Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 6 June 2019

Morning (Time: 2 hours 30 minutes) | Paper Reference **4MB1/02**

Mathematics B

Paper 2

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used**.

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.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ▶

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P 6 0 2 5 7 A 0 1 3 6

Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Malcolm is investigating the ages of the 200 members of a theatre company.

The table below gives information about the age group of each member of the company.

Age (t years)	Frequency
$10 < t \leqslant 20$	23
$20 < t \leqslant 30$	47
$30 < t \leqslant 40$	56
$40 < t \leqslant 50$	48
$50 < t \leqslant 60$	26

Malcolm is going to draw a pie chart for this information.

(a) Calculate the size, in degrees, of the angle of the sector in the pie chart for those members of the company whose age group is $40 < t \leqslant 50$

(2)

(b) Calculate an estimate for the mean age, to the nearest year, of the members of the theatre company.

(4)

Question 1 continued

(Total for Question 1 is 6 marks)

2 In 2017, country *A* had a population of 2.35×10^7 people.

Of these people, 48% were male.

(a) Calculate the number of males in country *A* in 2017

(2)

Country *A* is divided into three regions. These three regions are called East Region, Central Region and West Region.

In 2017, the ratio of the number of males in the East Region to the number of males in the Central Region to the number of males in the West Region was 5 : 3 : 2

(b) Calculate the number of males in the Central Region in 2017
Give your answer in standard form.

(2)

In 2017, the number of females in the Central Region was 12.5% greater than the number of males in the Central Region.

(c) Calculate the number of females in the Central Region in 2017

(2)

In 2010, country *B* had a population of 2.5×10^7 people.

From 2010 to 2014, the population of country *B* increased by 2.4%
From 2014 to 2018, the population of country *B* decreased by 2.4%

(d) Calculate the population of country *B* in 2018

(2)

Question 2 continued

(Total for Question 2 is 8 marks)

3

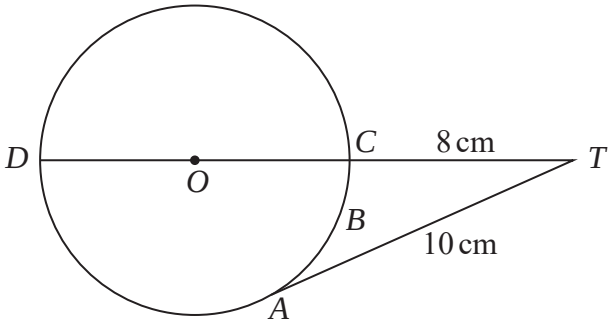


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows the circle *ABCD* with centre *O* and diameter *DC*.

The point *T* is such that *TCOD* is a straight line and *TA* is the tangent to the circle at *A*.

$AT = 10\,\text{cm}$ $TC = 8\,\text{cm}$

(a) Calculate the radius, in cm, of the circle.

(3)

(b) Calculate the length, in cm to 3 significant figures, of the arc *ABC*.

(3)

Question 3 continued

(Total for Question 3 is 6 marks)

4 Triangle A is drawn on the grid opposite.

The points (1, 2), (3, −2) and (1, 4) are the vertices of triangle B.

(a) On the grid, draw and label triangle B.

(1)

(b) Describe fully the single transformation that maps triangle A onto triangle B.

(2)

Triangle C is the image of triangle B under an enlargement with scale factor 2 and centre of enlargement the origin.

(c) On the grid, draw and label triangle C.

(3)

Triangle D is the image of triangle C under the transformation with matrix $\mathbf{M}$ where

$$\mathbf{M} = \begin{pmatrix} -\frac{1}{2} & 0 \\ \frac{1}{2} & -1 \end{pmatrix}$$

(d) On the grid, draw and label triangle D.

(3)

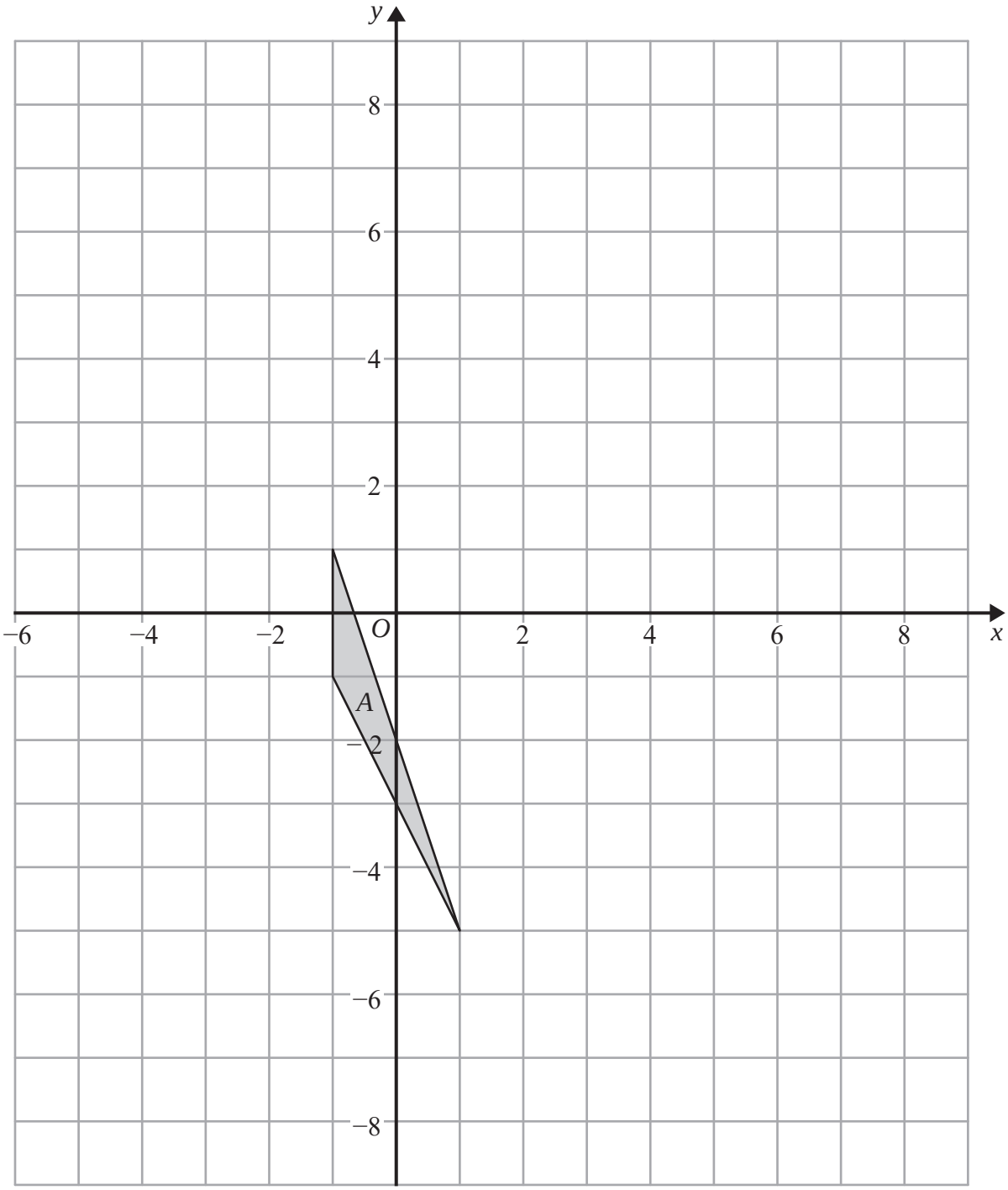
Triangle C is the image of triangle D under the transformation with matrix $\mathbf{N}$.

(e) Find the matrix $\mathbf{N}$.

(3)

$$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad - bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$$

Question 4 continued



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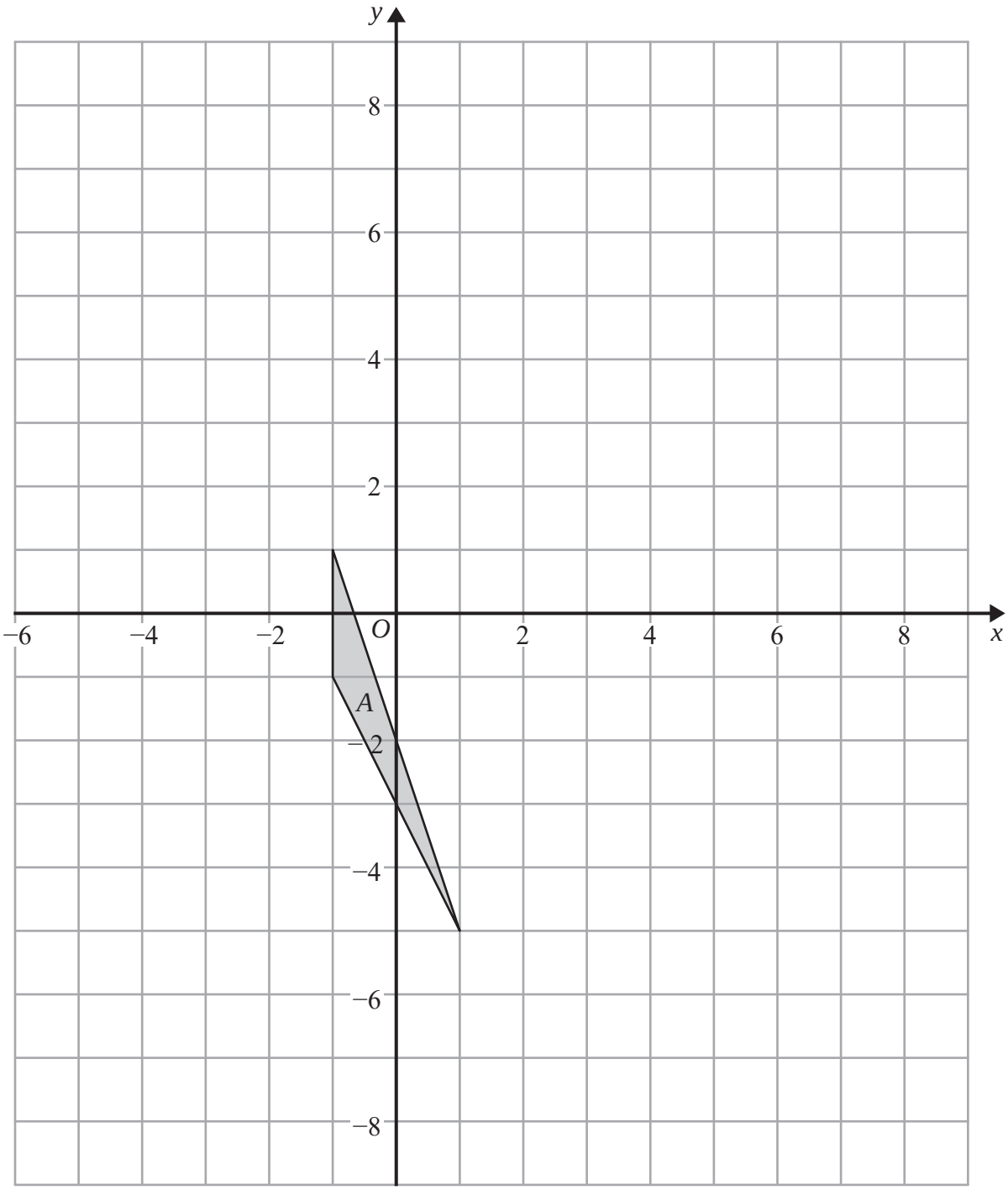
Question 4 continued

Question 4 continued

Only use this grid if you need to redraw your triangles.



(Total for Question 4 is 12 marks)

5

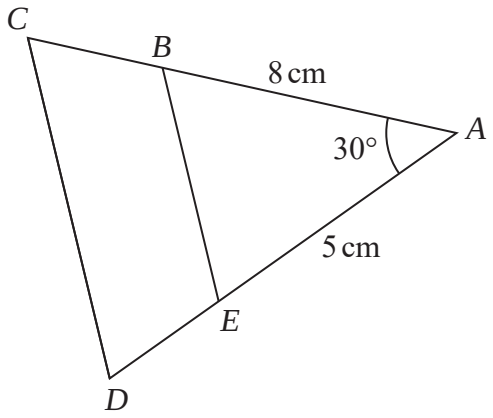


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Figure 2

Figure 2 shows the triangles ABE and ACD where B lies on AC and E lies on AD.
The triangles are similar with $\angle ABE = \angle ACD$.

$AB = 8\,\text{cm}$ $AE = 5\,\text{cm}$ $\angle BAE = 30°$

(a) Calculate the length, in cm to 3 significant figures, of BE.

(3)

(b) Calculate the size, in degrees to 3 significant figures, of $\angle ABE$.

(3)

The area of quadrilateral $BCDE$ is $18.9\,\text{cm}^2$

(c) Calculate the length, in cm to 3 significant figures, of CD.

(4)

$$\left[\begin{array}{c}\text{Cosine rule : } a^2 = b^2 + c^2 - 2bc\cos A \\ \text{Sine rule : } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \\ \text{Area of triangle } = \frac{1}{2}ab\sin C\end{array}\right]$$

Question 5 continued

Question 5 continued

(Total for Question 5 is 10 marks)

6 $A = \{a, b, c, d\}$

Write down all the subsets of A that contain the element b.

(Total for Question 6 is 4 marks)

7 To pass a course, Preety has to pass two tests, test **A** and test **B**.

Each test only has to be passed once.
Passing test **A** and passing test **B** are independent events.

Preety has three attempts to pass test **A**.

The probability that she passes test **A** on her first attempt is $\frac{3}{5}$

If she fails on her first attempt, the probability that she passes on her second attempt is $\frac{2}{5}$

If she fails on her second attempt, the probability that she passes on her third attempt is $\frac{3}{8}$

(a) Calculate the probability she passes test **A**.

(3)

Preety has two attempts to pass test **B**.

The probability that she passes test **B** on her first attempt is $\frac{3}{5}$

The probability that she passes test **B** is $\frac{3}{4}$

(b) Calculate the probability that Preety passes test **B** on her second attempt, given that she fails test **B** on her first attempt.

(3)

Preety decides to take the two tests only if the probability that she passes the course is greater than 0.5

(c) State whether or not Preety should take the two tests.
Give a reason for your answer.

(2)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 8 marks)

8

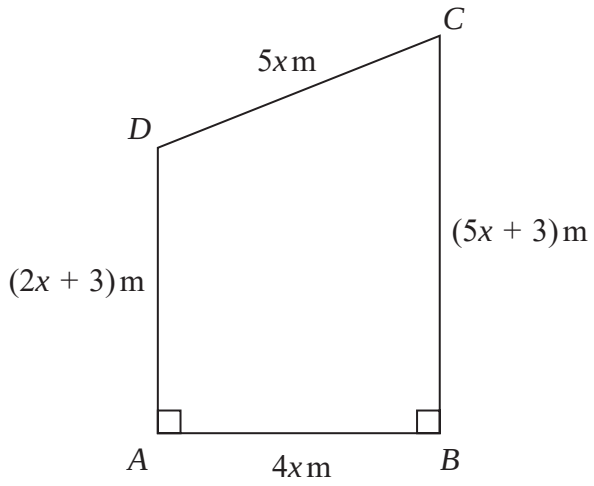


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows the plan for a lawn that is in the shape of a trapezium $ABCD$ in which

$AB = 4x$ metres $\quad BC = (5x + 3)$ metres $\quad CD = 5x$ metres $\quad DA = (2x + 3)$ metres

The perimeter of the lawn is P metres.

(a) Find and simplify an expression for P in terms of x.

(2)

The area of the lawn is $A\,\text{m}^2$

(b) Show that $A = 14x^2 + 12x$

(2)

The owner of the lawn wants the perimeter of the lawn to be greater than 52 m.
He also wants the area of the lawn to be at most $162\,\text{m}^2$

(c) Find the range of possible values of x.
Show clear algebraic working.

(6)

$$\left[\text{Area of trapezium} = \frac{1}{2}(a+b)h\right]$$

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)

9

$$\mathbf{p} = \begin{pmatrix} 2x - 1 \\ y \end{pmatrix} \qquad \mathbf{q} = \begin{pmatrix} y + 3 \\ -y \end{pmatrix}$$

The vectors **p** and **q** are such that $|\mathbf{p}| = \sqrt{98}$ and $\mathbf{p} + \mathbf{q} = \begin{pmatrix} 7 \\ 0 \end{pmatrix}$

(a) Show that $x^2 - 3x - 9 = 0$

(5)

Given that $x > 0$

(b) (i) find the exact value of x,

(2)

(ii) show that $y = 2 - 3\sqrt{5}$

(2)

(c) Find the exact value of $|\mathbf{q}|^2$
Show your working clearly.

(3)

$$\left[\text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right]$$

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 12 marks)

10 The curve C has equation $y = 2x^3 + ax^2 + bx + 10$ where a and b are constants.

The point A, with coordinates (1, 3), lies on C.

(a) Write down an equation in a and b.

(1)

The tangent to C at the point A has gradient -8

(b) Show that $2a + b = -14$

(3)

(c) Hence find the value of a and the value of b.
Show clear algebraic working.

(3)

Using the value of a and the value of b found in part (c),

(d) find the x coordinate of each of the points on C where the tangent to C is parallel to the line with equation $y = 7 - 4x$.
Show clear algebraic working.

(3)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

11

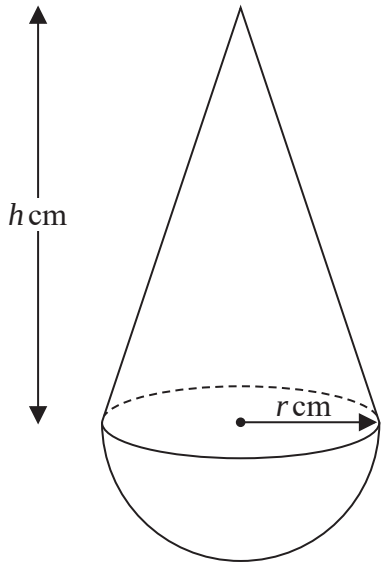


Diagram **NOT** accurately drawn

Figure 4

A child's toy is made by fixing a solid right circular cone, with base radius r cm and height h cm, on the flat circular face of a solid hemisphere of radius r cm. The centre of the base of the cone coincides with the centre of the hemisphere, as shown in Figure 4

Given that $h + 6r = 15$

(a) find the upper bound for the value of r.
Give a reason for your answer.

(2)

The volume of the toy is $V\text{cm}^3$

(b) Show that $V = \frac{1}{3}\pi r^2(15 - 4r)$

(3)

$$\left[\begin{array}{l} \text{Volume of cone} = \frac{1}{3}\pi r^2 h \\ \text{Volume of sphere} = \frac{4}{3}\pi r^3 \end{array}\right]$$

Question 11 continued

Question 11 continues on the next page

Question 11 continued

(c) Complete the following table of values for $V = \frac{1}{3}\pi r^2(15 - 4r)$

Give your values of V to one decimal place.

(3)

r	0	0.4	0.8	1.2	1.6	2.0	2.4
V	0		7.9			29.3	32.6

(d) On the grid opposite, plot the points from your completed table and join them to form a smooth curve.

(2)

The volume of one particular toy is $26\,cm^3$

(e) Use your curve to find, to one decimal place, the value of r.

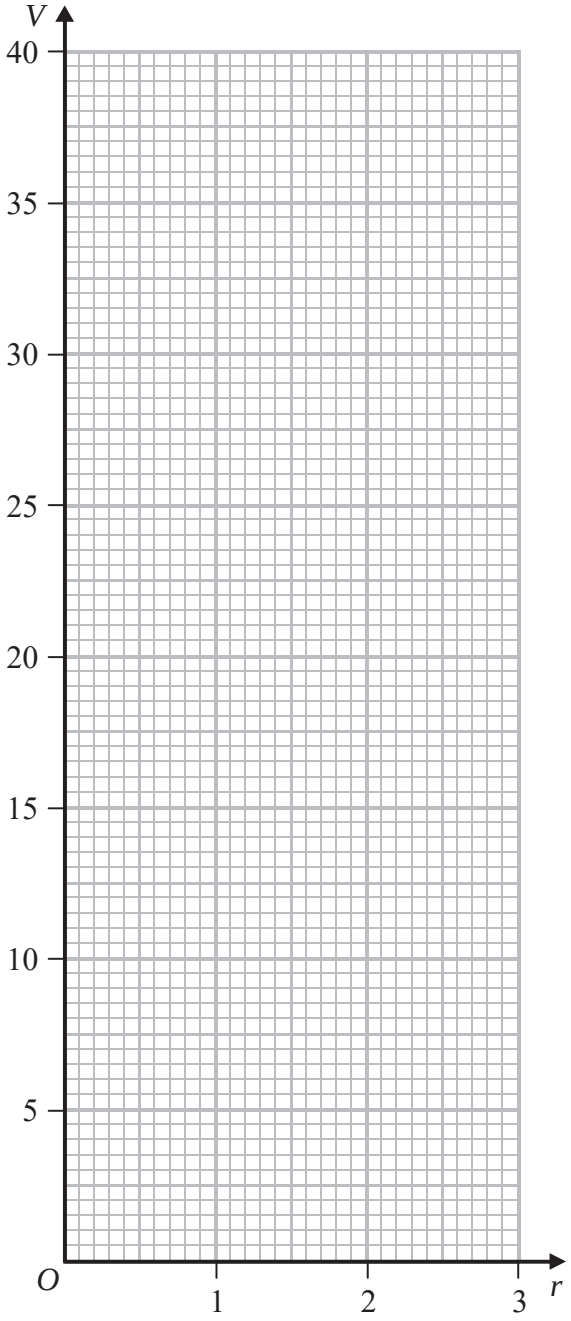
(1)

The manufacturer of the toy decides that the value of V should be twice the value of h.

(f) By drawing a suitable straight line on the grid, find an estimate, to the nearest integer, for the value of V.

(3)

Question 11 continued



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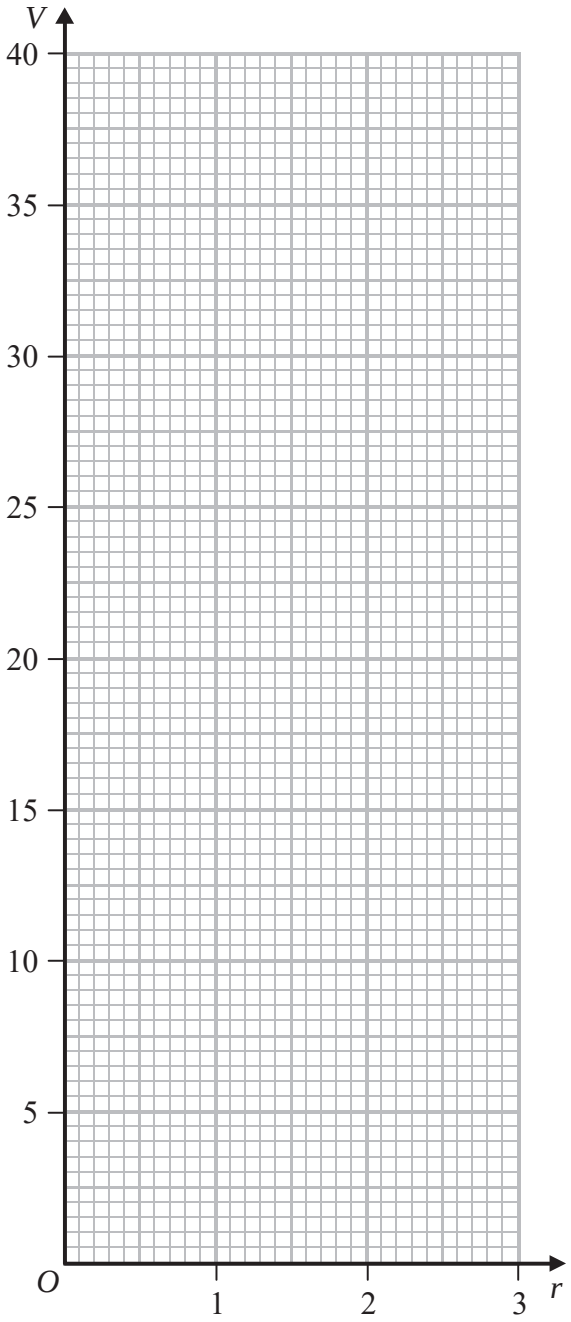
Question 11 continued

Only use this grid if you need to redraw your curve.



(Total for Question 11 is 14 marks)

TOTAL FOR PAPER IS 100 MARKS