Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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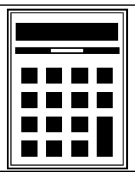
General Certificate of Secondary Education
June 2003

MATHEMATICS (MODULAR) (SPECIFICATION B) 33005/H2
Module 5 Higher Tier
Paper 2 Calculator

H

Tuesday 10 June 2003 9.00 am to 10.15 am

In addition to this paper you will require:
- a calculator
- mathematical instruments.



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 π button, take the value of π 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.

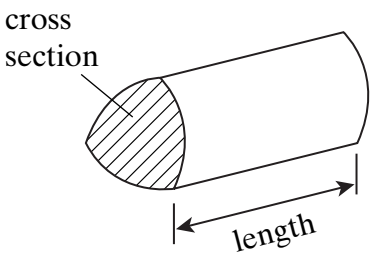
Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

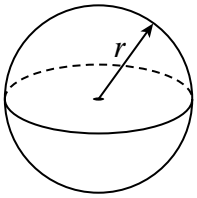
You may need to use the following formulae:

Volume of prism = area of cross section × length



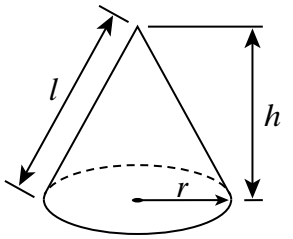
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

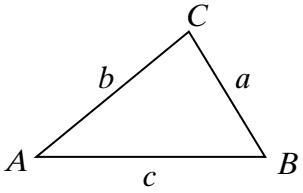
Curved surface area of cone = $\pi r l$



In any triangle ABC

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

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



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

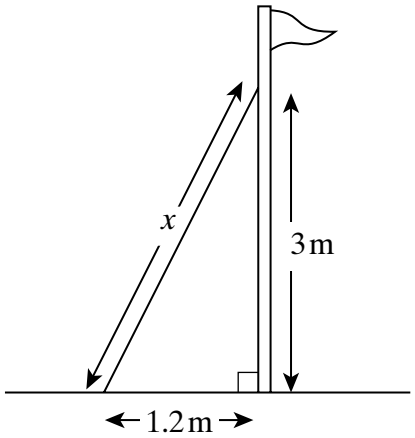
The Quadratic Equation

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 support for a flagpole is attached at a height of 3 m and is fixed to the ground at a distance of 1.2 m from the base.



Not to scale

Calculate the length of the support (marked x on the diagram).

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Answer ..... m *(3 marks)*

3

2 Parveen is using trial and improvement to find a solution to the equation

$$x^3 + 7x = 30$$

This table shows her first two trials.

x	$x^3 + 7x$	**Comment**
2	22	Too small
3	48	Too big

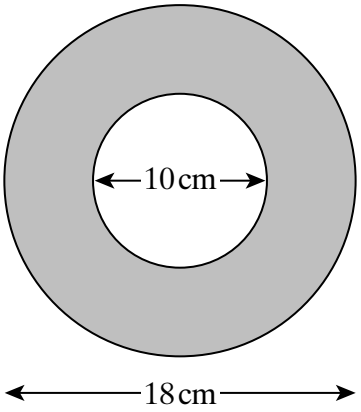
Continue the table to find a solution to the equation.

Give your answer to 1 decimal place.

Answer ..... *(3 marks)*

3 A circular photo frame is shown below.

The diameter of the photo is 10 cm and the outer diameter of the frame is 18 cm.



Not to scale

Calculate the area of the frame.

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Answer ..... *(5 marks)*

4 Solve the equation $2(x + 5) = 7 - 4x$

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

11

Turn over ▶

5 In the formulae given below, the letters p, q and r represent lengths.

(a) Grant has written down this formula

$$\text{Volume} = \frac{1}{4}\pi r^4$$

Explain how you can tell that Grant has made a mistake.

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(1 mark)

(b) Jared has this formula

$$\text{Area} = p^2 + 2q$$

Explain how you can tell that Jared has made a mistake.

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(1 mark)

6 (a) List the integer values of n such that $3 \leqslant 3n < 18$

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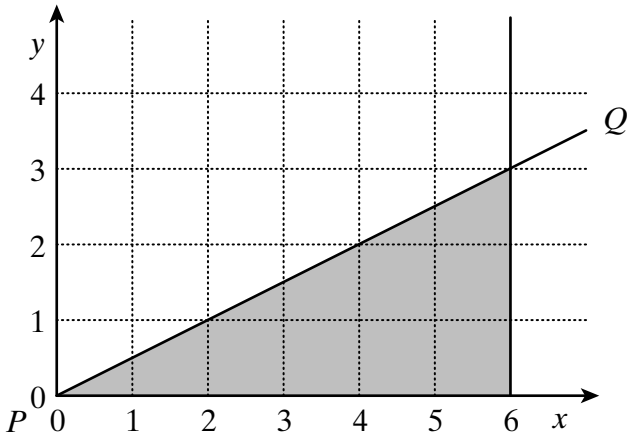
Answer ..... *(3 marks)*

(b)



(i) Find the equation of the line PQ.

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Answer ..... *(1 mark)*

(ii) Write down **three** inequalities which together describe the shaded area.

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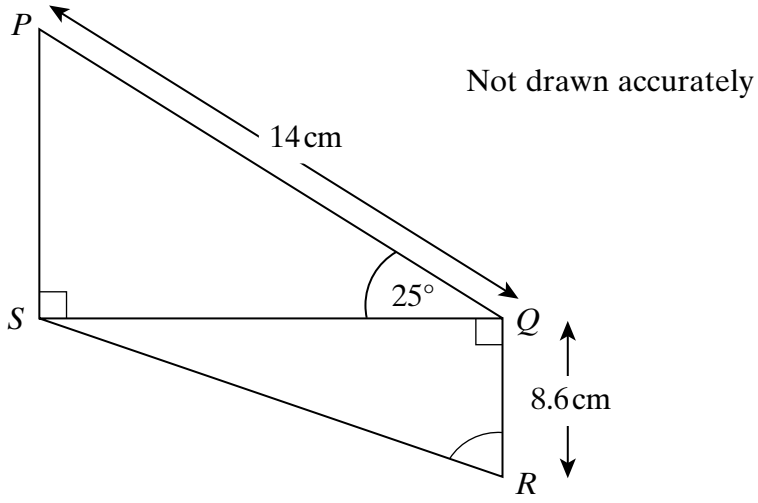
Answer ..... *(3 marks)*

9

7 In the diagram, $PQ = 14\,\text{cm}$ and $QR = 8.6\,\text{cm}$.

Angle PSQ = angle $SQR = 90°$

Angle $PQS = 25°$



Calculate angle R.

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Answer ..... degrees *(5 marks)*

8 (a) Factorise completely $3x^2 - 6xy$

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Answer ..... *(2 marks)*

(b) Factorise $y^2 - 9y + 14$

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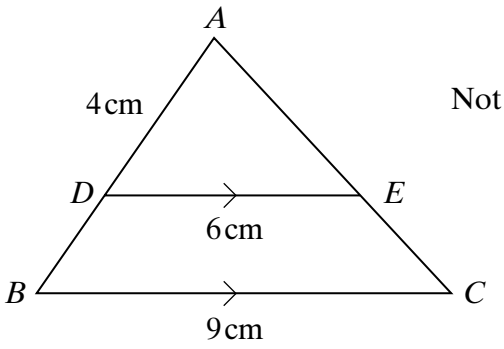
Answer ..... *(2 marks)*

9 Triangles ADE and ABC are similar.

DE is parallel to BC.

$AD = 4\,\text{cm}$, $DE = 6\,\text{cm}$ and $BC = 9\,\text{cm}$.



Not to scale

Calculate the length of BD.

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Answer ..... cm *(3 marks)*

12

10 Solve the equation $x^2 + 4x - 10 = 0$

Give your answers to 2 decimal places.

You **must** show your working.

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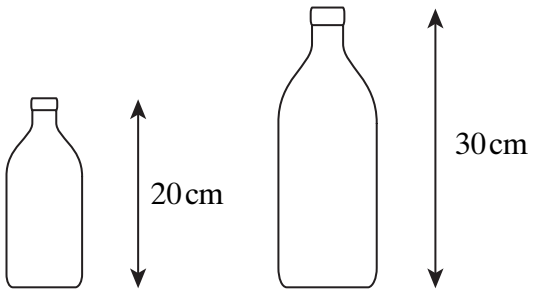
Answer ..... *(3 marks)*

11 Two similar bottles are shown below.

The smaller bottle is 20 cm tall and holds 480 ml of water.

The larger bottle is 30 cm tall.



Not to scale

How much water does the larger bottle hold?

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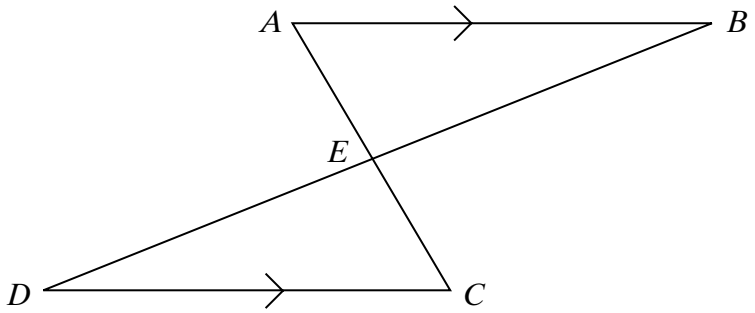
Answer ..... ml *(2 marks)*

12 In the diagram, the lines AC and BD intersect at E.

AB and DC are parallel and $AB = DC$.



Prove that triangles ABE and CDE are congruent.

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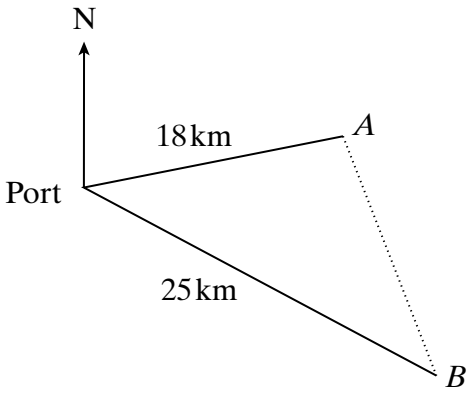
(4 marks)

TURN OVER FOR THE NEXT QUESTION

13 Two ships, A and B, leave a port at 1300 hours.

Ship A travels at a constant speed of 18 km per hour on a bearing of 070°.

Ship B travels at a constant speed of 25 km per hour on a bearing of 152°.



Not drawn accurately

Calculate the distance between A and B at 1400 hours.

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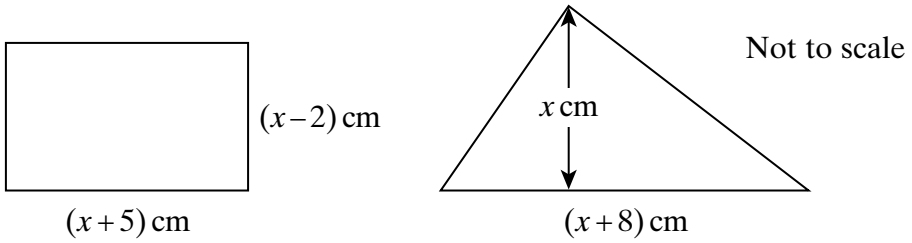
Answer ..... km *(4 marks)*

14 A rectangle has length $(x + 5)$ cm and width $(x - 2)$ cm.
A triangle has base $(x + 8)$ cm and height x cm.



The area of the rectangle is equal to the area of the triangle.

Show that $x^2 - 2x - 20 = 0$ (You are **not** required to solve this equation.)

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(4 marks)

8

Turn over ▶

15 $x^2 - 6x + 13 = (x - a)^2 + b$

(a) Find the values of a and b.

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Answer a = ... b = ... *(3 marks)*

(b) Hence find the minimum value of $x^2 - 6x + 13$.

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Answer ..... *(1 mark)*

16 Solve the equation $\frac{x}{x+1} - \frac{2}{x-1} = 1$

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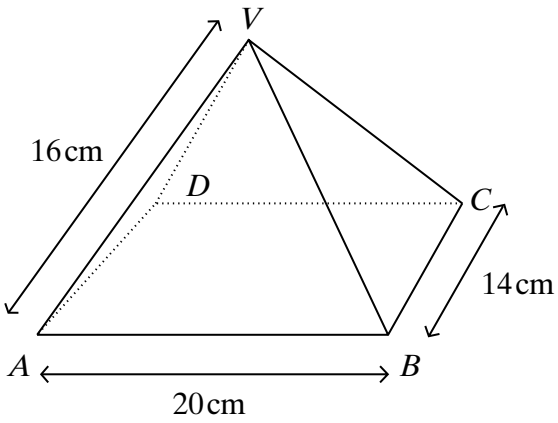
Answer ..... *(5 marks)*

17 $VABCD$ is a right pyramid on a rectangular base.

$VA = VB = VC = VD = 16\,\text{cm}$.

$AB = 20\,\text{cm}$ and $BC = 14\,\text{cm}$.



Not drawn accurately

Calculate the angle between the edge VC and the base $ABCD$.

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Answer ..... degrees *(5 marks)*

18 Simplify $\dfrac{5x^2 + 14x - 3}{x^2 - 9}$

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Answer ..... *(4 marks)*

END OF QUESTIONS

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