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General Certificate of Secondary Education  
June 2004



**MATHEMATICS (MODULAR) (SPECIFICATION B)**  
**Module 5 Higher Tier**  
**Paper 2 Calculator**

**33005/H2**

**H**

Tuesday 15 June 2004 9.00 am to 10.15 am

<p><b>In addition to this paper you will require:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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For Examiner's Use	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16	
TOTAL	
Examiner's Initials	

Time allowed: 1 hour 15 minutes

**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 in the spaces provided.
- Do all rough work in this booklet.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.14 unless otherwise instructed in the question.

**Information**

- The maximum mark for this paper is 70.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.
- You are expected to use a calculator where appropriate.

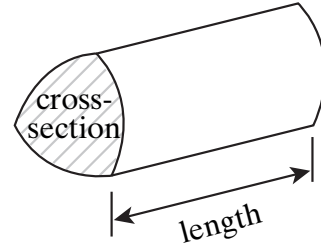
**Advice**

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

### Formulae Sheet: Higher Tier

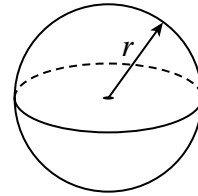
You may need to use the following formulae:

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



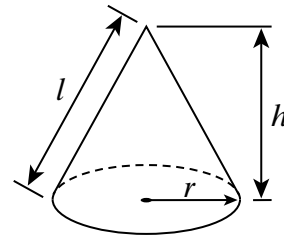
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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



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

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

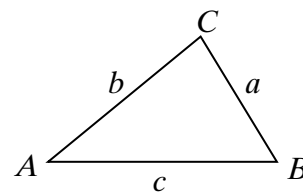


**In any triangle ABC**

**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 Dario is using trial and improvement to find a solution to the equation

$$x + \frac{1}{x} = 5$$

The table shows his first trial.

$x$	$x + \frac{1}{x}$	Comment
4	4.25	Too low

Continue the table to find a solution to the equation.  
Give your answer to 1 decimal place.

Answer  $x = \dots\dots\dots$  (4 marks)

4

Turn over 

2 (a) Multiply out  $s(s^2 + 6)$

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Answer ..... (2 marks)

(b) Simplify fully

(i)  $(2t^3u) \times (3tu^2)$

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Answer ..... (2 marks)

(ii)  $(2c^4)^3$

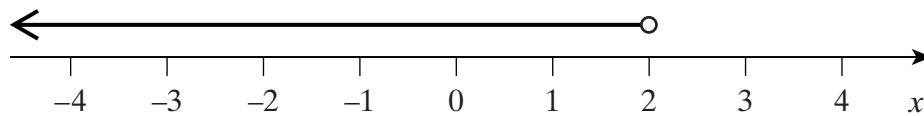
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Answer ..... (2 marks)

- 3 (a) Solve the inequality  $2x + 3 \geq 1$

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Answer ..... (2 marks)

- (b) Write down the inequality shown by the following diagram.



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Answer ..... (1 mark)

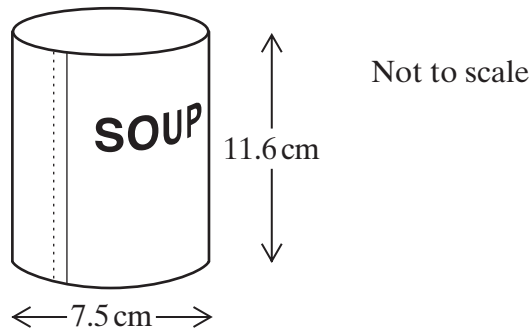
- (c) Write down all the integers that satisfy both inequalities shown in parts (a) and (b).

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Answer ..... (1 mark)

**TURN OVER FOR THE NEXT QUESTION**

- 4 The diagram shows a cylindrical tin of soup of diameter 7.5 cm and height 11.6 cm.



- (a) Calculate the volume of the cylinder.

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Answer .....  $\text{cm}^3$  (3 marks)

- (b) A sheet of paper is wrapped around the curved surface of the tin with a 1 cm overlap along the dotted line shown in the diagram.

Calculate the area of the paper.

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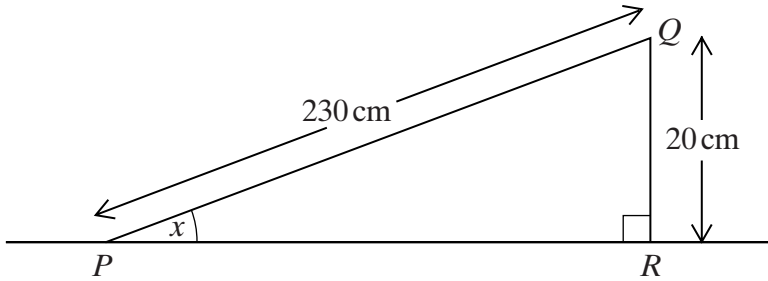
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Answer .....  $\text{cm}^2$  (4 marks)

- 5  $PQ$  is the surface of a ramp laid on level ground.  
The ramp is 230 cm long and 20 cm high, as shown in the diagram.



Work out the size of angle  $x$ .

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Answer ..... degrees (3 marks)

- 6 Solve the equation  $y^2 + 5y = 0$

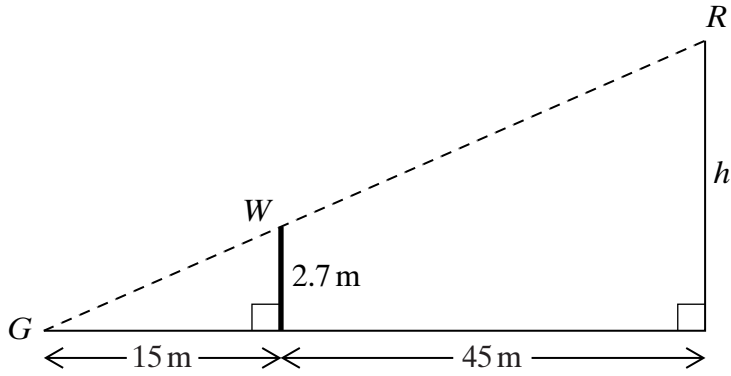
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Answer ..... (3 marks)

- 7 Gary,  $G$ , can just see the top of a radio mast,  $R$ , over a wall,  $W$ .  
 Gary is 15 m from the wall.  
 The wall is 45 m from the radio mast.  
 The wall is 2.7 m high.



Not to scale

Calculate the height of the radio mast, marked  $h$  on the diagram.

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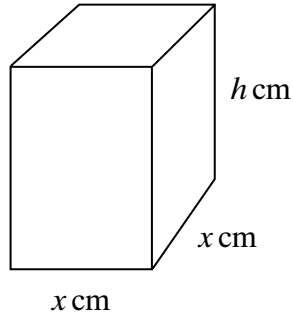
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Answer ..... m (3 marks)



- 8 A cuboid has a square base of side  $x$  cm.  
The volume of the cuboid is  $V$  cm<sup>3</sup> and the height is  $h$  cm.



Write down an expression for  $x$  in terms of  $V$  and  $h$ .

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Answer  $x =$  ..... (3 marks)

- 9 Solve the equation  $\frac{3x+1}{2} - \frac{2x+5}{3} = 1$

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Answer  $x =$  ..... (4 marks)

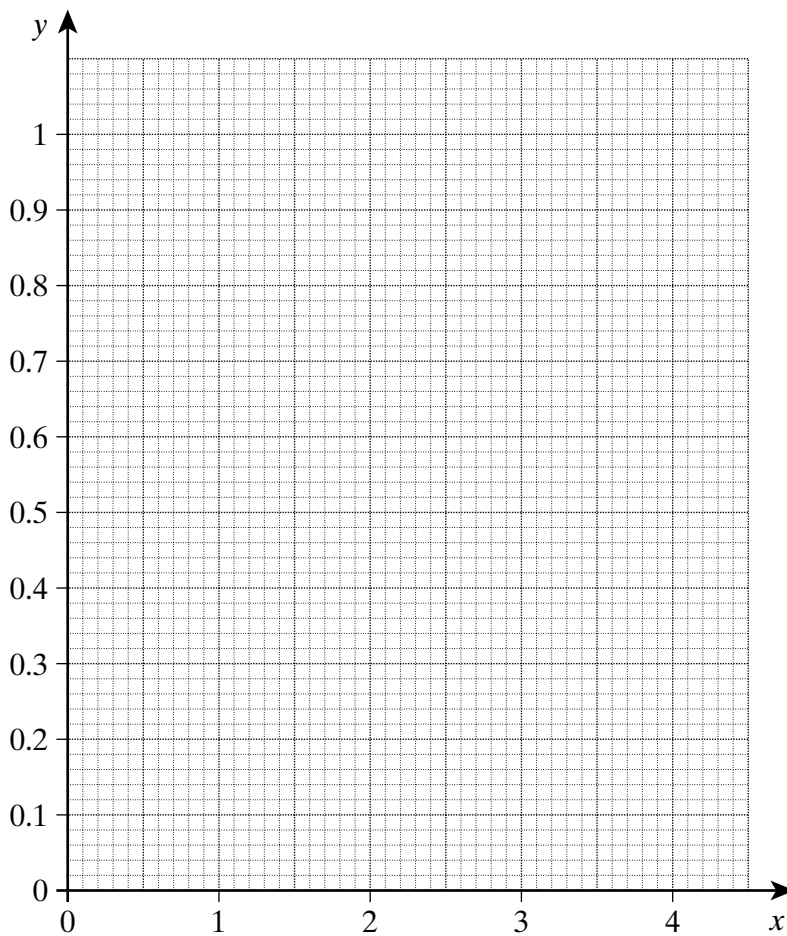
Turn over ►

10 (a) Complete the table of values for  $y = (0.8)^x$

$x$	0	1	2	3	4
$y$	1	0.8	0.64		0.41

(1 mark)

(b) On the grid below, draw the graph of  $y = (0.8)^x$  for values of  $x$  from 0 to 4.

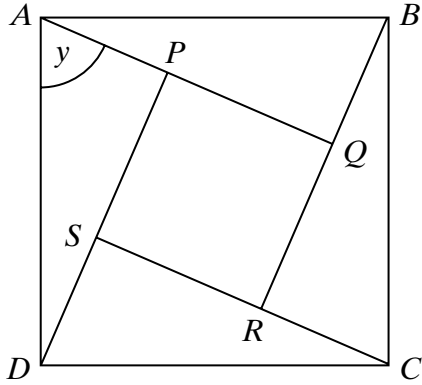


(2 marks)

(c) Use your graph to solve the equation  $(0.8)^x = 0.76$

Answer ..... (1 mark)

- 11  $ABCD$  and  $PQRS$  are squares.  
Angle  $DAP = y$



Not drawn accurately

Prove that triangles  $ABQ$  and  $DAP$  are congruent.

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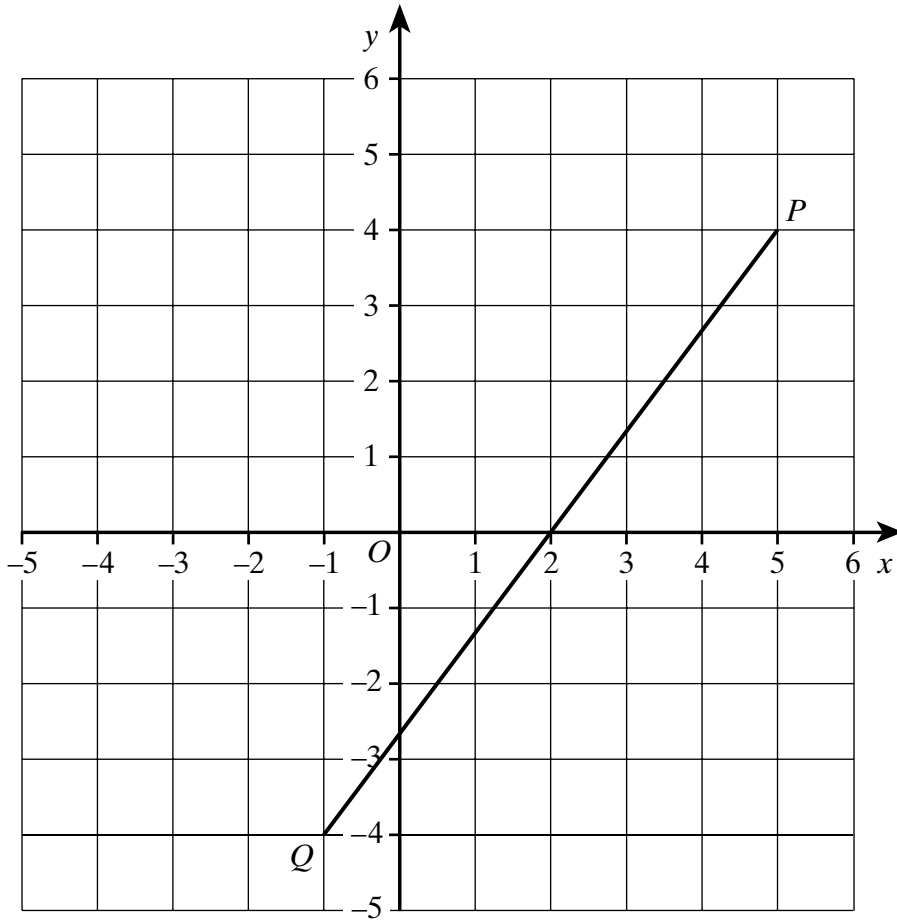
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(4 marks)

Turn over ►

12 The line  $PQ$  is shown on the grid.



(a) Find the gradient of a line which is perpendicular to  $PQ$ .

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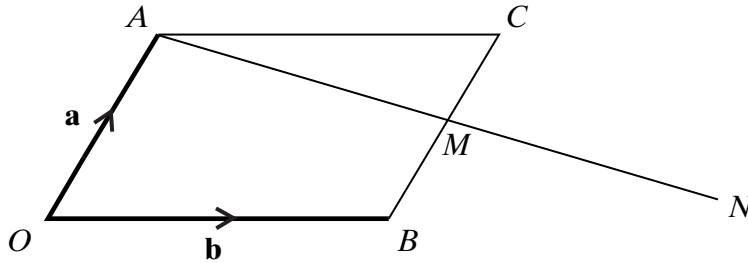
Answer ..... (3 marks)

(b) Hence find the equation of the perpendicular bisector of the line  $PQ$ .

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Answer ..... (2 marks)

- 13  $OACB$  is a parallelogram and  $M$  is the mid-point of  $BC$ .  
 $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$



Not drawn accurately

- (a) Express the following vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$

(i)  $\vec{BA}$

Answer ..... (1 mark)

(ii)  $\vec{AM}$

Answer ..... (1 mark)

- (b)  $AM$  is extended to  $N$ , where  $\vec{AN} = 2\vec{AM}$ .

Show that  $\vec{BN} = \mathbf{b}$

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 ..... (2 marks)

- (c) What does this tell you about the position of  $N$ ?

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 .....  
 ..... (1 mark)

Turn over

14 Solve the simultaneous equations

$$y = x + 2$$
$$y = 3x^2$$

You **must** show your working.  
Do **not** use trial and improvement.

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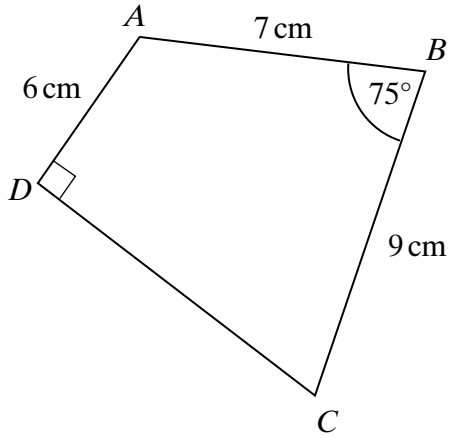
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Answer ..... (5 marks)

- 15 *ABCD* is a quadrilateral.  
*AB* = 7 cm, *AD* = 6 cm and *BC* = 9 cm.  
Angle *ABC* =  $75^\circ$  and angle *ADC* =  $90^\circ$



Not drawn accurately

Calculate the perimeter of *ABCD*.

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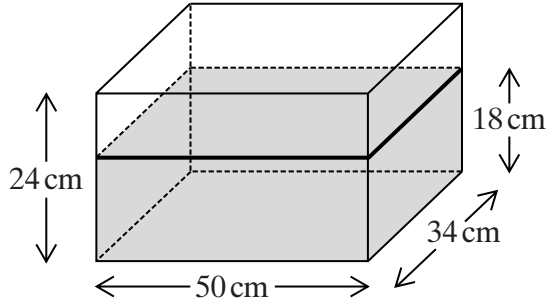
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Answer ..... cm (5 marks)

- 16 A water tank is 50 cm long, 34 cm wide and 24 cm high. It contains water to a depth of 18 cm.



Not to scale

Four identical spheres are placed in the tank and are fully submerged. The water level rises by 4.5 cm.

Calculate the radius of the spheres.

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Answer ..... cm (5 marks)

**END OF QUESTIONS**