General Certificate of Secondary Education
June 2007

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

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

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Monday 11 June 2007   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.

33005/H2

Formulae Sheet: Higher Tier

You may need to use the following formulae:

Volume of prism = area of cross-section × length
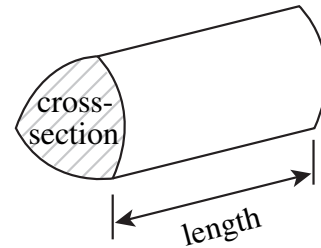
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
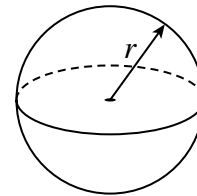
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
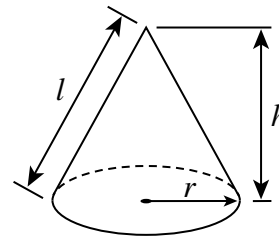
In any triangle *ABC*

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

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

Cosine rule $\quad a^2 = b^2 + c^2 - 2bc \cos A$
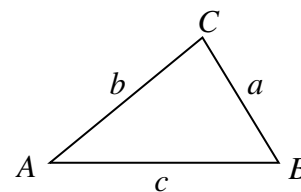
The Quadratic Equation

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 Kerry is using trial and improvement to find a solution to the equation

$$8x - x^3 = 5$$

Her first two trials are shown in the table.

x	$8x - x^3$	Comment
2	8	too high
3	-3	too low

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

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

2 Simplify

(a) $x^4 \times x^2$

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Answer .... *(1 mark)*

(b) $\dfrac{y^8}{y^3}$

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Answer .... *(1 mark)*

(c) $3p^4q^3 \times 2p^3q$

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Answer .... *(2 marks)*

(d) $4(2t + 1) - 3(t - 3)$

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Answer .... *(2 marks)*

(e) $(w - 2)(w + 4)$

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Answer .... *(2 marks)*

3 The diameter of a solid cylinder is 9.2 cm.
The cylinder is 25 cm long.
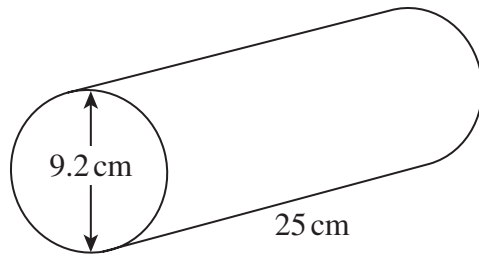
Not drawn accurately

(a) Calculate the area of one end of the cylinder.

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

(b) Calculate the **total** surface area of the cylinder.
You **must** show your working.

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Answer .... cm^2 *(3 marks)*

Turn over ▶   **13**

4 Each pattern is made up from matchsticks.
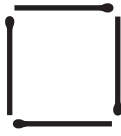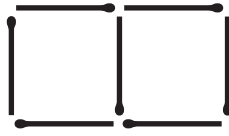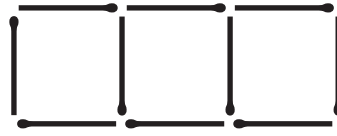
| Pattern 1 | Pattern 2 | Pattern 3 |
| 4 matchsticks | 7 matchsticks | 10 matchsticks |

(a) How many matchsticks will be in Pattern n ?

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Answer ....   *(2 marks)*

(b) Explain why there will **not** be a pattern which uses 146 matchsticks.

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(2 marks)

5 Solve the equation $2x + 11 = 3(2x - 5)$

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

6   The points *P* (–2, 3), *S* (–2, 0) and *R* (4, –3) are shown on the grid.
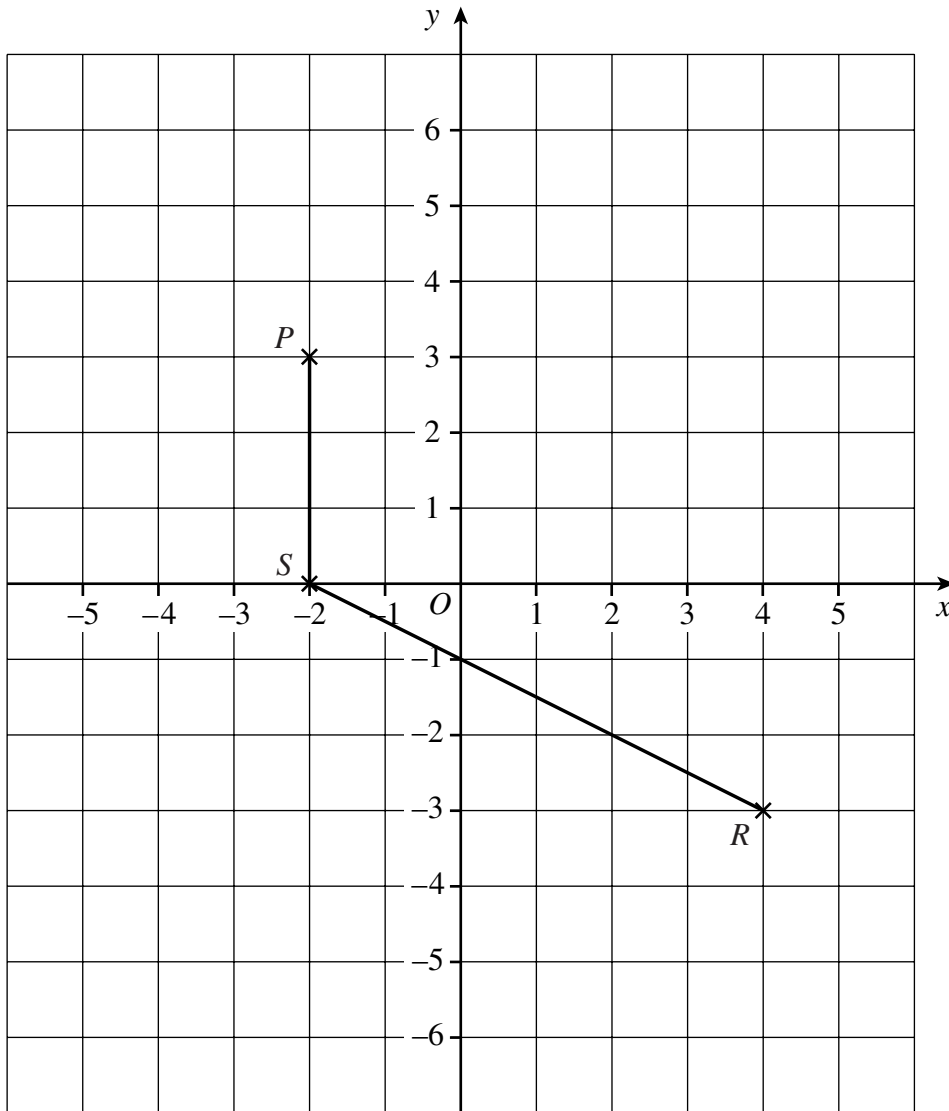
(a)   *PQRS* is a kite.

Complete the kite *PQRS* and write down the coordinates of *Q*.

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

(b)   The kite is rotated through 90° anticlockwise about *S*.

Draw the kite in its new position.

(2 marks)

(c)   Write down the new coordinates of *R*.

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

Turn over ▶

12

7 In triangle *LMN*, angle *M* = 90°
  LN = 32 cm and *MN* = 14 cm.
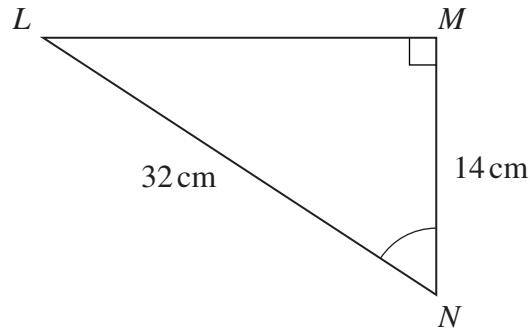
Not drawn accurately

Calculate the size of angle *N*.

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

8 Triangle *PQR* is an enlargement of triangle *ABC* with scale factor $\frac{5}{4}$.
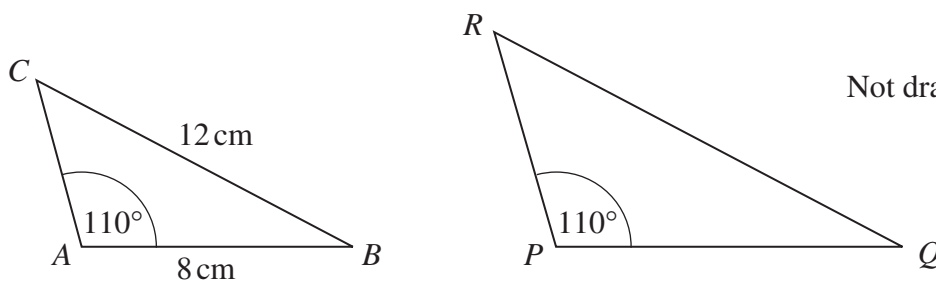
Not drawn accurately

Calculate the length of *RQ*.

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

9 Solve the simultaneous equations

$$4x + 3y = 9$$
$$3x - y = 10$$

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

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Answer .... *(3 marks)*

Turn over for the next question

10 The diagram shows the line joining the points *P* (2, 6) and *Q* (9, 1).
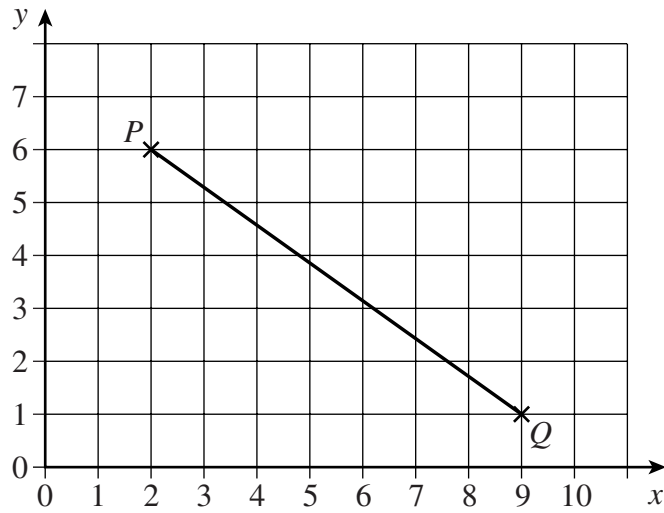
Calculate the length of the line *PQ*.
Give your answer to two decimal places.

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

11 *AB* is a minor arc of a circle of radius 5.2 m.
Angle *AOB* = 100°
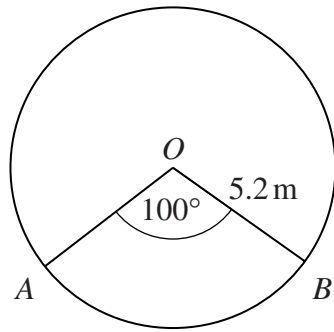
Not drawn accurately

Calculate the length of the minor arc *AB*.

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

Turn over for the next question

12 In the triangle *ABC*, angle *B* = 95°, angle *C* = 24° and *AC* = 17 cm.
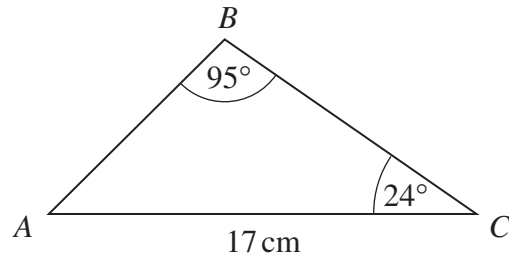
Not drawn accurately

(a) Calculate the length of *AB*.

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

(b) Calculate the area of triangle *ABC*.

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Answer .... cm^2 *(3 marks)*

13 The diagram shows a shape in which all the corners are right angles.

$3x$ cm

$2x$ cm

$5x$ cm

3 cm

Not drawn accurately

(a) The area of the shape is $108\,\text{cm}^2$.

Form an equation in terms of x for the area of the shape.
Show that it can be simplified to $x^2 + x - 18 = 0$

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(3 marks)

(b) Solve this equation to find the value of x.
Give your answer to two decimal places.

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Answer .... *(3 marks)*

Turn over ▶

12

14 Solve the equation $\dfrac{5}{2y+3} + \dfrac{6}{y+2} = 3$

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Answer .... *(6 marks)*

15 (a) Match two of these equations with the sketch graphs *A* and *B*.

$y = 3x^2$ $\quad$ $y = -3x^2$ $\quad$ $y = 3 - x^2$ $\quad$ $y = x^2 - 3$ $\quad$ $y = x^2 + 3$

Graph *A* $\qquad\qquad\qquad\qquad\qquad\qquad$ Graph *B*

Graph *A* is $y = $ .... $\qquad$ Graph *B* is $y = $ ....
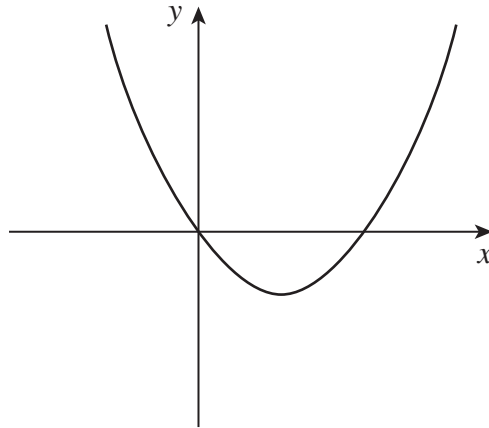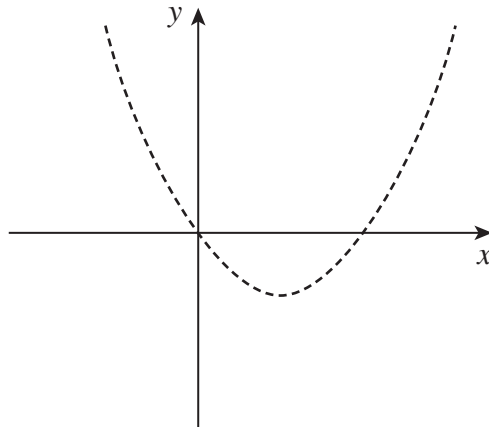
(2 marks)

(b) This is a sketch graph of $y = x^2 - 3x$

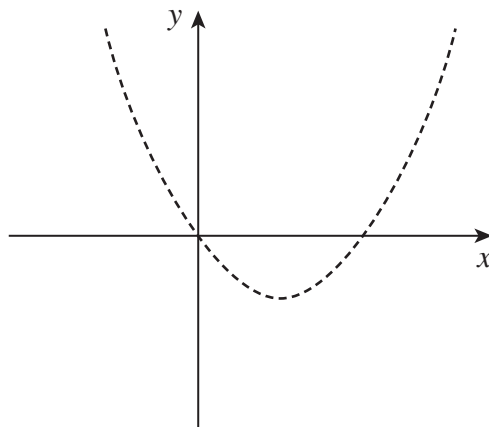Sketch the graphs indicated on the grids below.
In each case the graph of $y = x^2 - 3x$ is shown to help you.

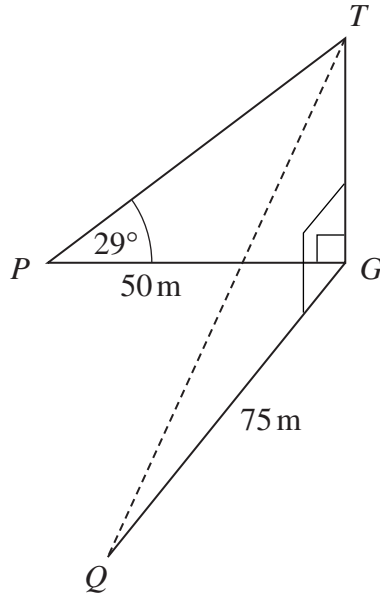(i) $y = x^2 - 3x - 2$

(1 mark)

(ii) $y = 3x - x^2$

(1 mark)

Turn over for the next question

Turn over ▶

10

16 *TG* is a vertical wireless mast standing on level ground.
  P is a point on the ground 50 metres due west of the mast.
  The angle of elevation of *T* from *P* is 29°.
  Q is a point on the ground 75 metres due south of the mast.

Not drawn accurately

Calculate the angle of elevation of *T* from *Q*.

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

END OF QUESTIONS

4