Write your name here

Surname

Other names

Centre Number

Candidate Number

Mathematics A
Paper 4HR

Higher Tier

Wednesday 15 January 2014 – Morning
Time: 2 hours

Paper Reference
4MA0/4HR

You must have:
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ▶
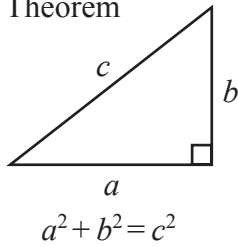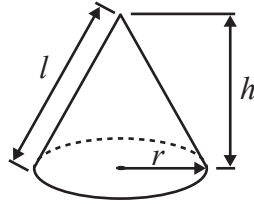
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PEARSON

International GCSE MATHEMATICS
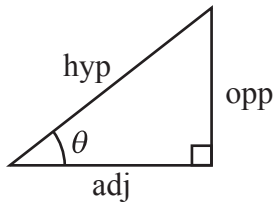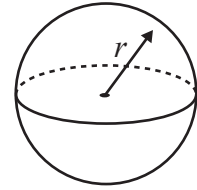## FORMULAE SHEET – HIGHER TIER

Pythagoras'
Theorem

$a^2 + b^2 = c^2$

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

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

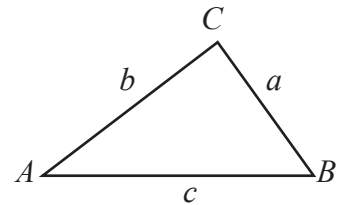Volume of sphere $= \frac{4}{3}\pi r^3$

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

$adj = hyp \times \cos\theta$
$opp = hyp \times \sin\theta$
$opp = adj \times \tan\theta$

or $\quad \sin\theta = \dfrac{opp}{hyp}$

$\cos\theta = \dfrac{adj}{hyp}$

$\tan\theta = \dfrac{opp}{adj}$

In any triangle ABC

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

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$
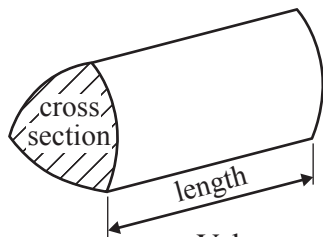
Volume of prism = area of cross section $\times$ length
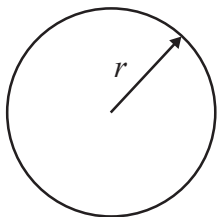
Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$

Area of a trapezium $= \frac{1}{2}(a + b)h$
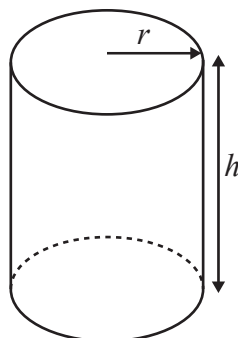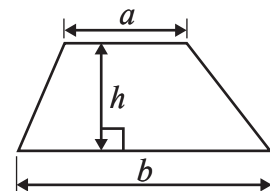
Volume of cylinder $= \pi r^2 h$

Curved surface area
of cylinder $= 2\pi rh$

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 TWENTY TWO questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 (a) Write $3 \times 3 \times 3 \times 3 \times 3$ as a single power of 3

....
(1)

(b) Write $\dfrac{7^5 \times 7^9}{7^6}$ as a single power of 7

....
(2)

(Total for Question 1 is 3 marks)

2 Here are Ryan's scores in nine French tests.

   4   6   4   7   8 a 6   7   7

The mean of Ryan's nine scores is 6

Work out the value of a.

$a =$ ....

(Total for Question 2 is 3 marks)

Do NOT write in this space.

3
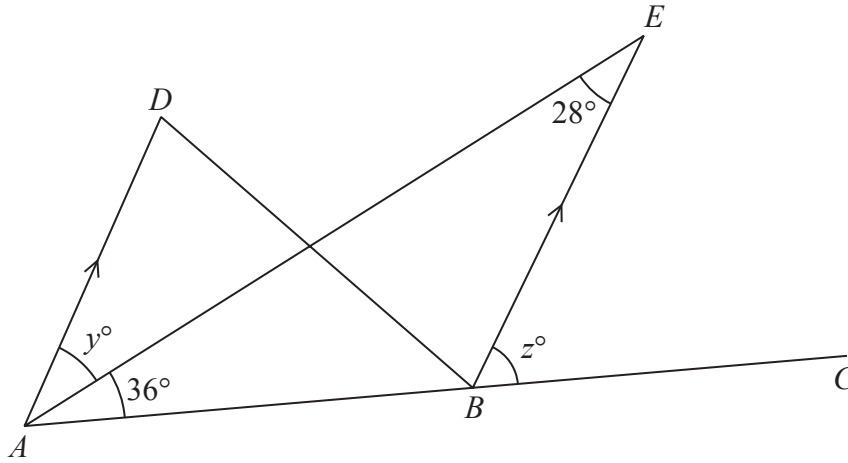
Diagram **NOT** accurately drawn

ADB and *AEB* are triangles.
ABC is a straight line.
AD is parallel to *BE*.

(a) Find the value of *y*.

y = ...
(1)

(b) Find the value of *z*.

z = ...
(2)

(Total for Question 3 is 3 marks)

Do NOT write in this space.

4 (a) Show that $\dfrac{4}{5} + \dfrac{2}{3} = 1\dfrac{7}{15}$

(2)

(b) Show that $2\dfrac{1}{4} \div 3\dfrac{1}{2} = \dfrac{9}{14}$

(3)

(Total for Question 4 is 5 marks)

5 Use ruler and compasses to construct the bisector of angle *ABC*.

You must show all of your construction lines.
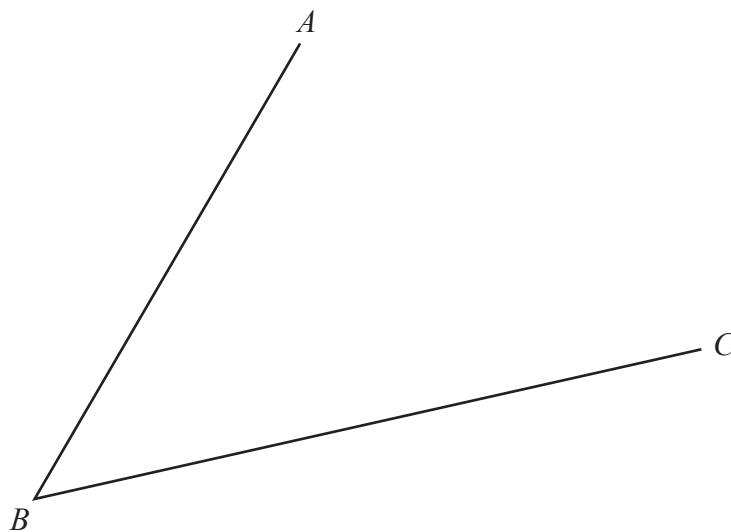
(Total for Question 5 is 2 marks)

Turn over ▶

6 Mansi left her home at 09 00 to walk to the shops.
She stopped at the newspaper shop and then carried on to the fish shop.
Here is the distance-time graph for Mansi's journey from her home to the fish shop.
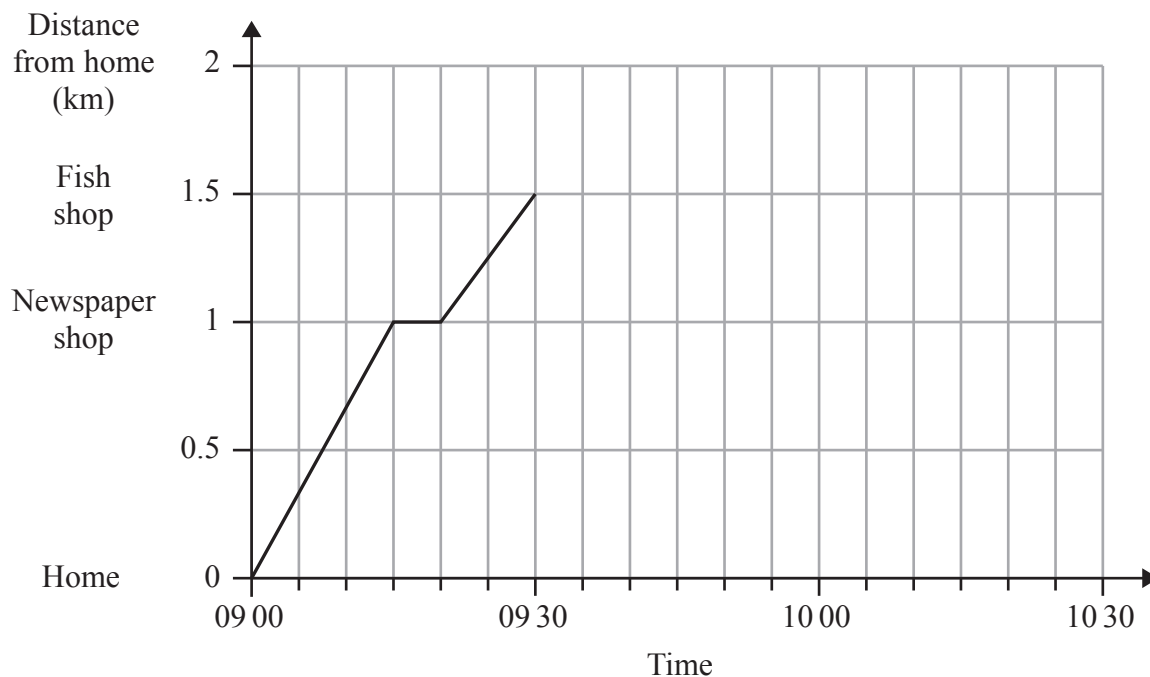
(a) How many minutes did it take Mansi to walk from the newspaper shop to the fish shop?

.... minutes

(1)

(b) Work out the average speed, in kilometres per hour, for Mansi's journey from her home to the newspaper shop.

.... km/h

(2)

Mansi stopped for 10 minutes in the fish shop.
She then walked home at a constant speed of 3 km/h.

(c) Show this information on the graph.

(2)

(Total for Question 6 is 5 marks)

7
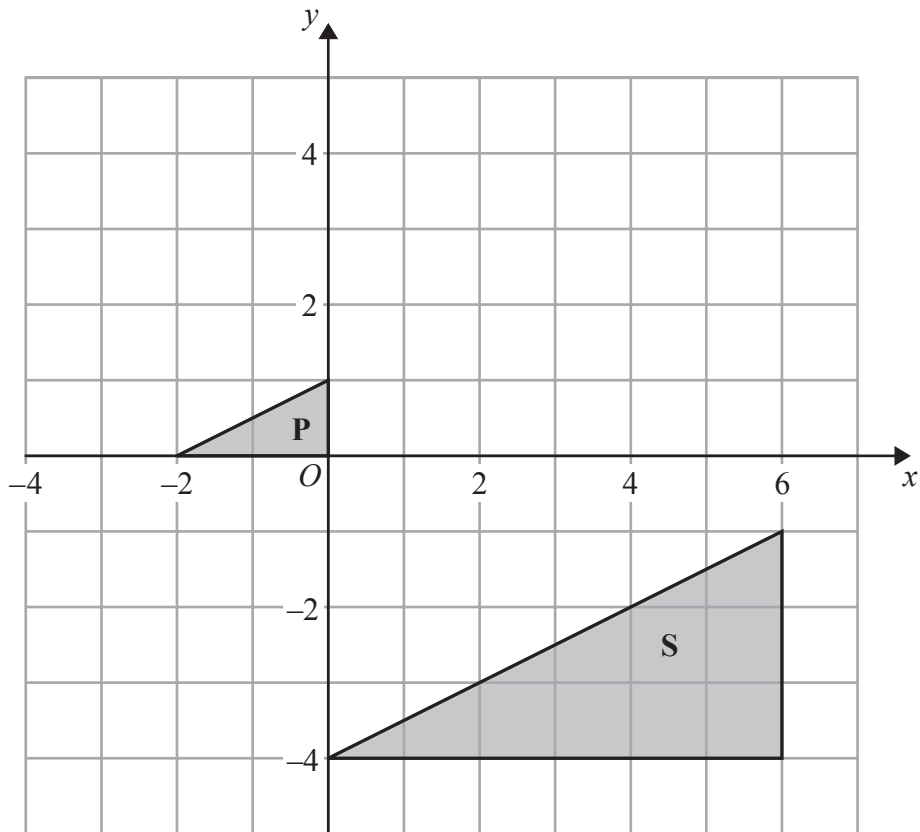
(a) On the grid, translate triangle **P** by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Label the new triangle **Q**.

(1)

(b) Describe fully the single transformation that maps triangle **P** onto triangle **S**.

....

....

(3)

(Total for Question 7 is 4 marks)

Do NOT write in this space.

8 (a) Complete the table of values for $2x + y = 4$

x	-1	2	4
y			

(2)

(b) On the grid, draw the graph of $2x + y = 4$ for values of x from -1 to 4

(2)
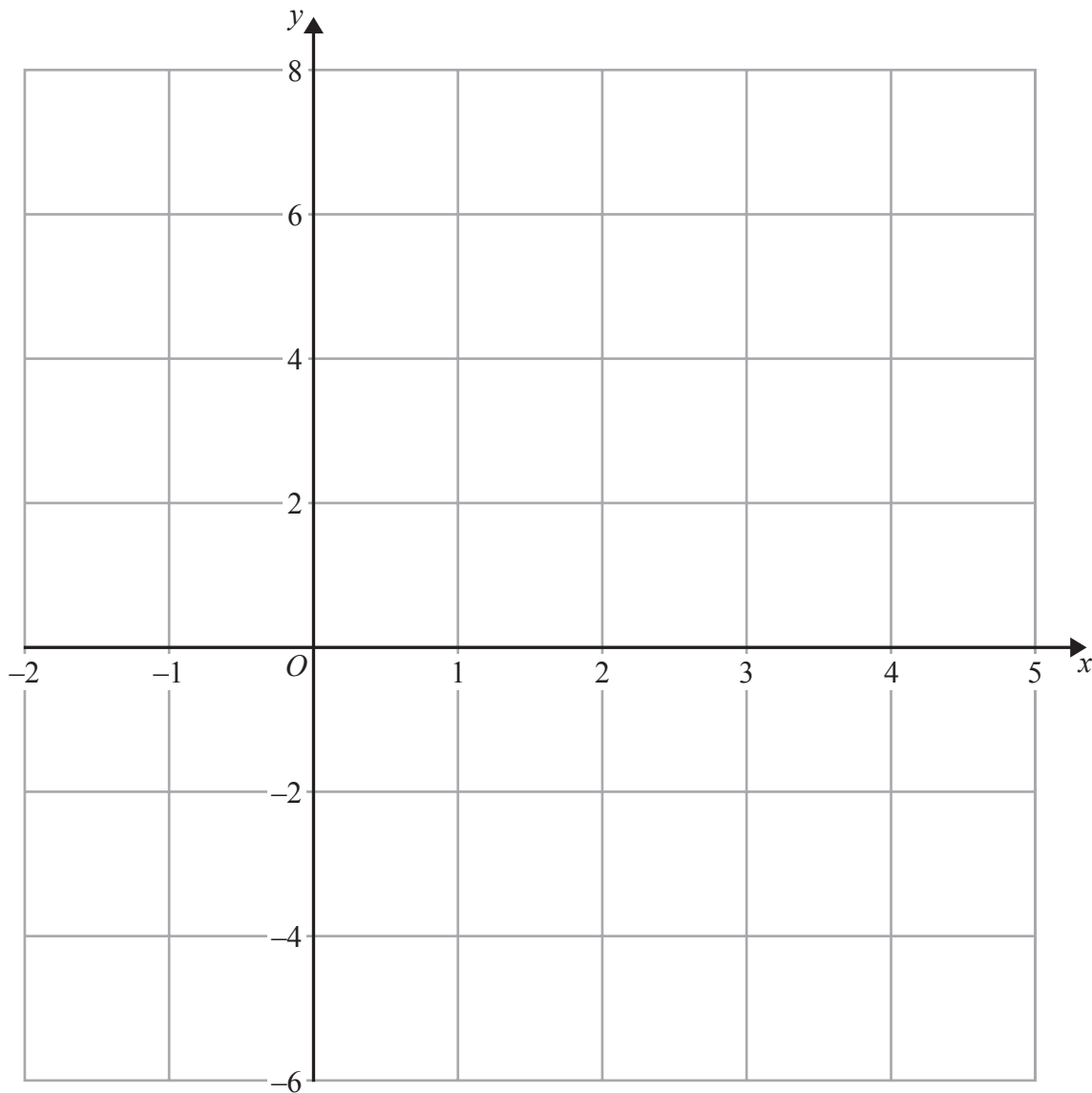
(c) Show, by shading on the grid, the region which satisfies **all three** of the inequalities

$$x \geqslant -1, \quad y \geqslant 2 \quad \text{and} \quad 2x + y \leqslant 4$$

Label the region **R**.

(2)

(Total for Question 8 is 6 marks)

9 On a map, 4 centimetres represents a real distance of 1 kilometre.

(a) On the map, the distance between two points is 14 cm.
Work out the real distance between these two points.
Give your answer in kilometres.

.... km

(2)

(b) Work out the scale of the map in the form $1:n$

1 : ....

(2)

(Total for Question 9 is 4 marks)

Do NOT write in this space.

10

North

Diagram **NOT**
accurately drawn

Y

S

B
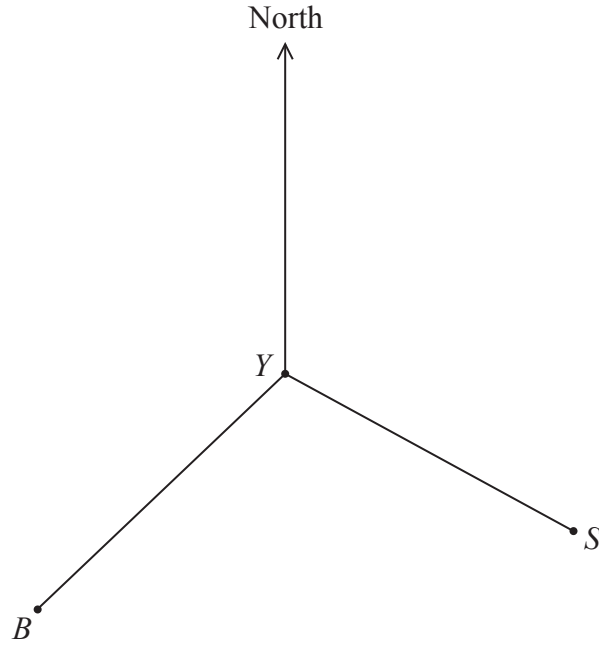
The diagram shows the positions of a yacht *Y*, a ship *S* and a beacon *B*.
The bearing of *B* from *Y* is 228°

(a) Find the bearing of *Y* from *B*.

..............................°

(2)

The bearing of *S* from *Y* is 118°

(b) Find the size of the angle *BYS*.

..............................°

(1)

(c) Given also that $BY = SY$, find the bearing of S from B.

.... °
(2)

(Total for Question 10 is 5 marks)

11 The table shows the population of each of three countries in 2012.

Country	Population
India	1.21×10^9
Turkey	7.48×10^7
Singapore	5.2×10^6

(a) Find the total population of India, Turkey and Singapore in 2012.
Give your answer in standard form.

....
(2)

Population density is calculated by the formula

Population density = Population ÷ Land area

The land area of India is 3.29×10^6 km^2

(b) Calculate the population density of India in 2012.
Give your answer correct to 3 significant figures.

.... people/km^2
(2)

(Total for Question 11 is 4 marks)

12 Loma grows tomatoes in her garden.
The table shows information about the weights, in grams, of some of her tomatoes.

Weight of tomato (w grams)	Number of tomatoes
$0 < w \leqslant 10$	2
$10 < w \leqslant 20$	8
$20 < w \leqslant 30$	16
$30 < w \leqslant 40$	10
$40 < w \leqslant 50$	4

(a) Work out an estimate for the total weight of these tomatoes.

.... grams

(3)

Loma also grows potatoes.
The incomplete histogram shows information about the weights, in grams, of some of her potatoes.

Weight of potato (grams)
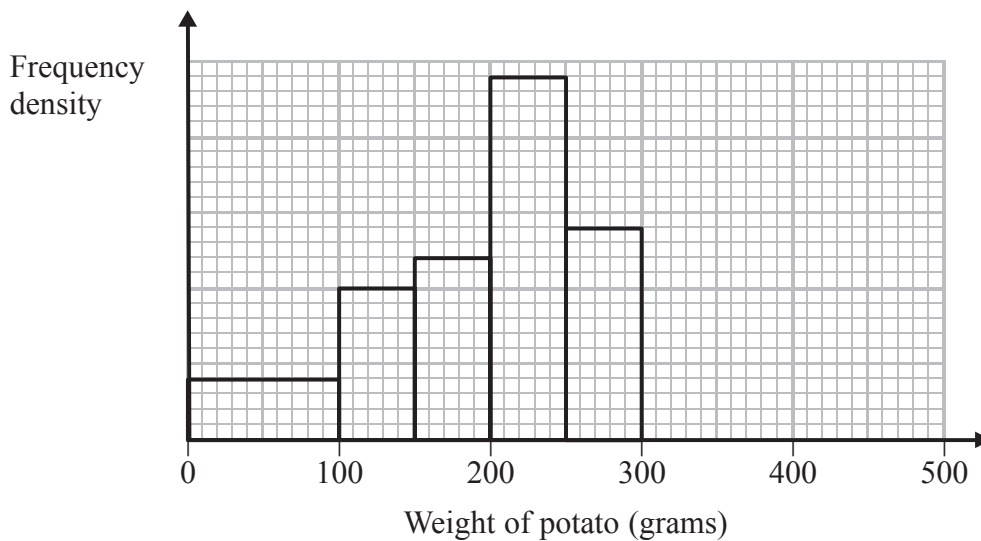
There were 10 potatoes with weights between 100 grams and 150 grams.

(b) How many potatoes had weights less than 100 grams?

....

(2)

There were 12 potatoes with weights between 300 grams and 450 grams.

(c) Show this information on the histogram.

(2)

(Total for Question 12 is 7 marks)

Do NOT write in this space.

13 (a) The straight line **L** passes through the points (0, 12) and (10, 4).
Find an equation for **L**.

....

(3)

(b) Find an equation of the straight line which is parallel to **L** and passes through the point (5, −11).

....

(2)

(Total for Question 13 is 5 marks)

Do NOT write in this space.

14

Diagram **NOT** accurately drawn
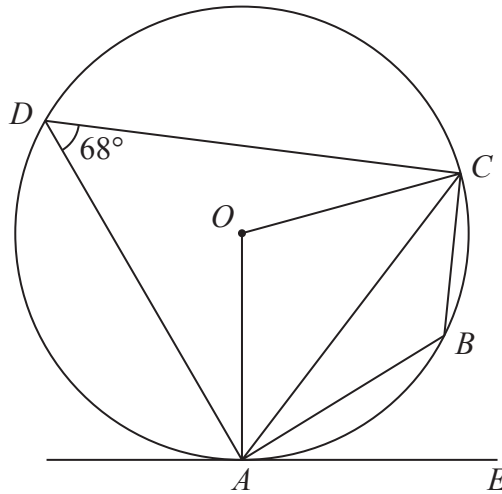
A, B, C and D are points on a circle, centre O.
AE is a tangent to the circle.
Angle $ADC = 68°$

(a) (i) Find the size of angle ABC.

.... °

   (ii) Give a reason for your answer.

....

(2)

(b) (i) Find the size of angle AOC.

.... °

   (ii) Give a reason for your answer.

....

(2)

(c) Find the size of angle CAE.

.... °

(1)

(Total for Question 14 is 5 marks)

15 For the curve with equation $y = 4x^3 - 2x + 5$

(i) find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

....

(ii) find the coordinates of the two points on the curve where the gradient of the curve is 1

(.............. , ...) and (.............. , ...)

(Total for Question 15 is 6 marks)

Do NOT write in this space.

16 A particle moves from rest.
The speed of the particle is v m/s when it has moved a distance of x metres.

v is proportional to $\sqrt{x}$

When $v = 8$, $x = 25$

(a) Express v in terms of x.

....
(3)

(b) Find the speed of the object when it has moved a distance of 56.25 metres.

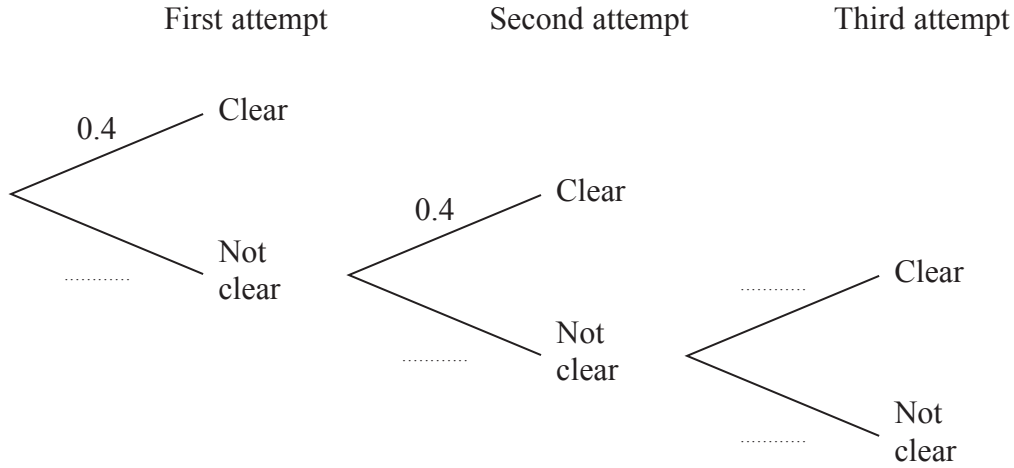........................ m/s
(2)

(Total for Question 16 is 5 marks)

17 Hugo competes in the high jump at a school athletics competition.
He has up to 3 attempts to clear the bar at each height.
When he clears the bar, he does not have another attempt at that height.

When the bar is set at a height of 1.60 metres, the probability that Hugo will clear the bar on any attempt is 0.4
The probability tree diagram shows the possible outcomes of Hugo's attempts at 1.60 metres.

First attempt   Second attempt   Third attempt

```
        Clear
   0.4 ╱
      ╱                      Clear
     ╱                 0.4 ╱
    ╲   Not              ╱                        Clear
 ....  ╲  clear         ╱                   .... ╱
        ╲──────────────╲   Not                 ╱
                  ....   ╲  clear              ╱
                          ╲─────────────────╲
                                       ....   ╲  Not
                                               ╲  clear
```

(a) Complete the probability tree diagram to show the four missing probabilities.

(1)

(b) Work out the probability that Hugo does not clear the bar on his first two attempts and then does clear the bar on his third attempt at 1.60 metres.

....

(2)

Hugo clears the bar at 1.60 metres and the height is raised to 1.65 metres.
He has up to three attempts to clear the bar at 1.65 metres.

When the bar is set at a height of 1.65 metres, the probability that Hugo will clear the bar on any attempt is 0.3
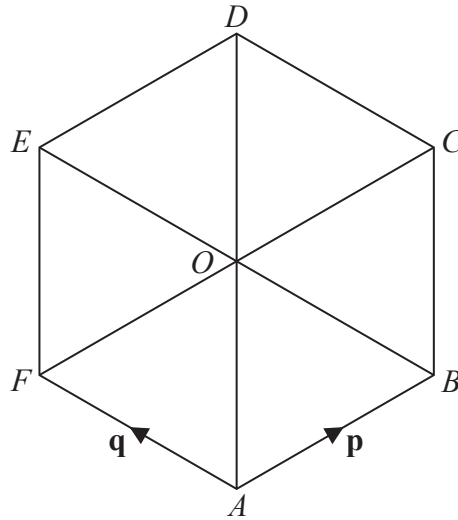
(c) Find the probability that Hugo clears the bar at 1.65 metres.

....

(3)

(Total for Question 17 is 6 marks)

P 4 3 1 3 1 A 0 1 9 2 4

18

Diagram **NOT**
accurately drawn

ABCDEF is a regular hexagon, centre *O*.

$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AF} = \mathbf{q}$

(a) Express in terms of **p** and **q**

  (i) $\overrightarrow{AO}$

....

  (ii) $\overrightarrow{AD}$

....

  (iii) $\overrightarrow{AC}$

....

(3)

(b) Given that $\mathbf{p} = \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$ centimetres,

   find the length of a side of the hexagon.

.... cm

(2)

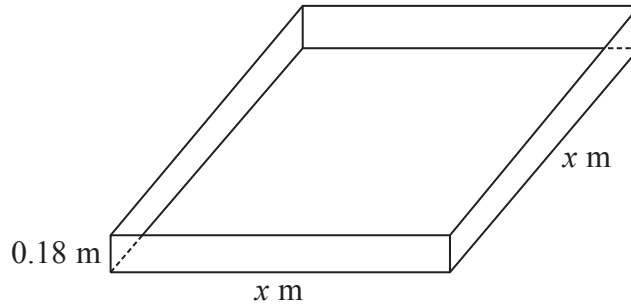**(Total for Question 18 is 5 marks)**

19

Diagram **NOT** accurately drawn

x m

0.18 m

x m

Trena wants to build a sandpit in the shape of a cuboid.
The volume of sand in the sandpit will be 1.0 m³, correct to 1 decimal place.
The depth of sand in the sandpit will be 0.18 metres, correct to 2 decimal places.
The sandpit will have a square base with sides of length x metres.

Find the upper bound for x
Give your answer correct to 3 significant figures.

upper bound = ...

(Total for Question 19 is 4 marks)

Do NOT write in this space.

Turn over ▶

20 Express $\dfrac{4}{x-1} - \dfrac{3}{x+1}$ as a single fraction.
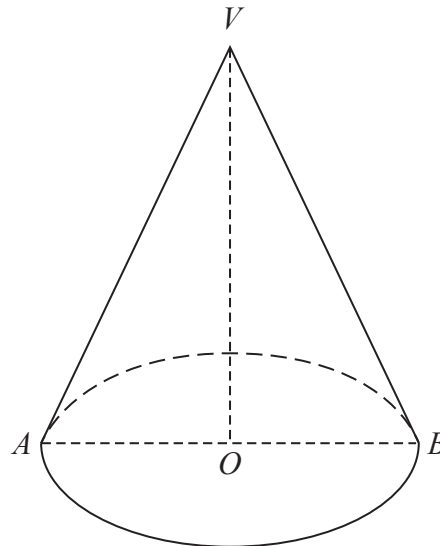
Give your answer as simply as possible.

....

(Total for Question 20 is 3 marks)

Do NOT write in this space.

21

V

A $\dashrightarrow$ O $\dashrightarrow$ B

The diagram shows a solid cone.
The base of the cone is a horizontal circle, centre O, with radius 4.5 cm.
AB is a diameter of the base and OV is the vertical height of the cone.
The curved surface area of the cone is 130 cm²

Calculate the size of the angle AVB.

Give your answer correct to 1 decimal place.

.... °

(Total for Question 21 is 4 marks)

22 Solve the simultaneous equations

$$x^2 + y^2 = 26$$

$$y = 3 - 2x$$

Show clear algebraic working.

....