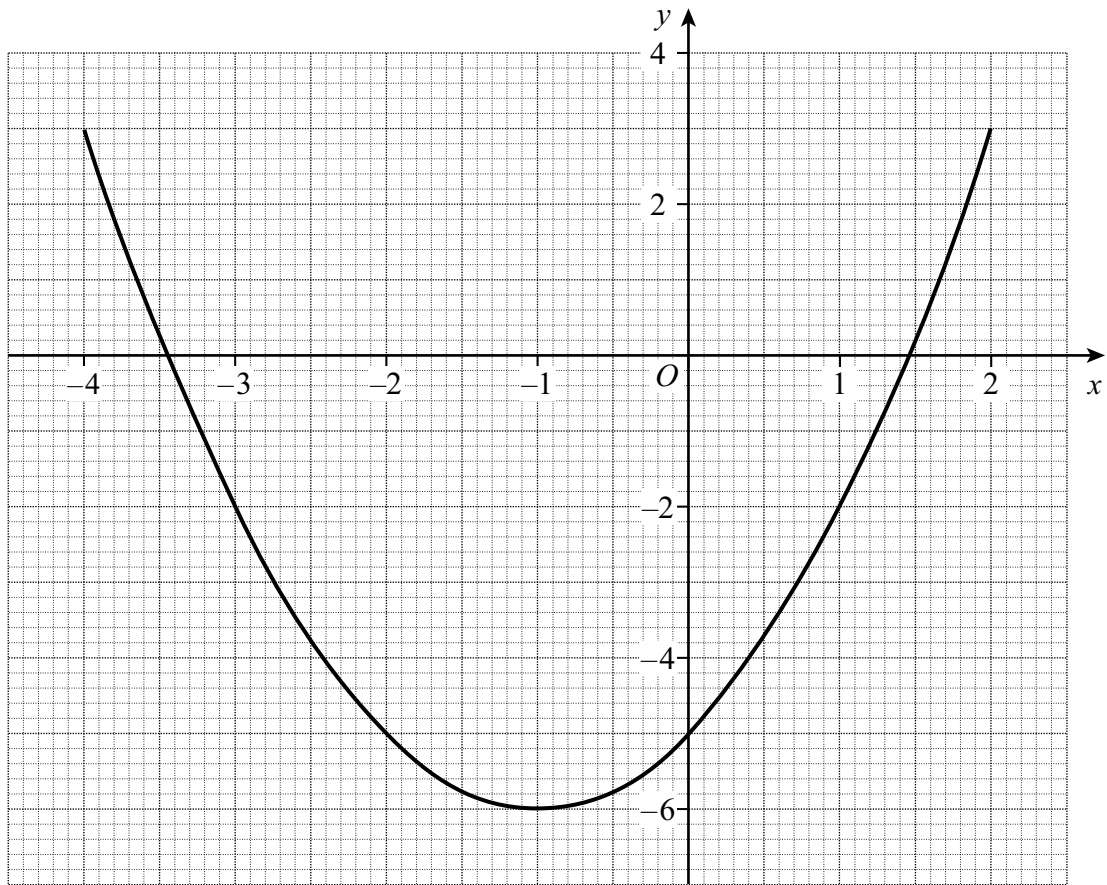
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(4 marks)

Turn over 

- 13 The grid shows the graph of $y = x^2 + 2x - 5$



By drawing an appropriate straight line, solve the equation $x^2 + 2x - 5 = x - 1$

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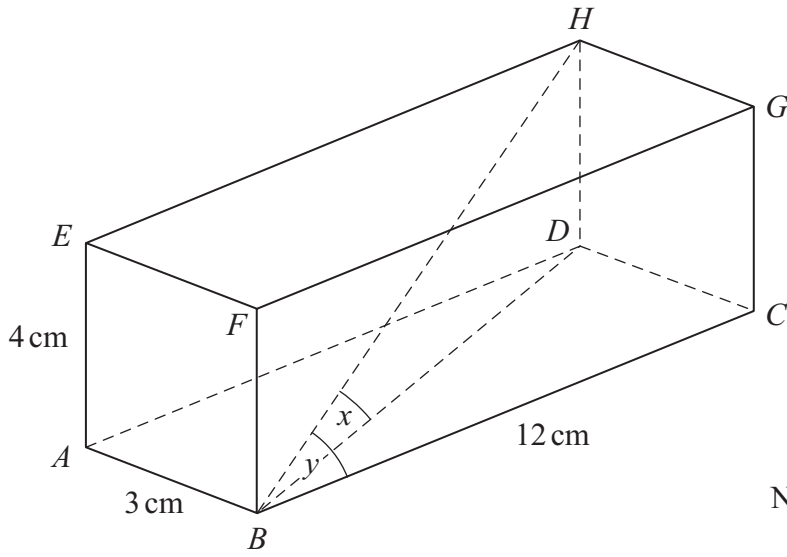
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Answer (3 marks)

- 14 The diagram shows a cuboid.
 $AB = 3\text{ cm}$, $AE = 4\text{ cm}$, $BC = 12\text{ cm}$.



Not drawn accurately

- (a) Find the length of BH .

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Answer cm (2 marks)

- (b) The angle between BH and BD is x and the angle between BH and BC is y .

Which angle is bigger, x or y ?
 You **must** show your working.

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Answer (3 marks)

Turn over

16 (a) Simplify

(i) $w^2 \times w^6$

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Answer (1 mark)

(ii) $w^{10} \div w^4$

.....

Answer (1 mark)

(iii) $(w^4)^3$

.....

Answer (1 mark)

(b) If $x = 3^p$ and $y = 3^q$

Express in terms of x and/or y

(i) 3^{p-q}

.....

Answer (1 mark)

(ii) 3^{2p}

.....

Answer (1 mark)

(iii) 3^{q+2}

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Answer (1 mark)

18 (a) Show that $(\sqrt{12} + \sqrt{3})^2 = 27$

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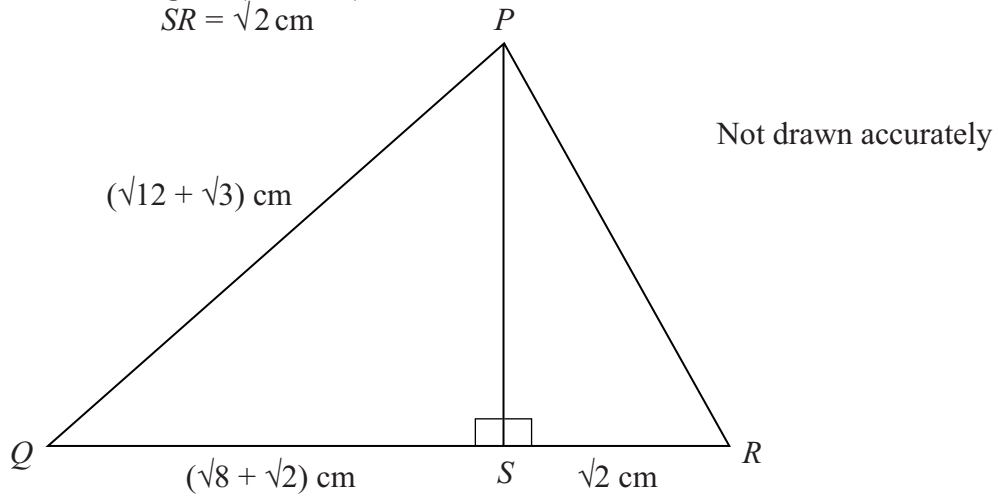
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(2 marks)

(b) In the diagram $PQ = (\sqrt{12} + \sqrt{3})$ cm
 $QS = (\sqrt{8} + \sqrt{2})$ cm
 $SR = \sqrt{2}$ cm



(i) Show that $PS = 3$ cm

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(4 marks)

(ii) Find the area of triangle PQR giving your answer in the form $a\sqrt{2}$, where a is a positive integer.

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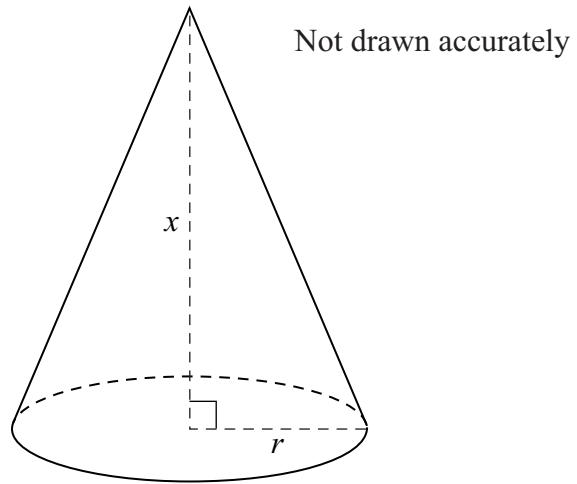
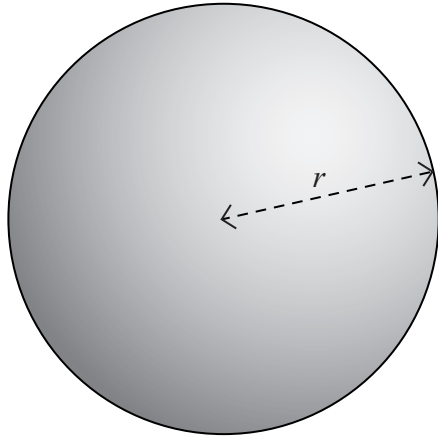
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Answer cm² (3 marks)

Turn over

- 19** A sphere has radius r .
 A cone has base radius r and perpendicular height x .
 The volume of the sphere is double the volume of the cone.



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

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(2 marks)

- (b) Calculate the ratio of the surface area of the sphere to the curved surface area of the cone.
 Give your answer in surd form.

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Answer (4 marks)

END OF QUESTIONS