A503/02

MATHEMATICS A
Unit C (Higher Tier)

THURSDAY 4 JUNE 2015: Morning
DURATION: 2 hours
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	
Centre number		**Candidate number**	

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator
Geometrical instruments
Tracing paper (optional)

YOU ARE PERMITTED TO USE A CALCULATOR FOR THIS PAPER

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.

Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Your quality of written communication is assessed in questions marked with an asterisk (*).
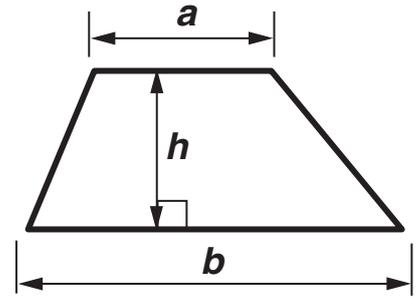
Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
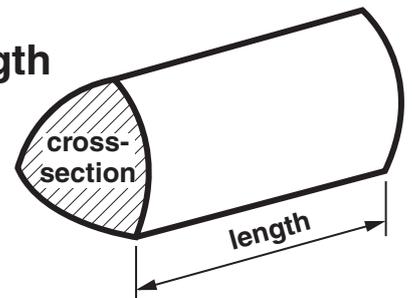
The total number of marks for this paper is 100.

Any blank pages are indicated.

FORMULAE SHEET: HIGHER TIER

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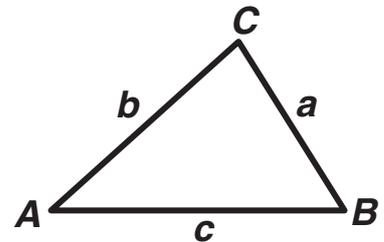
Volume of prism = (area of cross-section) × length

In any triangle *ABC*

Sine rule $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
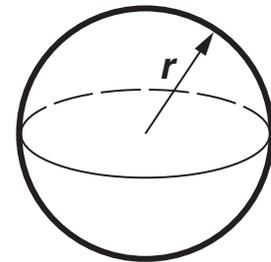
Cosine rule $\quad a^2 = b^2 + c^2 - 2bc \cos A$
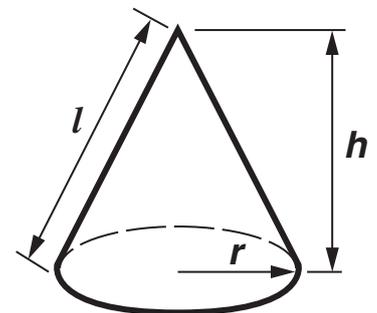
Area of triangle $= \frac{1}{2} ab \sin C$

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 $= \pi r l$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

3

Answer ALL the questions.

1   (a) At the supermarket, Sue bought 2.4 kg of apples and 1.9 kg of oranges.

         She paid for these with a £20 note and received £12.66 change.

         Given that the apples cost £1.95 per kilogram, work out the cost per kilogram of the oranges.

                              (a) £ _____ per kilogram [3]

(b) In a survey of 209 people at the supermarket, 83% said that the fruit being sold was of excellent quality.

How many of the 209 people could have said that the fruit was of excellent quality?

(b) _____ **[3]**

5

2   Tom takes a counter, at random, from a bag of counters.

He records the colour of the counter and replaces it into the bag.

He does this 2000 times.

The table below shows his results.

Colour of counter	Red	Blue	Yellow
Number of times	653	509	838

(a) Can Tom be certain that there are only red, blue and yellow counters in the bag?

Give a reason to support your answer.

_____ because _____

_____ [1]

(b) Tom is now told that there are only red, blue and yellow counters in the bag.

   (i) Complete the relative frequency table below.

     Give each of your answers as a decimal.

Colour of counter	Red	Blue	Yellow
Relative frequency			

[2]

   (ii) Explain why these relative frequencies are reasonable estimates of the probabilities of randomly choosing the different colours of counters from the bag.

_____

_____ **[1]**

(iii) Tom chooses another counter from the bag at random.

Work out an estimate of the probability that it is either red or blue.

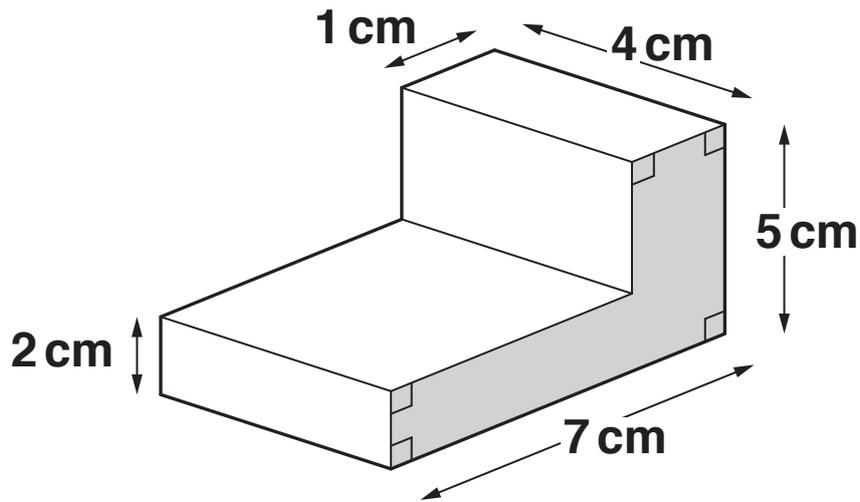(b)(iii) _____ [2]

(iv) There are 24 counters altogether in the bag.

Work out an estimate of the number of yellow counters.

(iv) _____ [2]

3 This solid shape is a prism.

NOT TO SCALE

(a) Show that the area of the shaded face of the solid is $17\,\text{cm}^2$. [2]

(b) Work out the TOTAL surface area of the solid.

(b) _____ cm^2 [3]

4 The equation $x^3 - 4x - 1 = 30$ has a solution between 3 and 4.

Use trial and improvement to find this solution correct to one decimal place.

Show all your trials and their outcomes.

_____ [4]

5 (a) **Simplify fully.**

$$2x + 8y - 7 + x - 4y + 2$$

(a) _____ [3]

(b) **Simplify fully.**

$$\frac{15xy}{10y^2}$$

(b) _____ [2]

(c) **Factorise fully.**

$$4x^2 + 10xy$$

(c) _____ [2]

6 (a) 25 g of sweets are taken from a 1 kg jar of sweets.

   What fraction of the jar of sweets has been taken?

   Give your answer as a fraction in its simplest form.

(a) _____ [2]

(b) Pam has two cats, Tibbs and Fluff.

Tibbs is fed $\frac{1}{4}$ of a tin of cat food, 3 times a day.

Fluff is fed $\frac{1}{3}$ of a tin of cat food, 2 times a day.

Pam has 13 tins of cat food.

How many days will the cat food last?

(b) _____ **[4]**

7   Mrs Spencer goes to town by car, bus or taxi.

The probability she goes to town by car is 0.67.

The probability she goes to town by bus is 0.28.

Calculate the probability that Mrs Spencer goes to town by taxi.

_____ [2]

8 **(a) Multiply out and simplify fully.**

$2(5x + 7) - 3(x - 4)$

(a) _____ [3]

(b) Multiply out and simplify fully.

$(3x - 4)(2x + 1)$

(b) _____ [3]

9 The diagram shows a cuboid.

O is the origin, P is the point (3, 5, 0) and T is the point (0, 0, 2).
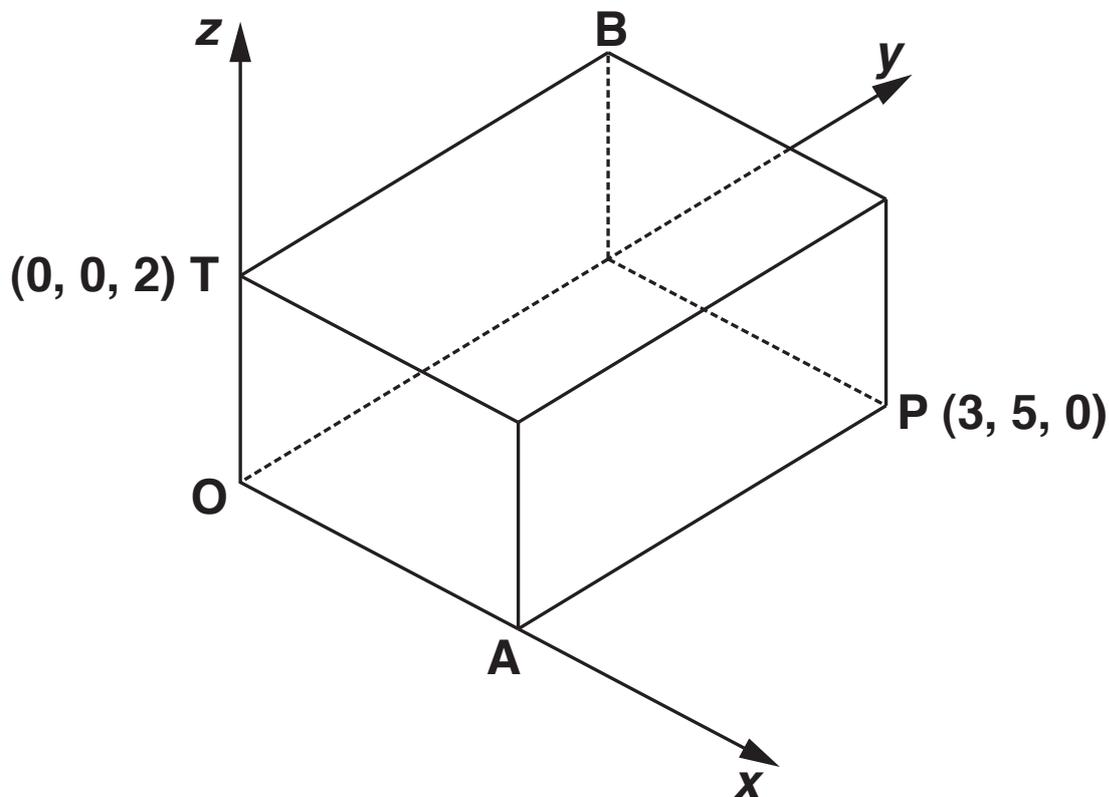
(a) Write down the coordinates of

   (i) A,

      (a)(i) (_____ , _____ , _____) [1]

   (ii) B.

      (ii) (_____ , _____ , _____) [1]

16

(b) One unit on the grid is 1 cm.

Work out the length PT.

(b) _____ cm [3]

10 The grid opposite shows the graph of $y = 2x - 4$.

(a) Complete the table for $y = x^2 - 4x + 3$.

x	0	1	2	3	4	5
y	3	0		0	3	

[2]

(b) On the grid, draw the graph of $y = x^2 - 4x + 3$ for $0 \leqslant x \leqslant 5$. [2]

(c) Use your graphs to solve these simultaneous equations.

$y = 2x - 4$

$y = x^2 - 4x + 3$

(c) $x =$ _____ $y =$ _____

$x =$ _____ $y =$ _____ [2]

18

$y = 2x - 4$
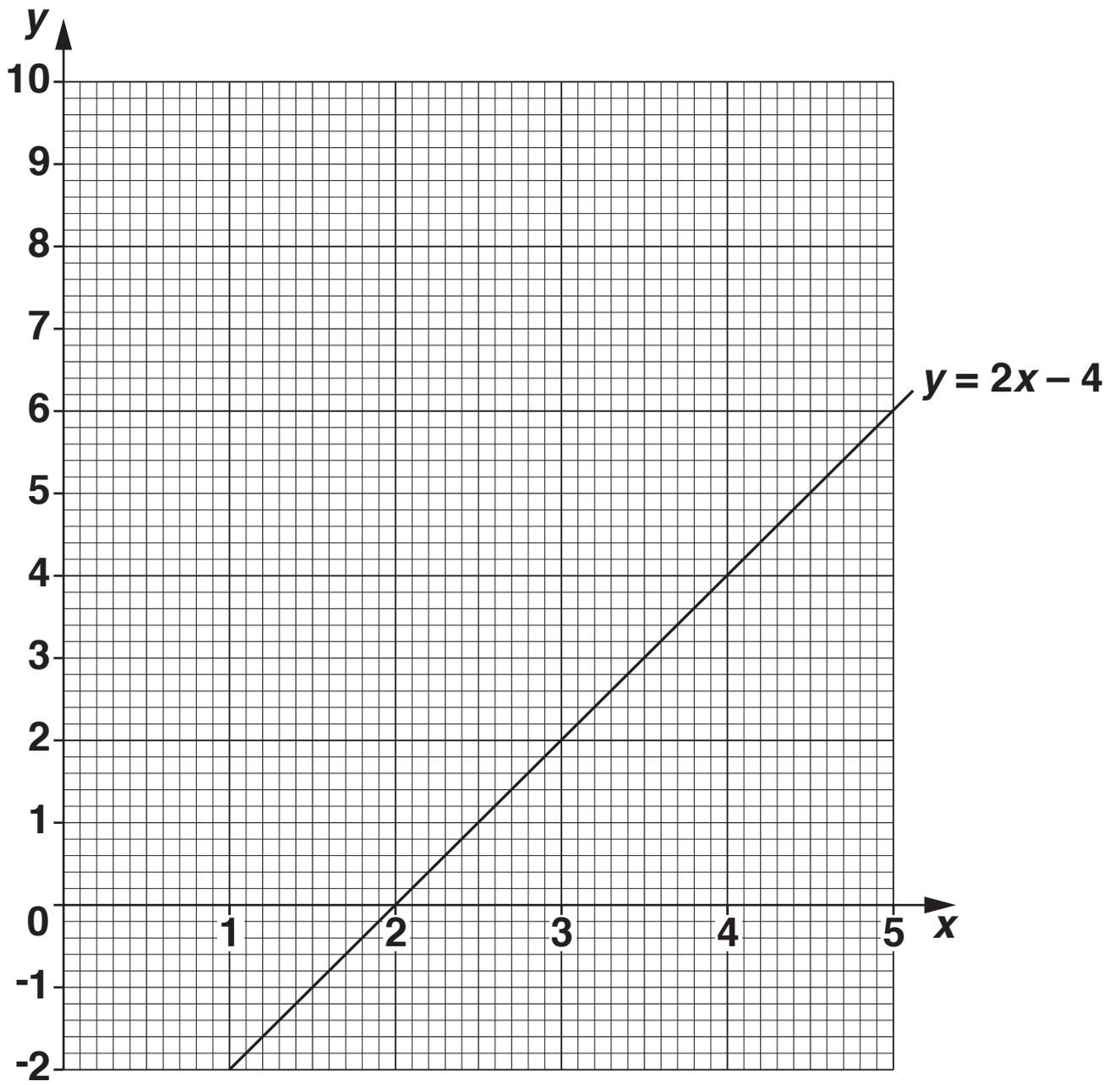
11 **Ahmed is playing a game with two unbiased five-sided spinners, each numbered 1 to 5.**

   He spins the two spinners.

   (a) **Complete the tree diagram opposite.**   [3]

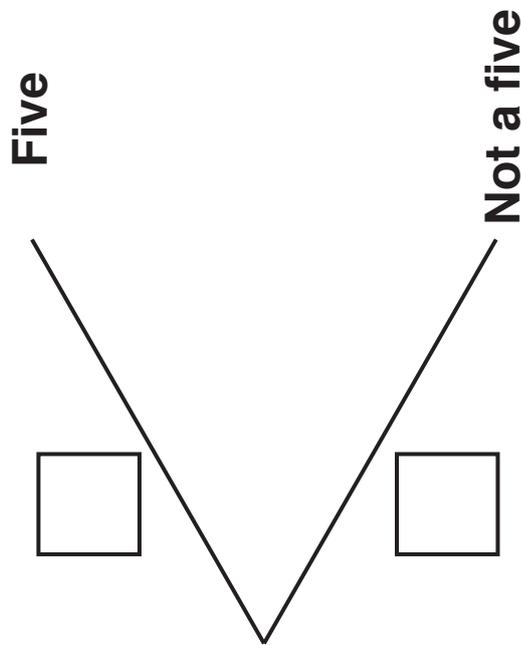   (b) **Ahmed needs EXACTLY ONE of the two spinners to show 5 to win the game.**

   Calculate the probability that Ahmed wins the game.

                                        (b) _____ [3]
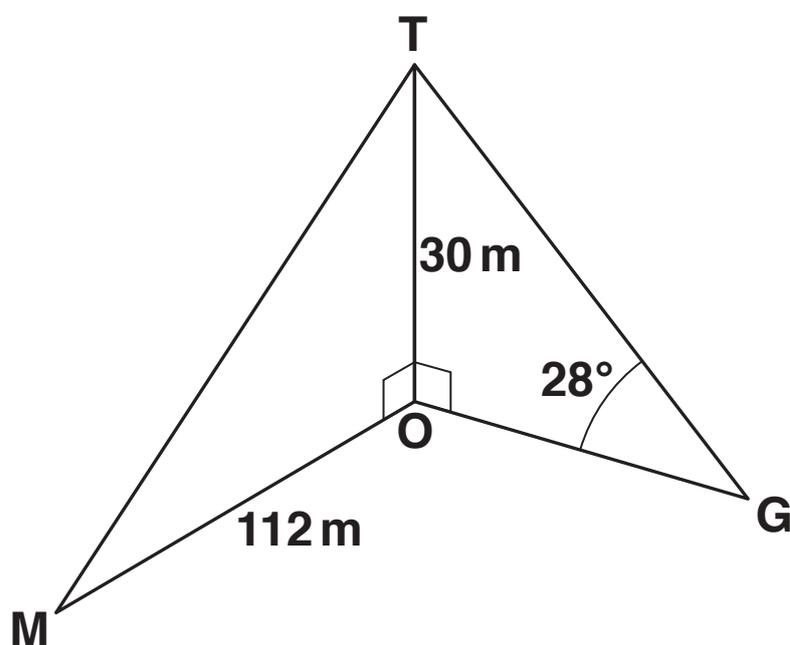
First spinner

Second spinner

Five

Five

Not a five

Not a five

Five

Not a five

Not a five
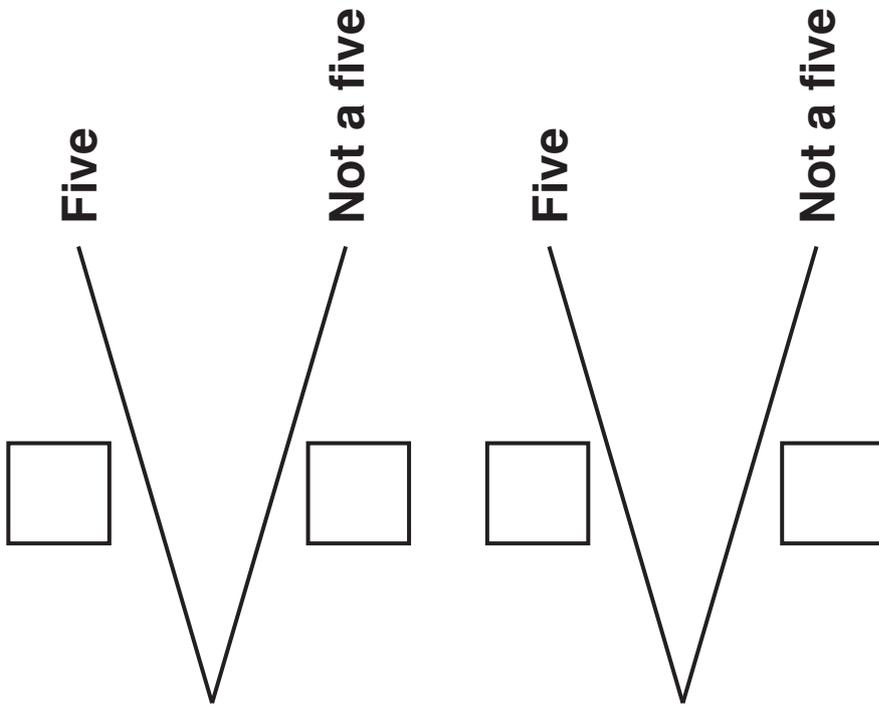
12* A vertical mobile phone mast, OT, is 30 m tall.

The diagram shows two of the straight wires, MT and GT, that support the mast.

M, G and O are all on horizontal ground.

The angle of elevation of the top of the mast, T, from G is 28°.

M is 112 m from O.

What TOTAL length of wire has been used for MT and GT?

_____ m [6]

13 (a) When 7.2×10^{-10} is written as an ordinary number, how many zeros are there AFTER the decimal point?

(a) _____ [1]

(b) Work out.

$$(1.6 \times 10^4)^2$$

Write your answer in standard form.

(b) _____ [2]

14 (a) Factorise.

$$x^2 + 2x - 15$$

(a) _____ [2]

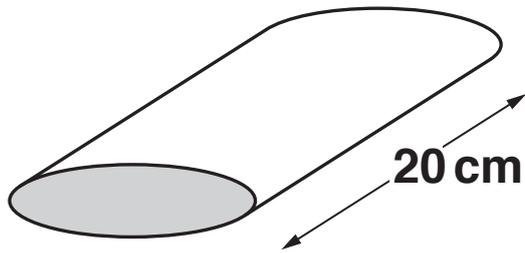**(b)** Hence solve this equation.

$$x^2 + 2x - 15 = 0$$

(b) _____ [1]

(c) Simplify fully.

$$\frac{x^2 + 2x - 15}{x^2 - 9}$$

(c) _____ [2]

15 (a) **An oil can is a prism 20 cm long.**

When full, the can contains 1.2 litres of oil.

20 cm

Calculate the area of the end of the oil can, shown shaded.

(a) _____ cm^2 [3]

(b) An oil drum, of length 1 m, is an enlargement of the oil can.
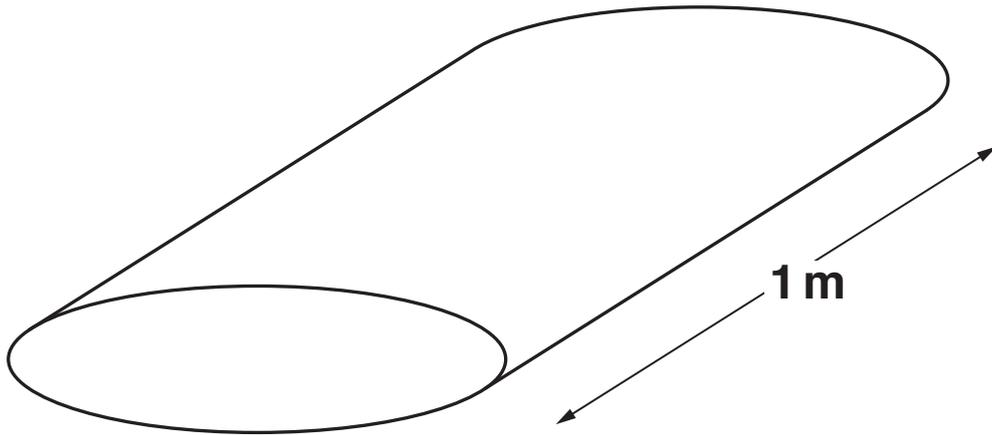
(i) Calculate the area of the end of the oil drum.

(b)(i) _____ cm² [3]

(ii) Calculate the volume of oil in the drum when full.

(ii) _____ litres [2]

16 The number of bacteria present in a culture is observed.

This number of bacteria, N, is given by the formula

$$N = 15\,000 \times 2^{-t}$$

where t is the time, in hours, after the observation starts.

(a) How many bacteria are present 3 hours after the observation starts?

(a) _____ [1]

(b) **After how many hours from the start of the observation will the bacteria have disappeared? That is, after how many hours will the number of bacteria first fall below 1?**

(b) _____ hours [2]

17 **Multiply out and simplify fully.**

$(3 + \sqrt{7})(4 + \sqrt{7})$

You must show your working.

_____ **[2]**

18 **A bracelet is made from a length of gold wire, bent to form an arc of a circle.**

O is the centre of this circle.

Radii OA and OB are 3 cm.

Angle AOB is 56°.
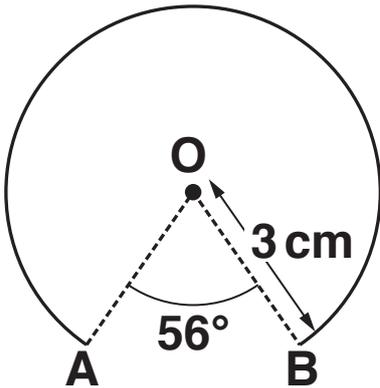
NOT TO SCALE

Calculate the length of gold wire used to form the bracelet.

_____ cm [3]

19 A lift can safely take a total weight of 600 kg, correct to the nearest 10 kg.

Can you be certain that eight people, each of weight 75 kg correct to the nearest kg, can safely travel in the lift?

Show how you decide. [3]

20 Solve these simultaneous equations algebraically.

$$y = 2x - 4$$

$$y = x^2 - 4x + 3$$

Give your answers correct to 2 decimal places.

x = _____   y = _____

x = _____   y = _____ [6]

END OF QUESTION PAPER

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