General Certificate of Secondary Education
June 2009

MATHEMATICS (MODULAR) (SPECIFICATION B) 43055/1H
Module 5 Higher Tier
Paper 1 Non-calculator

H

Monday 18 May 2009   1.30 pm to 2.45 pm

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.

Time allowed: 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book.

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.

Formulae Sheet: Higher Tier

Area of trapezium $= \frac{1}{2}(a+b)h$
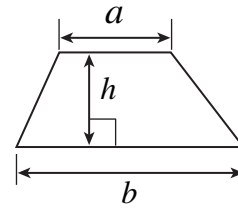
Volume of prism = area of cross-section × length
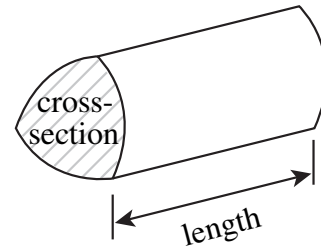
Volume of sphere $= \frac{4}{3}\pi r^3$

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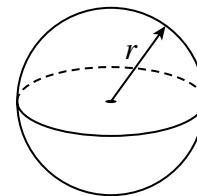
Volume of cone $= \frac{1}{3}\pi r^2 h$

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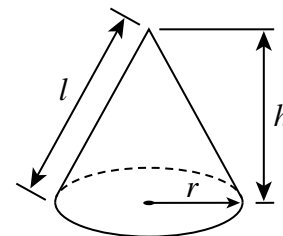
In any triangle *ABC*

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 $\quad a^2 = b^2 + c^2 - 2bc \cos A$
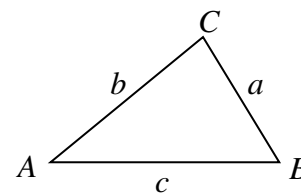
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 (a) Solve the equation $7x - 3 = 60$

....

....

Answer $x =$ .... *(2 marks)*

1 (b) y is an odd integer.

For each statement tick the correct box.

	True	False
$7y - 3$ is never odd	☐	☐
$7y - 3$ is never prime	☐	☐
$7y - 3$ is never a multiple of 7	☐	☐

(3 marks)

1 (c) Write down **one** integer which satisfies the inequality $7w > 63$

Answer .... *(1 mark)*

Turn over for the next question

6

Turn over ▶

2 The graph shows a car journey from London to Brighton and back.
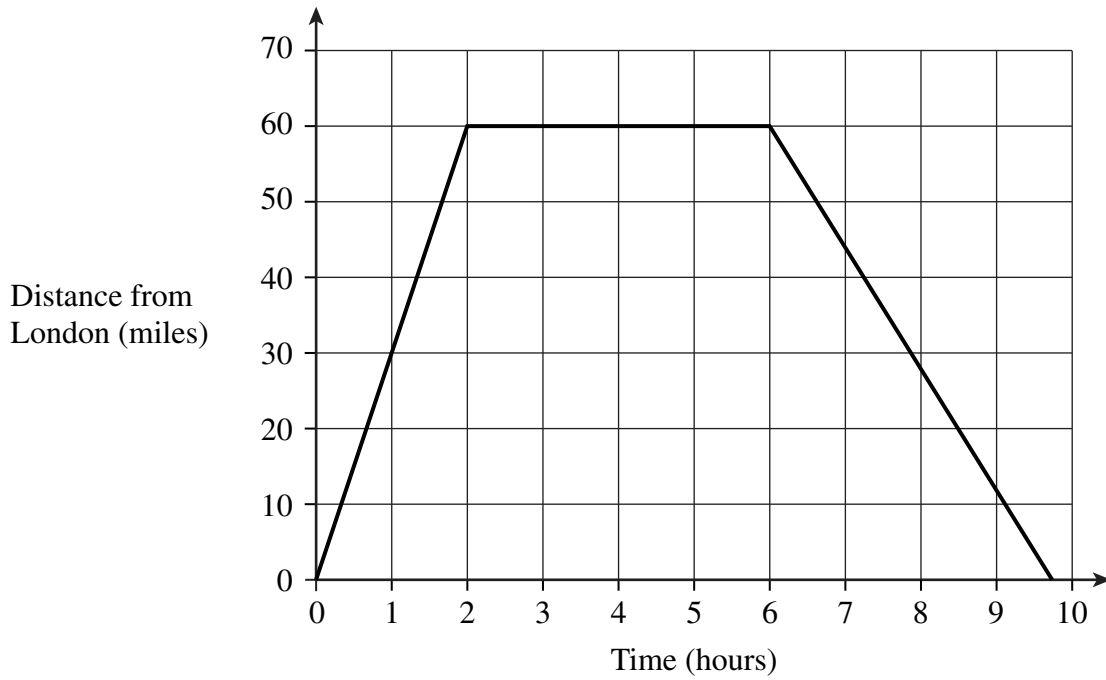
2 (a) What is the average speed of the car on the journey to Brighton?
State the units of your answer.

....

....

Answer .... *(3 marks)*

2 (b) Is the average speed on the return journey faster or slower?
Explain your answer.

....

....

(1 mark)

3 A shopkeeper uses these formulae to calculate the total cost when customers pay by monthly instalments.

$$d = 0.2C$$

$$C = d + 24m$$

C is the total cost in pounds.
d is the deposit in pounds.
m is the monthly instalment in pounds.

The total cost of a sofa is £600.

Work out the value of m.

....

....

....

Answer .... *(3 marks)*

Turn over for the next question

7

Turn over ▶

4   Airport runways have a two-digit number painted on them.
These numbers are used to work out the direction of the runway.

To work out the three-figure bearing, multiply the runway number by 10.

Here is a diagram of a runway on a three-figure bearing of 280° and a runway on a three-figure bearing of 040°.
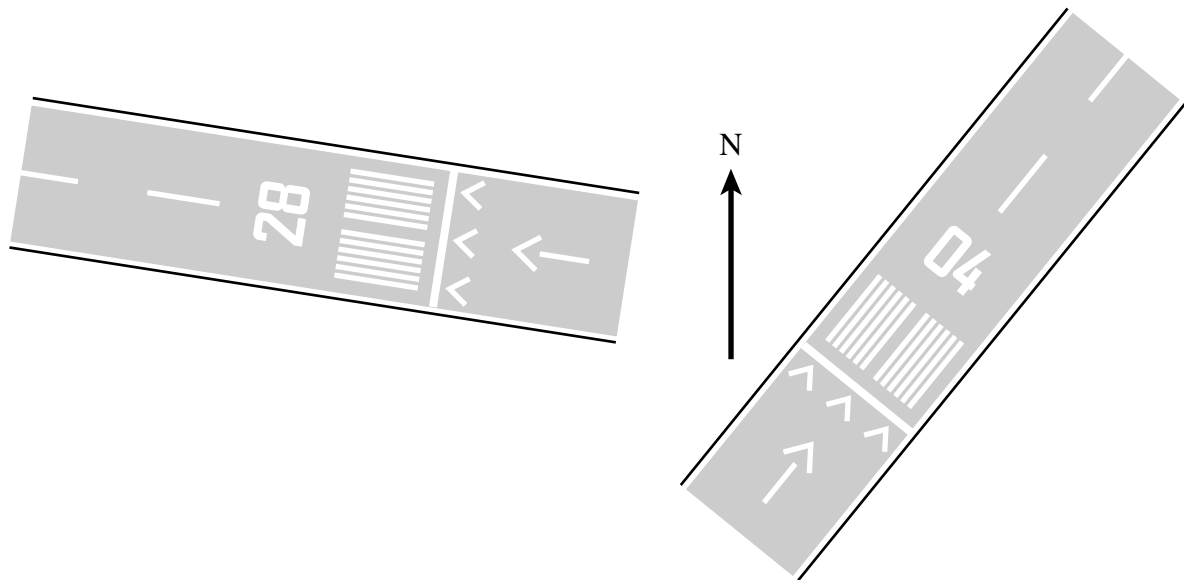
4   (a)   (i)   Write down the three-figure bearing for a runway pointing due South.

Answer .... °   *(1 mark)*

4   (a)   (ii)   Write down the runway number for a runway pointing due South.

Answer ....   *(1 mark)*

4   (a)   (iii)   A runway has a three-figure bearing of 060°.

Write down the runway number.

Answer ....   *(1 mark)*

4 (b) A runway is being painted.

N
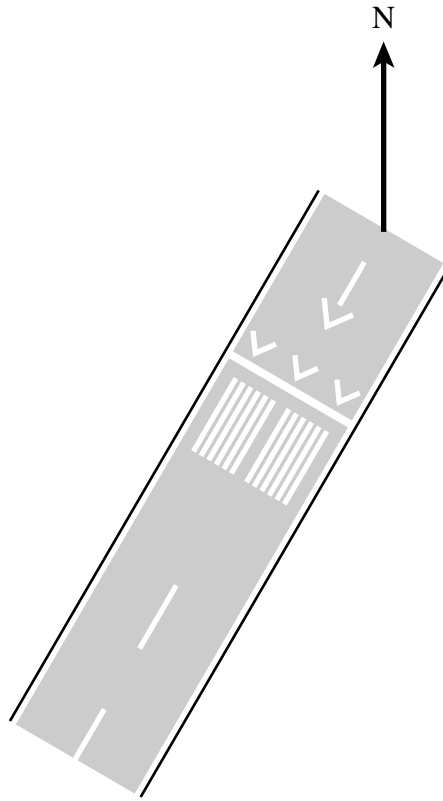
By measuring the three-figure bearing, work out the runway number.

....

Answer .... *(2 marks)*

Turn over for the next question

5

Turn over ▶

5 Triangles *A*, *B* and *C* are shown on the grid.
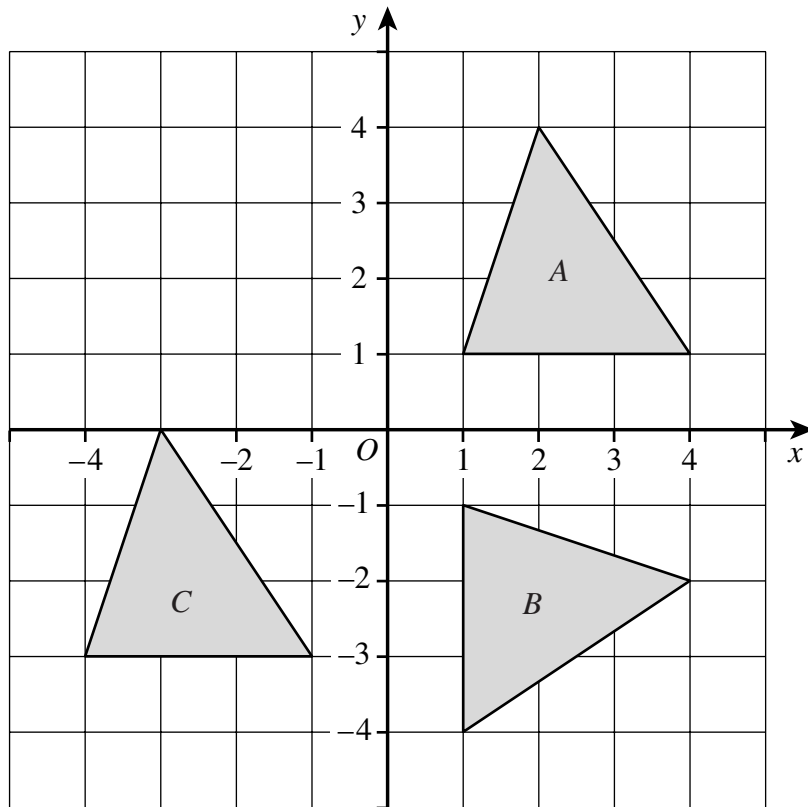
5 (a) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

....

....

....
(3 marks)

5 (b) Write down the vector which describes the translation of triangle *A* onto triangle *C*.

Answer
$\begin{pmatrix} .... \\ .... \end{pmatrix}$
(1 mark)

6 (a) In the diagram, *AB* is parallel to *CD*.

A ———— 123° ———— B

Not drawn accurately

C ———— *x* ———— D
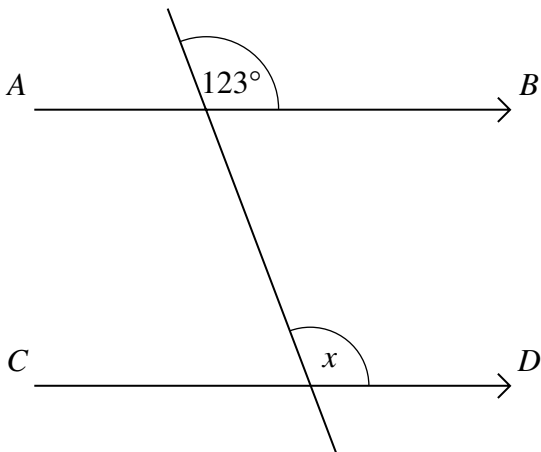
Write down the value of *x*.
Give a reason for your answer.

Answer .... degrees

Reason ....

(2 marks)

6 (b) In the diagram, *PQ* is parallel to *RS*.

P   R

Not drawn accurately

y   68°

Q   S
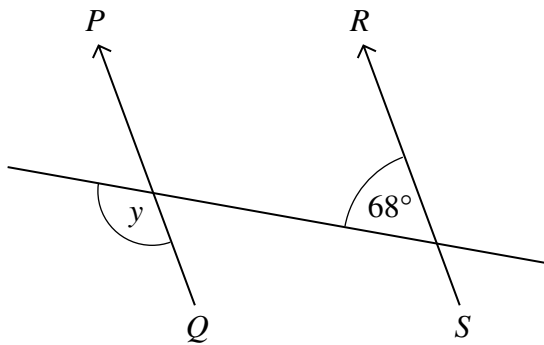
Work out the value of y.

....

....

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

8

Turn over ▶

7 (a) Expand and simplify $2x^2(x + 6) + 3x(x - 5)$

....

....

....

....

Answer .... *(3 marks)*

7 (b) Factorise fully $3mh^2 - 15m^2h$

....

....

Answer .... *(2 marks)*

7 (c) Factorise $x^2 - 16y^2$

....

Answer .... *(2 marks)*

8 (a) The diagram shows a regular pentagon.
One side has been extended.
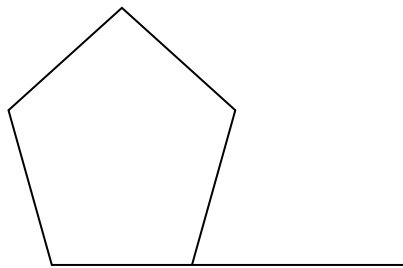
Not drawn accurately

8 (a) (i) Which **one** of these statements is true?

A The exterior angle of a regular pentagon is equal to $360° \div 5 = 72°$

B The interior angle of a regular pentagon is equal to $360° \div 5 = 72°$

C The exterior angle of a regular pentagon is equal to $360° - 72° = 288°$

D The interior angle of a regular pentagon is equal to $360° - 72° = 288°$

Answer .... *(1 mark)*

8 (a) (ii) The diagram shows two identical regular pentagons touching inside a rectangle.
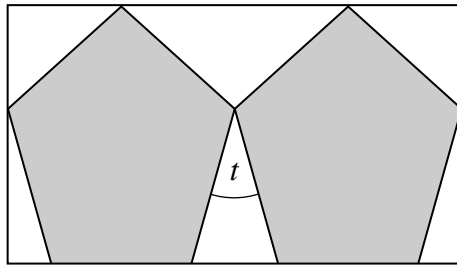
Not drawn accurately

Work out the value of *t*.

....

....

....

....

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

8 (b) The diagram shows a pentagonal prism.
The area of the cross-section is 90 cm^2.
The volume of the prism is 720 cm^3.
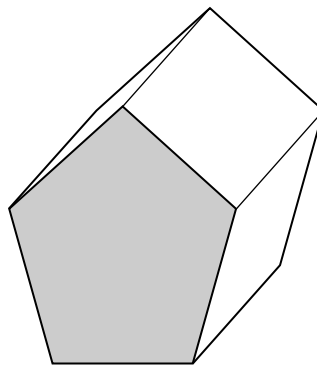
Work out the length of the prism.

....

....

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

12

*Areas outside
the box will
not be scanned
for marking*

9 The diagrams show a trapezium and a parallelogram.
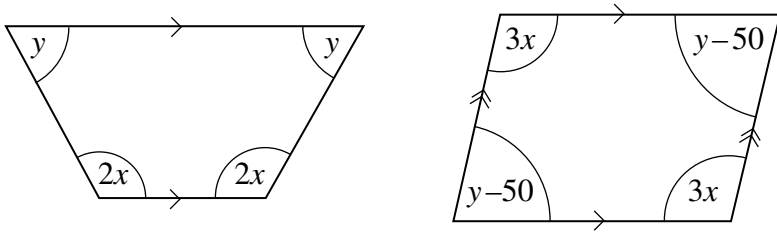
Not drawn accurately

9 (a) Use the trapezium to explain why $2x + y = 180$

....

....

(1 mark)

9 (b) The parallelogram can be used to form another equation connecting x and y.

Tick a box to show the correct equation.

....

....

☐ $3x + y = 130$ ☐ $3x + y = 230$

☐ $3x = y - 50$ ☐ $3x + y = 410$

(1 mark)

9 (c) Hence, or otherwise, work out the values of x and y.

....

....

....

....

....

....

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

10 *a*, *b* and *h* represent lengths.

Here are some units.

$$cm^2 \quad gram/cm^3 \quad kg \quad cm \quad cm^3 \quad cm/second$$

For each expression, write down the suitable unit from the list.

10 (a) $\frac{1}{2}(a + b)h$

Answer .... *(1 mark)*

10 (b) $a + b$

Answer .... *(1 mark)*

10 (c) *abh*

Answer .... *(1 mark)*

11 (a) A straight line has gradient 2 and passes through the point (0, 8)

Write down the equation of the line.

Answer .... *(1 mark)*

11 (b) A different line has equation $y = 3x + 6$

Write down the coordinates of any **two** points on the line.

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

11 (c) Write down the gradient of a line that is perpendicular to the line $y = 4x$

Answer .... *(1 mark)*

11 (d) Write down the equation of a line that is perpendicular to the line $y = 4x$

Answer .... *(1 mark)*

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*

12 In the diagram, *AB* is a diameter of the circle.
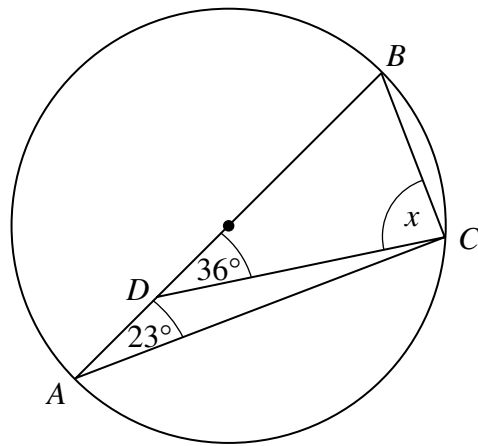
Not drawn accurately

Work out the value of *x*.

....

....

....

....

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

13 (a) Show that $9 + \dfrac{11}{x+2} = \dfrac{28}{x(x+2)}$ simplifies to $9x^2 + 29x - 28 = 0$

....

....

....

....

....

....

....

....

(3 marks)

13 (b) Solve $9x^2 + 29x - 28 = 0$

....

....

....

....

....

Answer .... *(3 marks)*

9

Turn over ▶

14 *OABC* is a quadrilateral.

D, *E*, *F* and *G* are midpoints of *OA*, *AB*, *BC* and *OC* respectively.

$\overrightarrow{OA}$ = 2**a**, $\overrightarrow{OB}$ = 2**b** and $\overrightarrow{OC}$ = 2**c**

Not drawn accurately
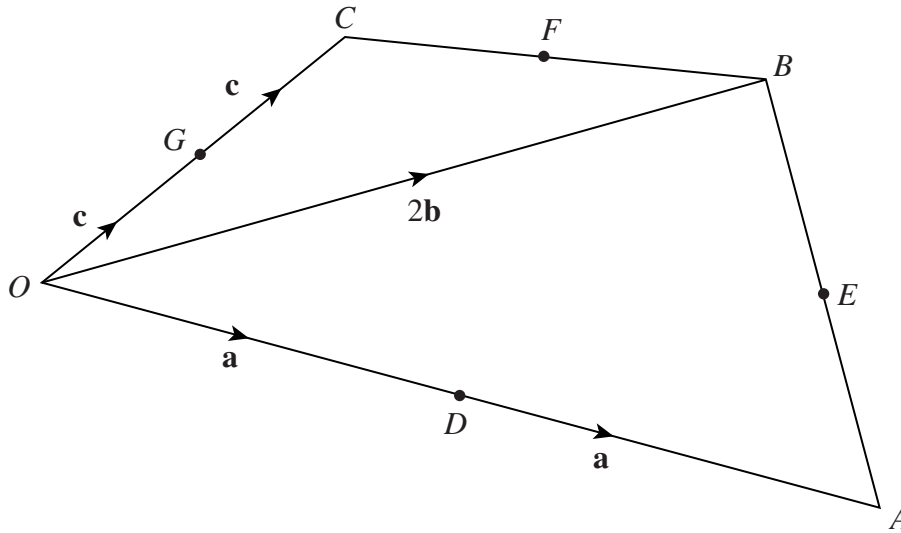
Find the following vectors in terms of **a**, **b** and **c**.

For example $\overrightarrow{DG}$ = **c** – **a**

14 (a) $\overrightarrow{AB}$

....

....

Answer ....   *(1 mark)*

14 (b) $\overrightarrow{BC}$

....

....

Answer ....   *(1 mark)*

14 (c)   Use your answers to parts (a) and (b) to show that $\overrightarrow{EF} = \mathbf{c} - \mathbf{a}$

....

....

....

(1 mark)

14 (d)   Explain how you can tell that *DEFG* is a parallelogram.

....

....

....

(1 mark)

Turn over for the next question

4

Turn over ▶

15   A sector *AOB* of a circle is shown below.
       The length of its arc *AB* is 10π cm.

Not drawn accurately
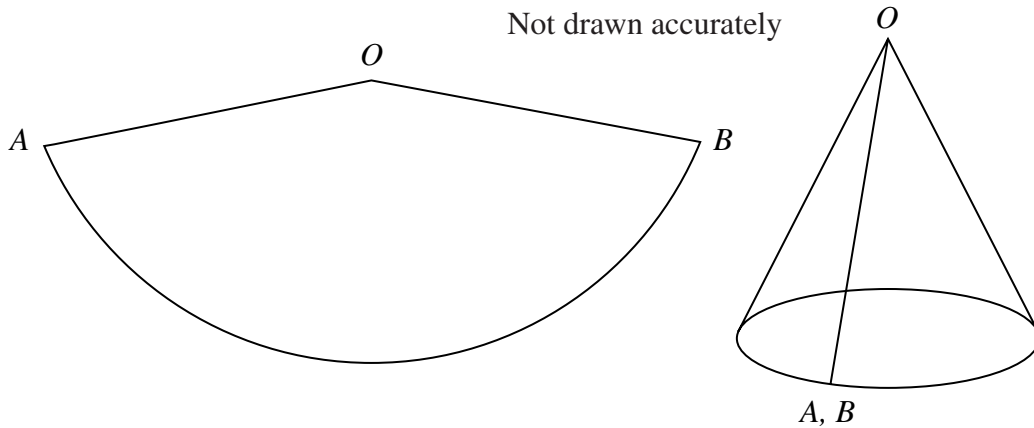
The sector is folded so that the straight edges meet and form a cone as shown.

15   (a)   Calculate the radius of the base of the cone.

....

....

....

....

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

15   (b)   The volume of the cone is 80π cm^3.

             Work out the perpendicular height of the cone.

....

....

....

....

....

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

END OF QUESTIONS

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED