Mathematics (Modular) **43055/1H**
(Specification B)
Module 5

H

Paper 1 Non-calculator

Monday 7 June 2010   1.30 pm to 2.45 pm

For this paper you must have:
- mathematical instruments.

You may **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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

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

Formulae Sheet: Higher Tier

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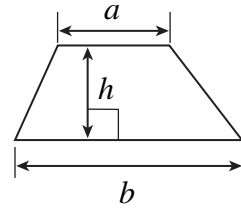
Volume of prism = area of cross-section × length
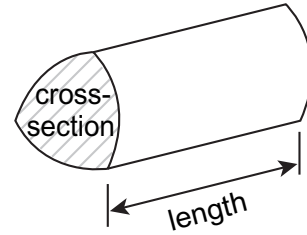
Volume of sphere = $\frac{4}{3}\pi r^3$

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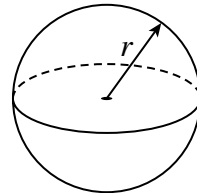
Volume of cone = $\frac{1}{3}\pi r^2 h$

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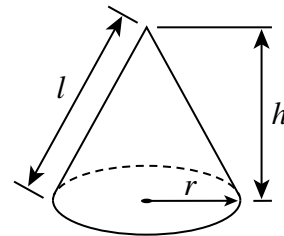
In any triangle ABC

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

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

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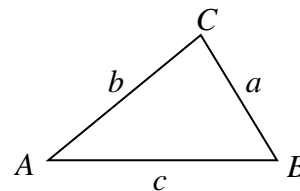
The Quadratic Equation

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 (a) Here is a number machine.

Work out the output.

Input   Output

$$-9 \quad \rightarrow \quad \boxed{\div 3} \quad \rightarrow \quad \boxed{+5} \quad \rightarrow \quad ....$$
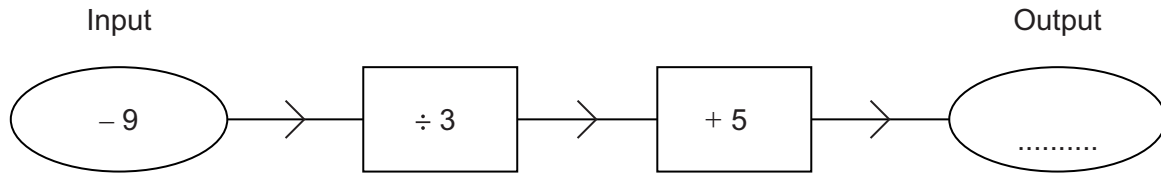
(1 mark)

1 (b) (i) Solve $\dfrac{x}{3} + 5 = 9$

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

1 (b) (ii) Solve $3(y - 5) = 18$

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

1 (c) Write down the value of abc when $a = 10$, $b = 2$ and $c = 0$

Answer .... *(1 mark)*

Turn over ▶

2 Here is a sequence.

10   1000   100 000   10 000 000

2 (a) Rewrite these four terms using powers of 10.

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

2 (b) Write down the next term in this sequence.

Answer .... *(1 mark)*

3 (a) Draw the L-shape after an enlargement of scale factor 2.
Use the point *A* as the centre of enlargement.

A
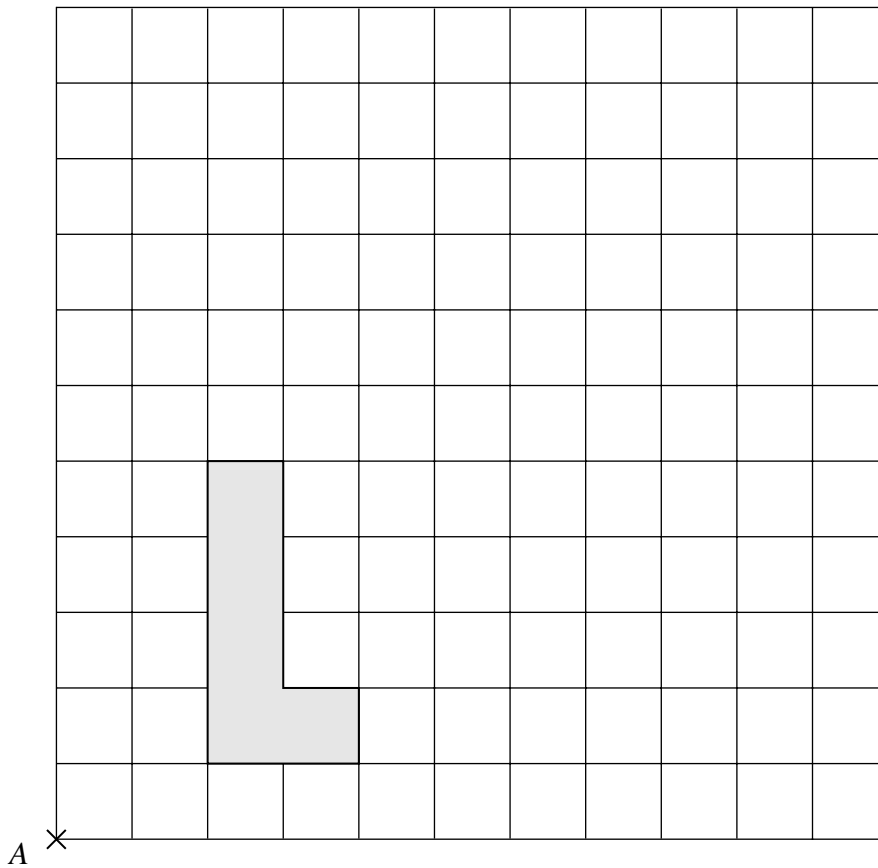
(3 marks)

3 (b)   Rotate the L-shape by a quarter turn clockwise.
Mark with a cross your centre of rotation.
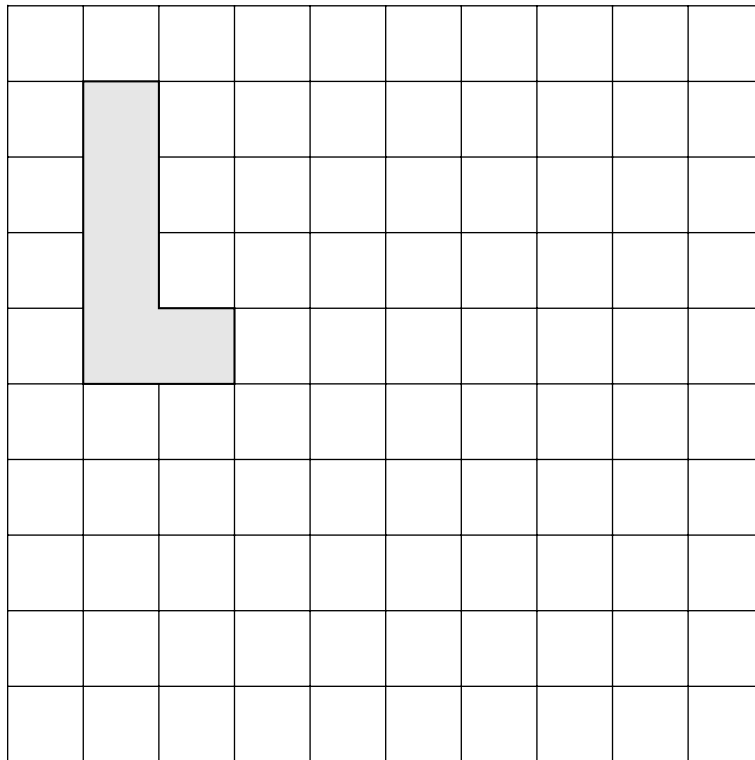
(3 marks)

Turn over for the next question

9

4 The diagram shows a cross.
All angles in the shape are made from right angles.
The length of each long side is double the length of each short side.
The length of each short side is 5 cm.
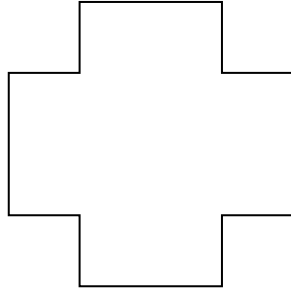
Not drawn accurately

4 (a) Work out the area of the cross.
State the units of your answer.

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Answer .... *(4 marks)*

4 (b) Work out the perimeter of the cross.

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

4 (c)   A shape is made by fitting together four of the cross shapes as shown.
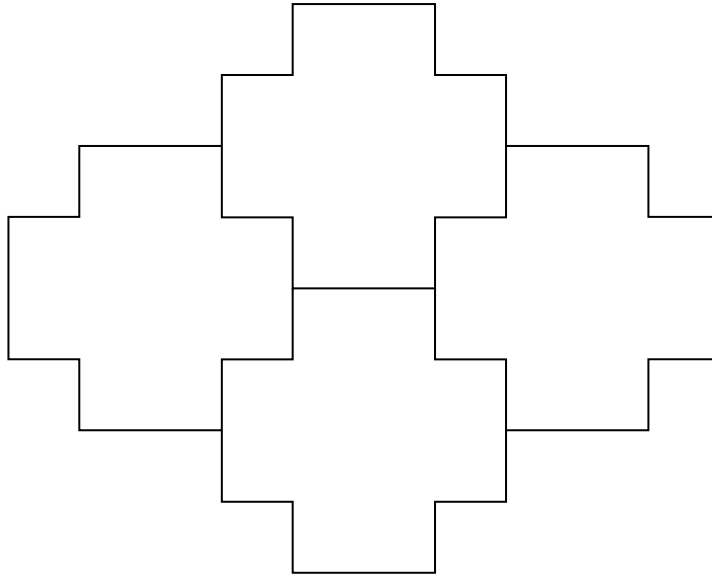
Not drawn accurately

Explain why the perimeter of this shape is **not** four times the perimeter of one cross.

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(1 mark)

Turn over for the next question

5 (a) Write down the coordinates of the point of intersection of the lines $y = 2$ and $x = -1$
You may use the grid to help you.

Answer (................ , ...) *(1 mark)*
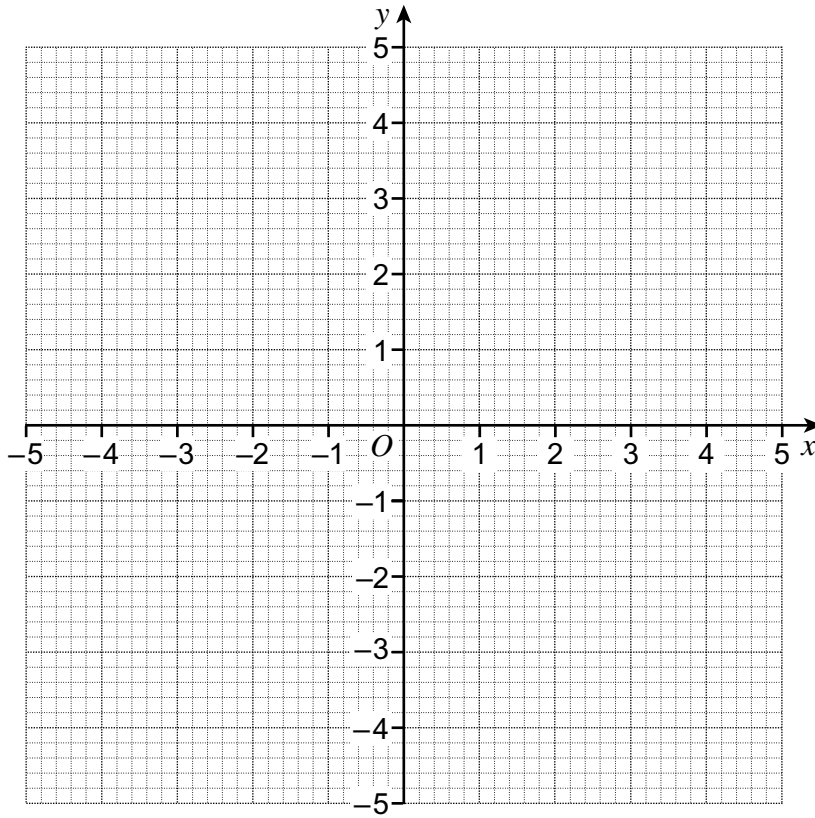
5 (b) On the grid draw the line $y = x + 3$

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(2 marks)

6 The diagram shows a prism of length 20 cm.
The cross-section is a parallelogram as shown.

Not drawn
accurately

20 cm

5 cm

6 cm
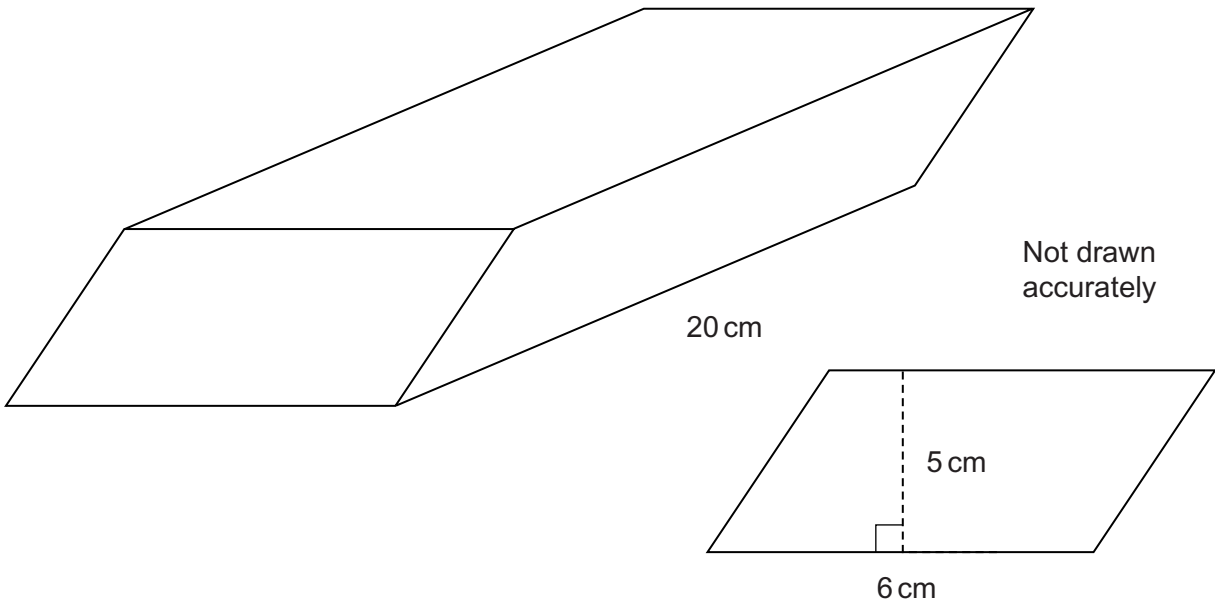
Work out the volume of the prism.

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

Turn over ▶

7 The diagram shows part of a regular polygon.
Each interior angle is 168°.
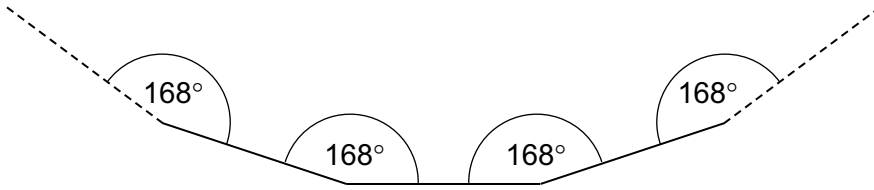
Not drawn accurately

Calculate the number of sides of this regular polygon.

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Answer .... *(3 marks)*

8 (a) Solve $\dfrac{3(7 + 3x)}{4(5x - 3)} = 1$

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

8 (b) Write down the solution to $\dfrac{4(5x - 3)}{3(7 + 3x)} = 1$

Answer $x =$ .... *(1 mark)*

Turn over for the next question

8

9 (a) The diagram shows a rectangular grass field of length 30 metres and width 20 metres.
A post, *P*, is in the middle of one side of the field.
A goat is tied to the post by a rope of length 7.5 metres.
The goat can reach half a metre further than the length of the rope.

Not drawn accurately

P
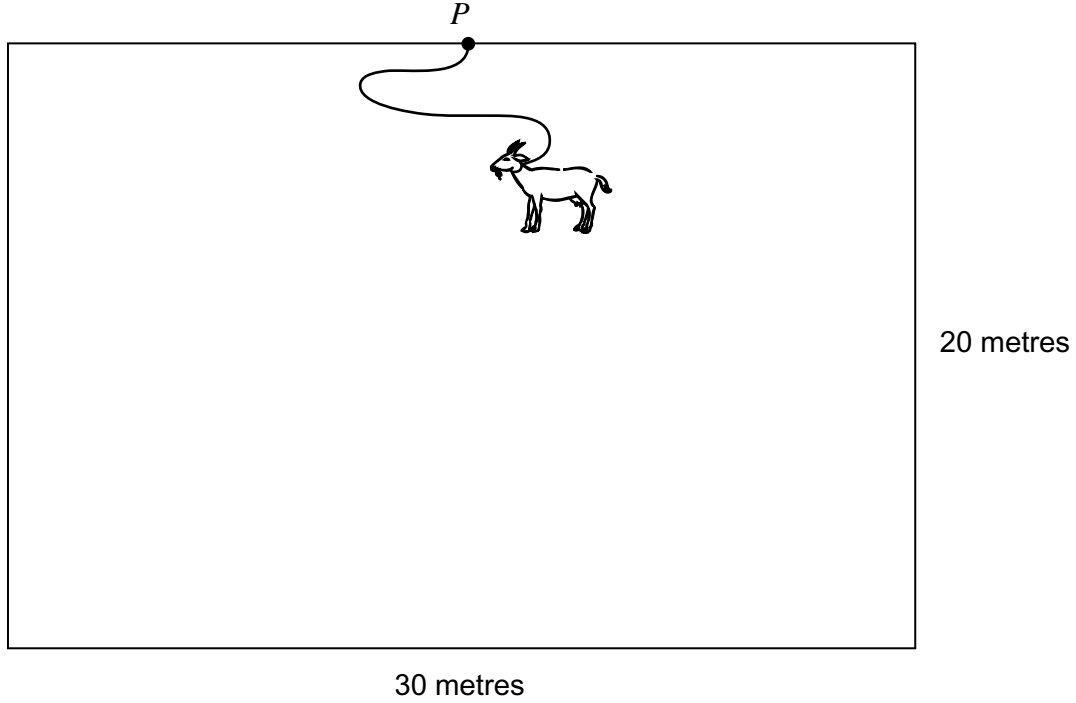
20 metres

30 metres

Describe fully the shape of the area of grass that the goat can eat.

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(2 marks)

9 (b) The rope is changed to a different rope of length 21 metres.

On the diagram below, sketch the shape of the area of grass that the goat can now eat.

Not drawn accurately

P

20 metres

30 metres
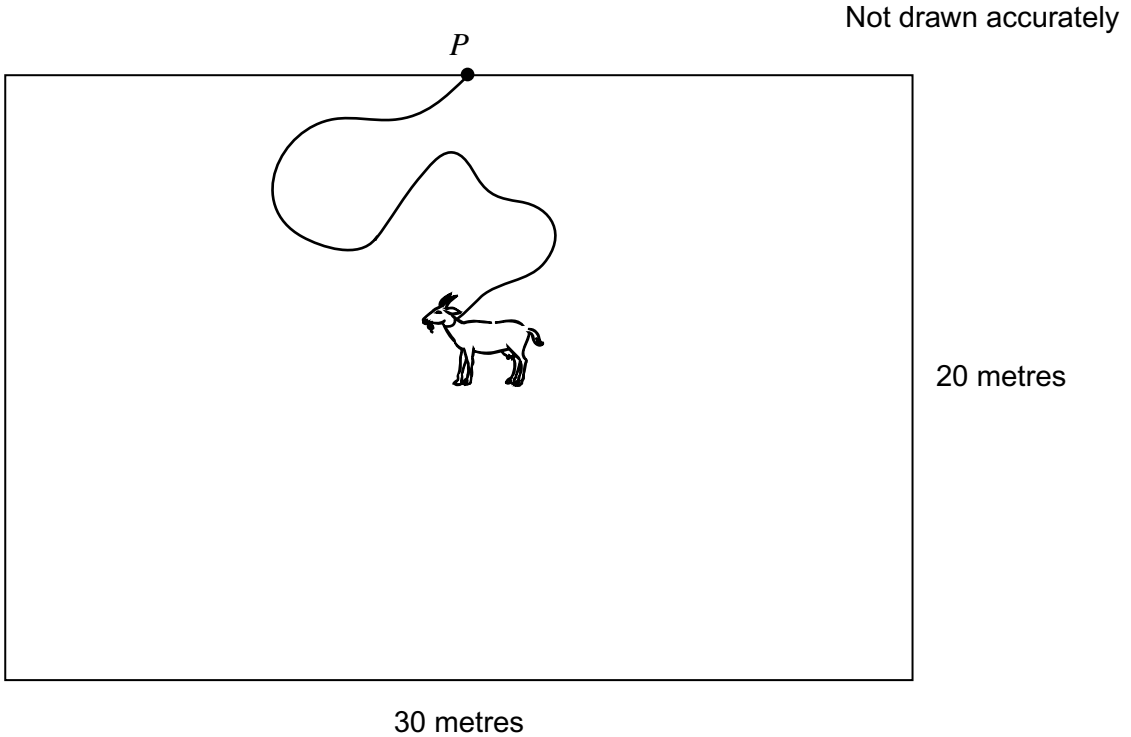
(2 marks)

Turn over for the next question

(2 marks)

Turn over ▶

4

10 The diagram shows a right-angled triangle.

Not drawn accurately

√5 cm   1 cm   2 cm   26.6°
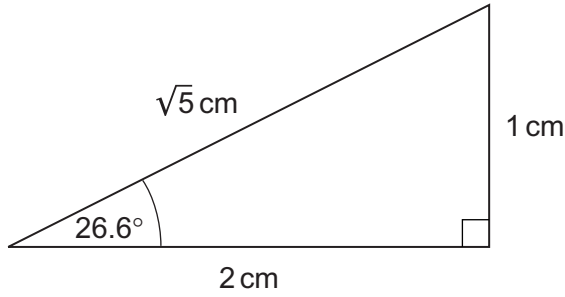
10 (a) Circle the value of sin 26.6°

$\frac{1}{2}$ (= 0.5) $\frac{1}{\sqrt{5}}$ (= 0.447) $\frac{2}{5}$ (= 0.894)

(1 mark)

10 (b) This triangle is **not** right-angled.

Not drawn accurately

4 cm   26.6°   5 cm
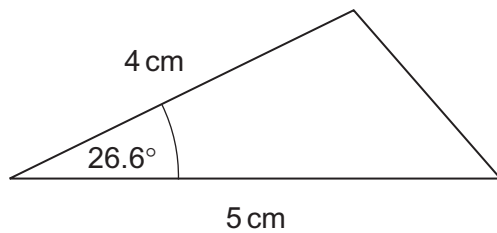
Work out the area of this triangle.

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

10 (c) The diagram shows a man looking up to the top of a hill.
A television mast of height 330.4 metres is on the top of the hill.
The height of the man is 1.8 metres.

Not drawn
accurately

Television mast

Hill

h

26.6°

1850 m
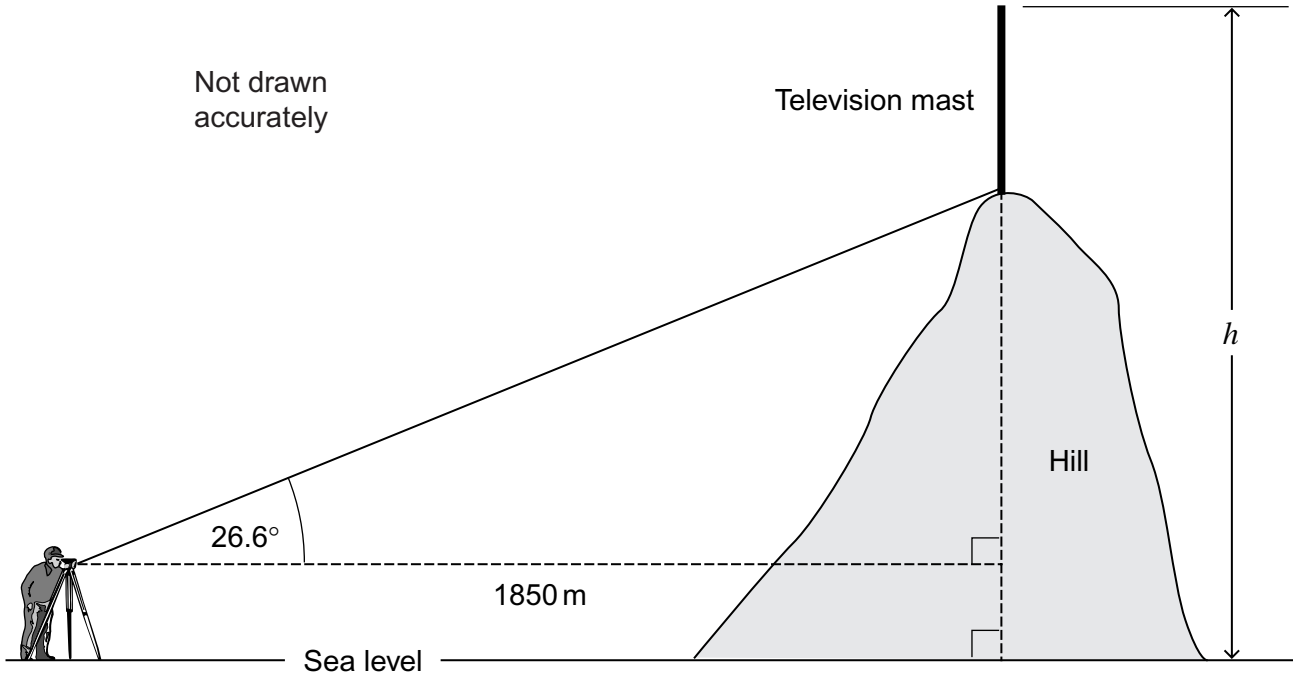
Sea level

Use the information given here and at the start of the question.

Work out the height of the top of the mast above sea level, marked h on the diagram.

Give your answer to the nearest ten metres.

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

8

Turn over ▶

11 The diagram shows an algebra addition table.
The total for each row and column is given.

x	x	y	5
y	$2y$	$2x$	19
z	$2z$	$3z$	30
11	23	20	

Work out the values of x, y and z.

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Answer x = ... , y = ... , z = ...   *(6 marks)*

12   Expand and simplify $(5x + 4y)(x - 7y)$

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          Answer ....   *(3 marks)*

13 (a)   Sketch the graph of $y = \dfrac{10}{x}$ for $x > 0$
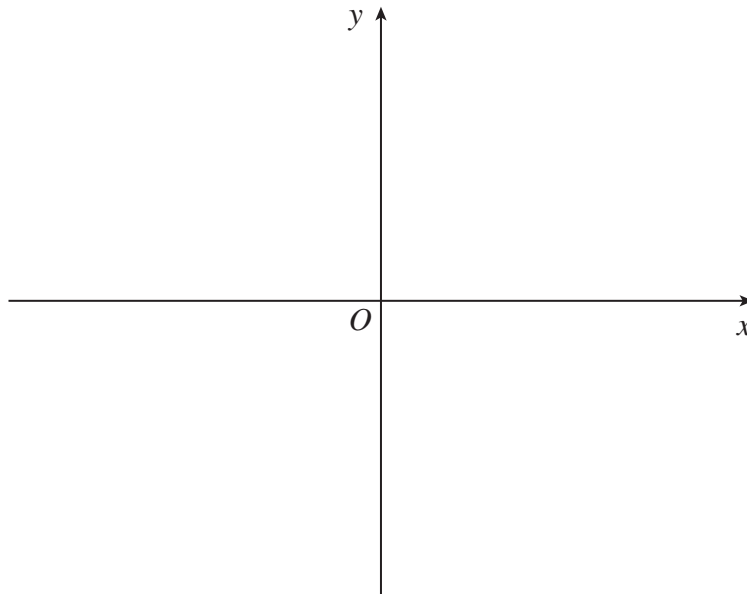
(1 mark)

13 (b)   Given that $y = \dfrac{10}{x}$ for $x > 0$

          explain what happens to the value of y as the value of x doubles.

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(1 mark)

11

Turn over ▶

14 The diagram shows three solid shapes, a cylinder, a cone and a sphere.
All measurements are given in centimetres.

The radius of the base of the cylinder is $4y$.
The radius of the base of the cone is $2y$.
The radius of the sphere is $3y$.

The height of the cylinder is $2y$.
The height of the cone is $12y$.

Not drawn accurately

Put these shapes in order of size by volume from smallest to largest.

Write your volumes as simply as possible in terms of π.

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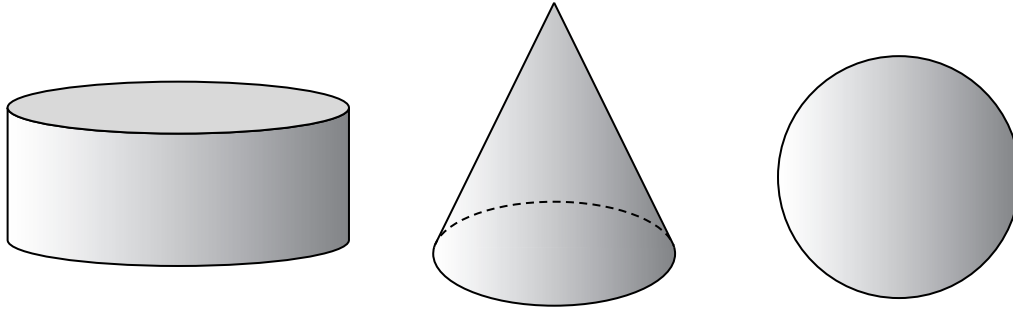...

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Answer Smallest .... Volume .... cm^3

　　　　　Middle .... Volume .... cm^3

　　　　　Largest .... Volume .... cm^3

(6 marks)

15   Simplify fully $\dfrac{5x^2 - 605}{2x^2 + 22x}$

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Answer ....   *(4 marks)*

END OF QUESTIONS

There are no questions printed on this page

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