Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

Further Pure Mathematics

Paper 2

Thursday 11 June 2015 – Afternoon
Time: 2 hours

Paper Reference
4PM0/02

Calculators 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.*

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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P 4 4 4 0 7 A 0 1 3 2

PEARSON

Answer all TEN questions

Write your answers in the spaces provided

You must write down all the stages in your working

1 (a) Show that $\sum_{r=1}^{n} r = \frac{n}{2}(1 + n)$

(2)

(b) Hence find the sum of all the integers from 1 to 100 inclusive that are **not** multiples of 7

(3)

Question 1 continued

(Total for Question 1 is 5 marks)

2 (a) Complete the table of values for $y = x + \dfrac{6}{x^2}$

Give your answers to 2 decimal places where necessary.

x	1.0	1.25	1.5	1.75	2.0	2.25	2.5	2.75	3.0
y			4.17	3.71		3.44		3.54	3.67

(2)

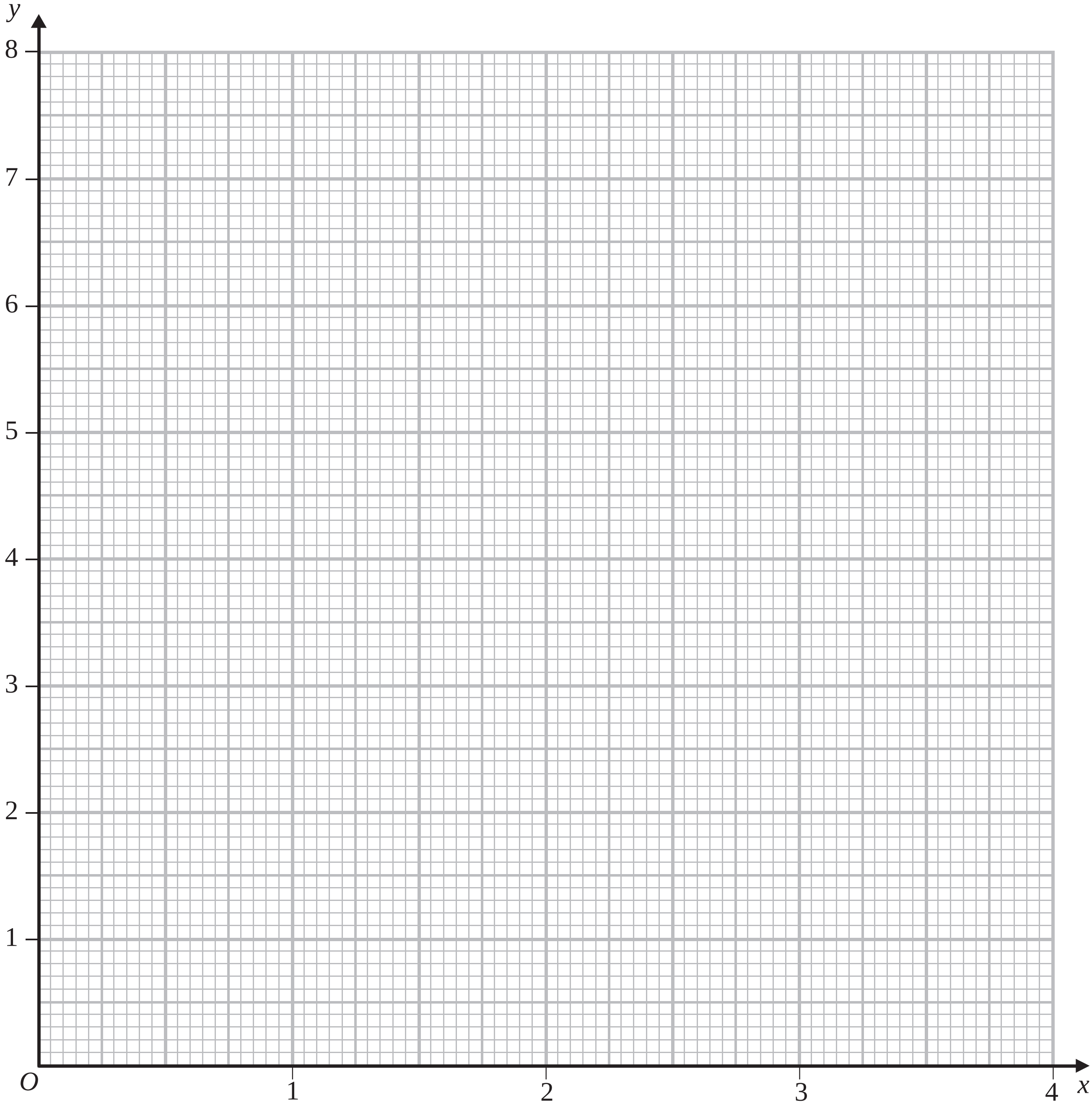
(b) On the grid opposite, draw the graph of $y = x + \dfrac{6}{x^2}$ for $1 \leqslant x \leqslant 3$

(2)

(c) By drawing a suitable straight line on the grid, obtain estimates, to 1 decimal place, for the solutions of the equation $x^3 - 3x^2 + 3 = 0$ in the interval $1 \leqslant x \leqslant 3$

(4)

Question 2 continued

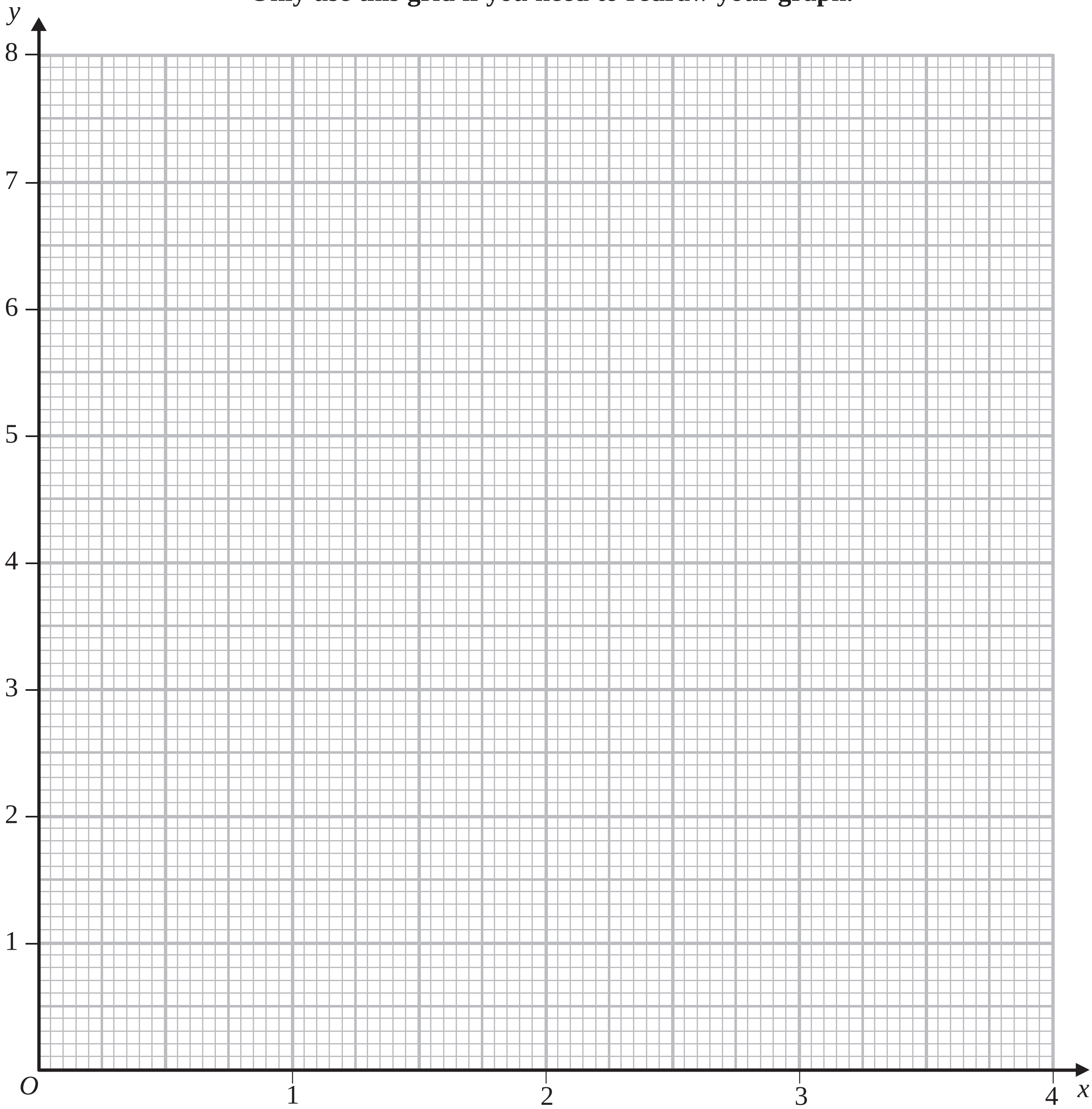


Turn over for a spare grid if you need to redraw your graph.

Question 2 continued

Question 2 continued

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



(Total for Question 2 is 8 marks)

3 Every term of a convergent geometric series is positive. The difference between the third term and the fourth term is twice the fifth term.

(a) Show that the common ratio of the series is $\frac{1}{2}$

(3)

The sum to infinity of this convergent series is 400

Find

(b) the first term of the series,

(2)

(c) the sum of the first 10 terms of the series, writing down all the digits on your calculator display.

(2)

Question 3 continued

(Total for Question 3 is 7 marks)

4 Referred to a fixed origin O, the position vectors of the points P and Q are $(3\mathbf{i} + 6\mathbf{j})$ and $(4\mathbf{i} - 2\mathbf{j})$ respectively.

(a) Find, as a simplified expression in terms of **i** and **j**, $\overrightarrow{PQ}$.

(2)

(b) Find a unit vector which is parallel to $\overrightarrow{PQ}$.

(2)

(c) Show that $\overrightarrow{OP}$ is perpendicular to $\overrightarrow{OQ}$.

(4)

Question 4 continued

(Total for Question 4 is 8 marks)

5 A particle P moves in a straight line such that at time t seconds, the displacement, s metres, of P from a fixed point O on the line is given by

$$s = t^3 - 5t^2 + 6t \qquad t \geqslant 0$$

(a) Find the values of $t (t > 0)$ when P passes through O.

(3)

(b) Find the speed of P when $t = 1$

(4)

(c) Find the magnitude of the acceleration of P at each of the times when it passes through O.

(3)

Question 5 continued

(Total for Question 5 is 10 marks)

6

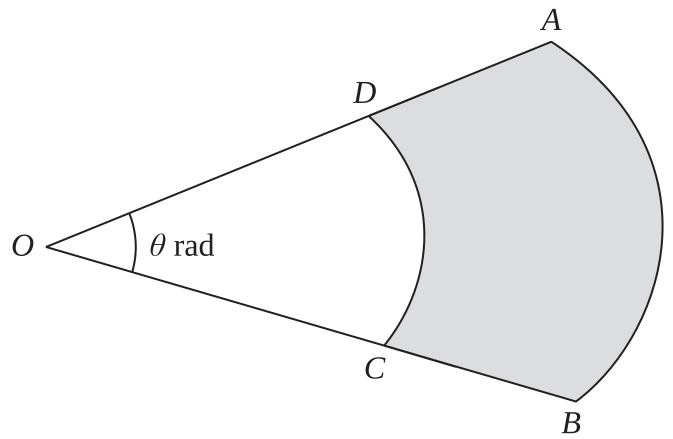


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a sector OAB of the circle with centre O and radius 10 cm.

The points C and D lie on OB and OA respectively and CD is an arc of the circle with centre O and radius 6 cm. The size of angle AOB is θ radians. The shaded region is bounded by the arcs AB and CD and the lines AD and BC.

The area of the shaded region is S cm^2.

(a) Show that $S = 32\theta$.

(3)

The size of angle AOB is increasing at a constant rate of 0.2 rad/s.

(b) Find the rate of increase of S.

(2)

When the area of the shaded region is 20 cm^2

(c) calculate the perimeter of the shaded region.

(5)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 10 marks)

7

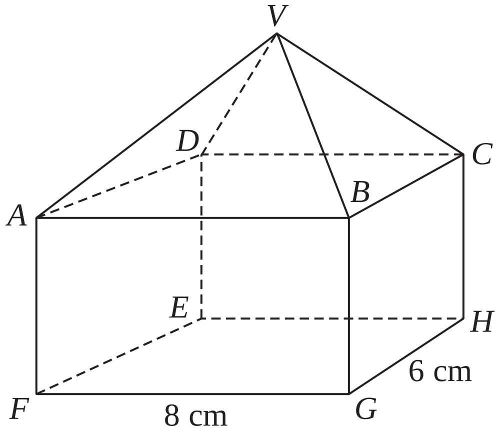


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a solid *VABCDEFGH* which is formed by joining a cuboid *ABCDEFGH* to a right pyramid *VABCD*. The height of the cuboid and the height of the pyramid are both h cm and FG = 8 cm and GH = 6 cm. The total volume of the solid is 256 cm^3.

(a) Show that $h = 4$

(2)

(b) Find, in cm to 3 significant figures, the length of *VF*.

(3)

Find, to the nearest 0.1°,

(c) the angle between *VA* and the plane *ABCD*,

(3)

(d) the acute angle between the plane *VAB* and the plane *ABHE*.

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 12 marks)

8

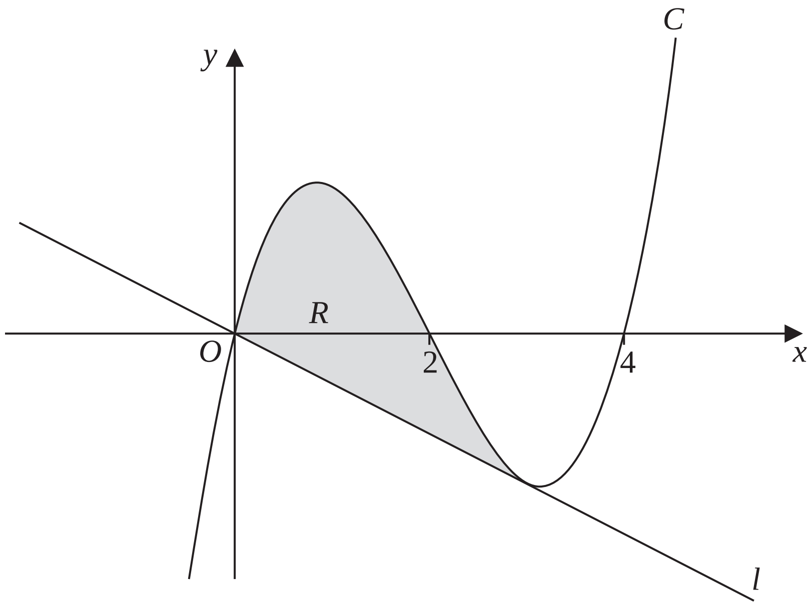


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows part of the curve C with equation $y = x^3 + ax^2 + bx + c$

The curve passes through the origin O and the points with coordinates (2, 0) and (4, 0).

(a) Show that $c = 0$

(1)

(b) Find the value of a and the value of b.

(3)

The point P with x-coordinate 3 lies on C. The line l passes through O and meets C at P.

(c) Show that l is the tangent to C at P.

(4)

The finite region R, shown shaded in Figure 3, is bounded by C and by l.

(d) Use algebraic integration to find the area of R.

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 13 marks)

9 The points A and B have coordinates (2, 9) and (10, 3) respectively.

The point M is the midpoint of AB.

(a) Find the coordinates of M.

(2)

(b) Find the length of AB.

(2)

The line l is the perpendicular bisector of AB.

(c) Find an equation for l giving your answer in the form $ay = bx + c$, where a, b and c are integers.

(4)

The point D lies on l and has coordinates $(d, 2)$.

(d) Find the value of d.

(2)

The point E lies on l and is such that $DM : ME = 1:2$

(e) Find the coordinates of E.

(2)

(f) Find the area of the kite $AEBD$.

(4)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 16 marks)

10 (a) Find the value of $\log_3 9$

(1)

Given that $\log_9 4 = k \log_3 4$

(b) find the value of k

(2)

(c) Show that

$$2x \log_3 x - 3 \log_3 x - 4x \log_9 4 + 6 \log_9 4 = \log_3 \left(\frac{x}{4}\right)^{(2x-3)}$$

(5)

(d) Hence solve the equation $2x \log_3 x - 3 \log_3 x - 4x \log_9 4 + 6 \log_9 4 = 0$

(3)

Question 10 continued

Question 10 continued

(Total for Question 10 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS