Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature									

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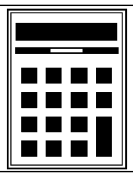
General Certificate of Secondary Education
June 2006

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

H

Monday 12 June 2006 9.00 am to 10.15 am

For this paper you must have:
- 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.
- Answer the questions in the spaces provided.
- Use a calculator where appropriate.
- Do all rough work in this book.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The maximum mark for this paper is 70.
- 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 book.

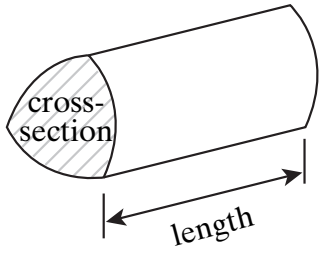
Advice
- In all calculations, show clearly how you work out your answer.

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

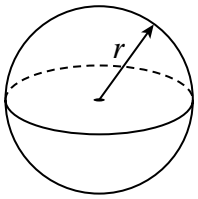
You may need to use the following formulae:

Volume of prism = area of cross-section × length



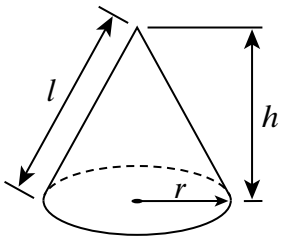
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

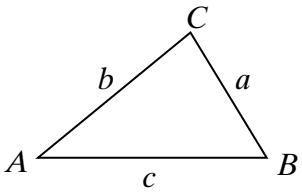


In any triangle ABC

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

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

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

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

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

1 Liam is using trial and improvement to find a solution to the equation

$$x^3 + 4x = 72$$

The table shows his first two trials.

x	$x^3 + 4x$	**Comment**
3	39	Too small
4	80	Too large

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

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

3

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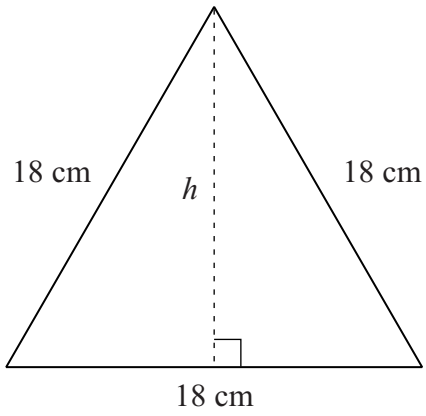
2 The diagram shows an equilateral triangle of side 18 cm.



Not drawn accurately

Calculate the height of the triangle (marked h in the diagram).

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

3 (a) Solve the inequality $5x + 3 < 18$

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

(b) y is an integer.

Write down all the solutions of the inequality $-6 \leqslant 2y < 0$

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

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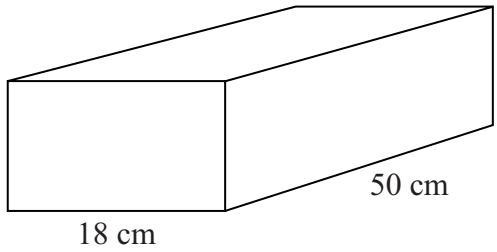
4 A wooden cuboid is 18 cm wide, 15 cm high and 50 cm long.
It weighs 12 kg.



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Calculate the density of the wood.
Give your answer in g/cm^3.

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Answer ..... g/cm^3 *(3 marks)*

Turn over for the next question

12

LEAVE MARGIN BLANK

5 (a) Multiply out $(2p^2q^3) \times (3p^5q)$

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

(b) Expand and simplify $(p + 7)(p + 2)$

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

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

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

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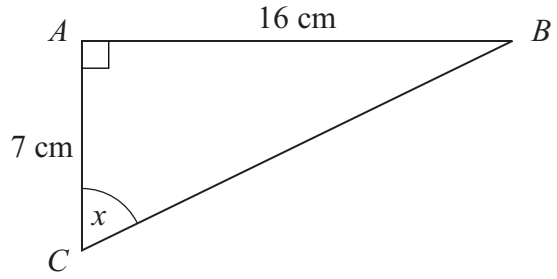
6 (a) In triangle ABC, angle $A = 90°$, $AB = 16\,\text{cm}$ and $AC = 7\,\text{cm}$



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Calculate the value of x.

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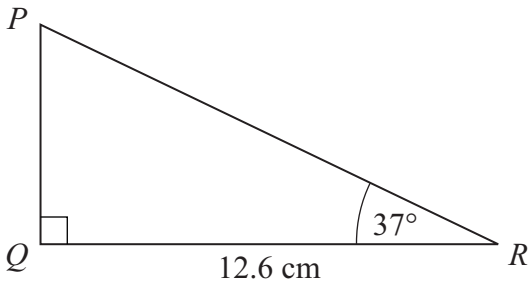
Answer ..... degrees *(3 marks)*

(b) In triangle PQR, angle $Q = 90°$, angle $R = 37°$ and $QR = 12.6\,\text{cm}$



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Calculate the length of PR.

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

13

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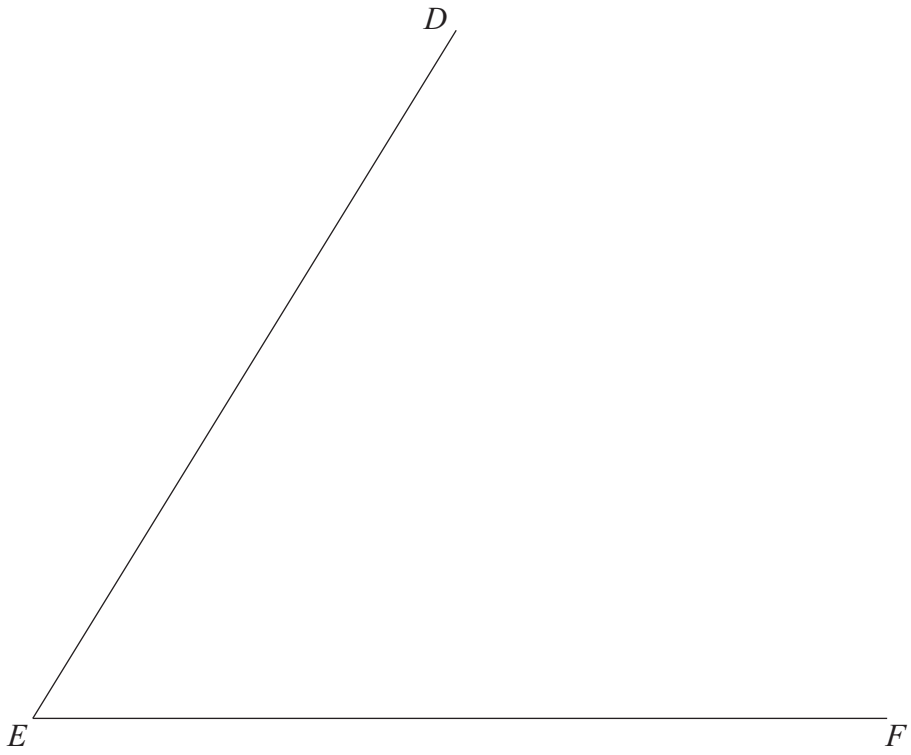
7 Using ruler and compasses only, construct the bisector of angle *DEF*.



(2 marks)

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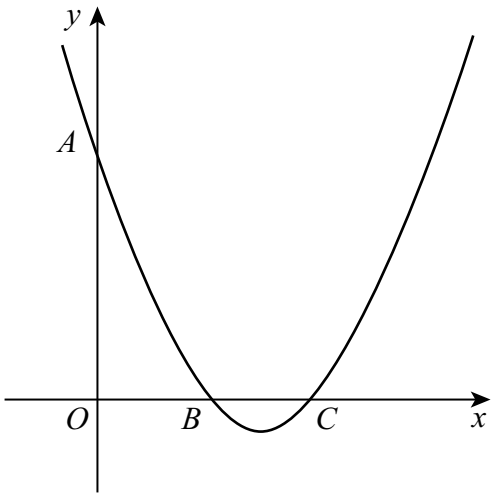
8 The sketch shows the graph of $y = (x - 2)(2x - 7)$



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(a) The graph crosses the y-axis at A.

Write down the coordinates of A.

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Answer A (..... , ...) *(1 mark)*

(b) The graph crosses the x-axis at B and C.

Write down the coordinates of B and C.

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Answer B (..... , ...)

C (..... , ...) *(2 marks)*

5

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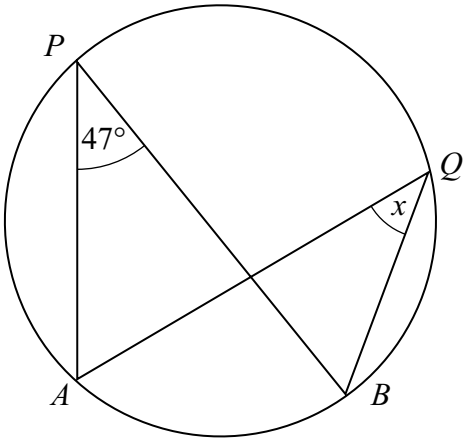
9 In the diagram, A, P, Q and B are points on the circumference of the circle.
Angle $APB = 47°$



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Find the value of x.
Give a reason for your answer.

Answer $x =$ ..... degrees

Reason .....

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(2 marks)

10 Solve the equation $y^2 - 3y - 14 = 0$
Give your answers to two decimal places.
You **must** show your working.

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

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11 (a) The equations of four lines are given below.

Line P $y = 3x + 5$

Line Q $y = 4 - 3x$

Line R $y + 3x = 8$

Line S $y - 3x = 1$

(i) Name the lines that are parallel to the line $y = 3x$

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

(ii) Which line goes through the point (2, 7)?

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

(b) Write down the gradient of the line $y + 2x = 7$

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

(c) Explain why the line $y = \frac{1}{2}x$ is perpendicular to the line $y + 2x = 7$

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(2 marks)

Turn over for the next question

10

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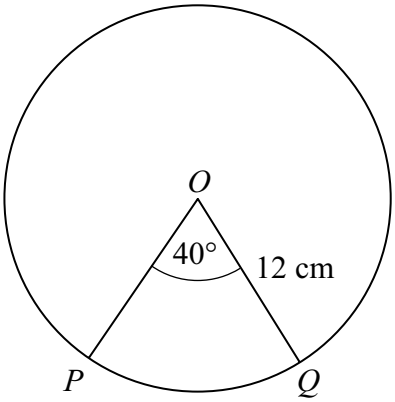
12 PQ is an arc of a circle of radius 12 cm.
The centre of the circle is at O.
Angle $POQ = 40°$



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Calculate the length of the minor arc PQ.

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

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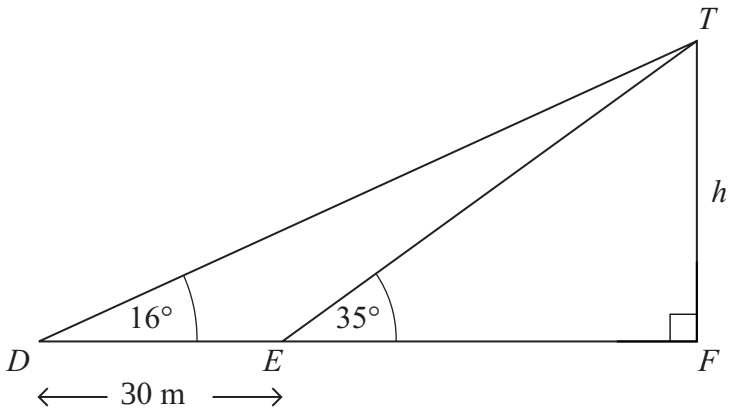
13 *D*, *E* and *F* are three points on level ground.
TF is the vertical side of a building.
The angle of elevation of the top of the building from *D* is 16°.
The angle of elevation of the top of the building from *E* is 35°.
The distance *DE* = 30 m



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Calculate the height of the building, marked *h* on the diagram.

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

8

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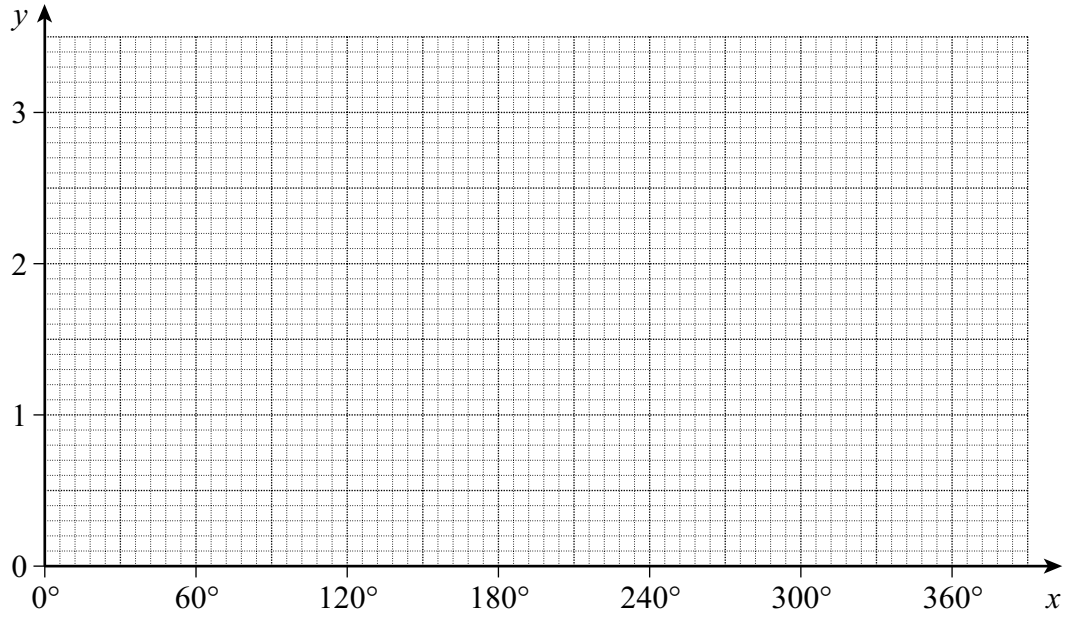
14 (a) Complete the table of values for $y = 2 - \cos x$

x	0°	30°	60°	90°	120°	150°	180°
y	1	1.13	1.5	2	2.5		3

(1 mark)

(b) On the grid, draw the graph of $y = 2 - \cos x$ for values of x from 0° to 180°.



(2 marks)

(c) Describe how you could transform your graph from 0° to 180° to produce the graph from 180° to 360°.

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(2 marks)

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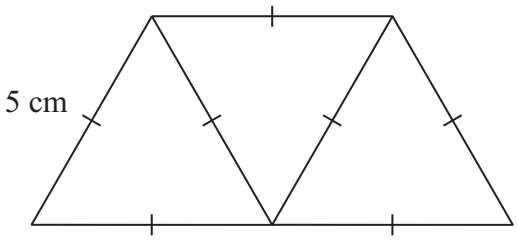
15 A trapezium is made from three equilateral triangles of side 5 cm.



Not drawn accurately

Calculate the area of the trapezium.

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Answer ..... cm^2 *(4 marks)*

16 The surface area of a sphere is 1380 cm^2.

Calculate the volume of the sphere.
State the units of your answer.

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

Turn over for the next question

LEAVE MARGIN BLANK

17 Solve the equation $\frac{3}{y+7} - \frac{1}{y+6} = \frac{1}{2}$

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

END OF QUESTIONS

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