Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 2

Tuesday 20 June 2017 – 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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Pearson

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) On the grid opposite, draw the graphs of the lines with equations

(i) $y = 2x$ (ii) $y = 6 - x$ (iii) $2y = x - 2$

(3)

(b) Show, by shading on the grid, the region R defined by the inequalities

$$y \leqslant 2x, \quad y \leqslant 6 - x, \quad 2y \geqslant x - 2, \quad y \geqslant 0$$

(1)

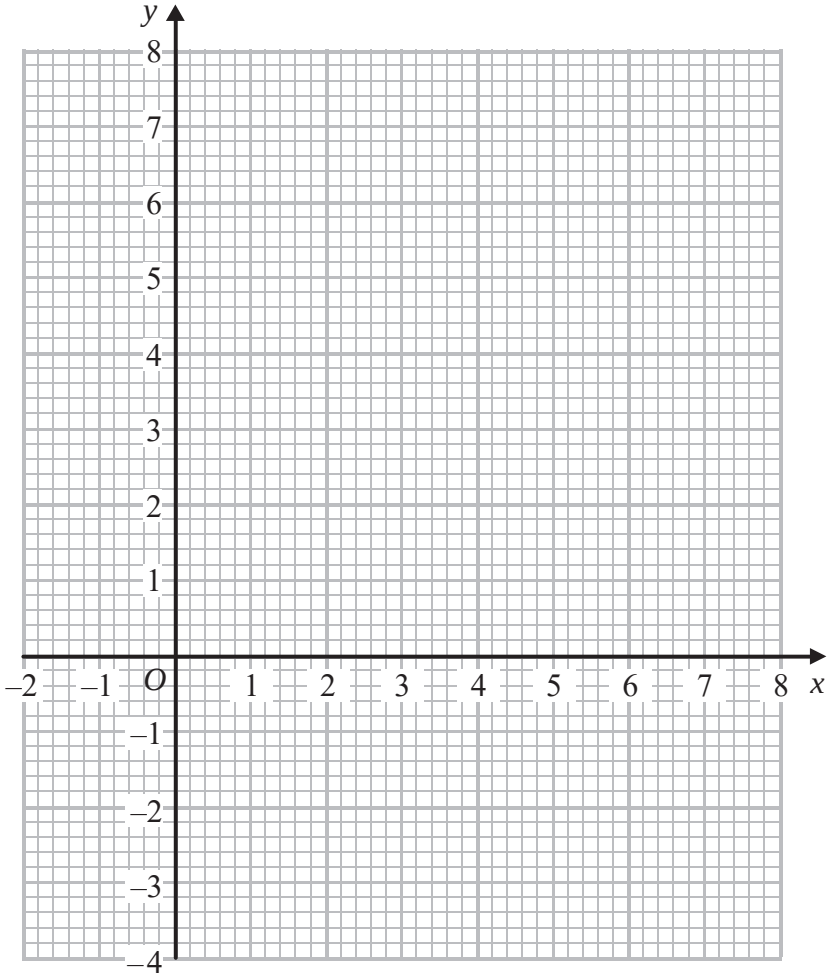
For all points in R, with coordinates (x, y),

$$P = y + 2x$$

(c) Find the greatest value of P.

(1)

Question 1 continued



(Total for Question 1 is 5 marks)

2 Solve the equations

$$y = x^2 - 6x + 5$$

$$y + x = 11$$

(5)

(Total for Question 2 is 5 marks)

3 (a) Find the set of possible values of p for which the equation $3x^2 + px + 3 = 0$ has no real roots.

(3)

(b) Find the **integer** values of q for which the equation $x^2 + 7x + q^2 = 0$ has real roots.

(3)

(Total for Question 3 is 6 marks)

4 A particle P is moving along a straight line which passes through the point O.
At time $t = 0$ the particle P is at the point O.

At time t seconds the velocity, v m/s, of P is given by $v = 3t^2 + 2t + 5$

(a) Find the acceleration of P when $t = 2$

(3)

(b) Find the displacement of P from O when $t = 3$

(3)

Question 4 continued

(Total for Question 4 is 6 marks)

5 In triangle ABC, $AB = x$ cm, $BC = (4x - 5)$ cm, $AC = (2x + 3)$ cm and angle $ABC = 60°$.

Find, to 3 significant figures,

(a) the value of x,

(5)

(b) the area of triangle ABC.

(3)

Question 5 continued

(Total for Question 5 is 8 marks)

6 $f(x) = (p + qx)^6$ where $p \neq 0$ and $q \neq 0$

(a) Find the expansion of $f(x)$ in ascending powers of x up to and including the term in x^4, simplifying each term as far as possible.

(3)

In the expansion of $f(x)$, 4 times the coefficient of x^4 is equal to 9 times the coefficient of x^2

Given that $(p + q) > 0$ and $f(1) = 15\,625$

(b) find the possible pairs of values of p and q.

(6)

Question 6 continued

(Total for Question 6 is 9 marks)

7 A solid cuboid has width x cm, length $5x$ cm and height h cm. The total surface area of the block is 480 cm^2. The volume of the block is V cm^3.

(a) Show that $V = 200x - \frac{25}{6}x^3$

(4)

(b) Find the maximum value of V.

(5)

Question 7 continued

(Total for Question 7 is 9 marks)

8 $f(x) = x^2 + px + 7 \qquad p \in \mathbb{R}$

The roots of the equation $f(x) = 0$ are α and β

(a) Find, in terms of p where necessary,

(i) $\alpha^2 + \beta^2$ (ii) $\alpha^2\beta^2$

(4)

Given that $7(\alpha^2 + \beta^2) = 5\alpha^2\beta^2$

(b) find the possible values of p

(2)

Using the positive value of p found in part (b) and without solving the equation $f(x) = 0$

(c) form a quadratic equation with roots $\frac{2p}{\alpha^2}$ and $\frac{2p}{\beta^2}$

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

9

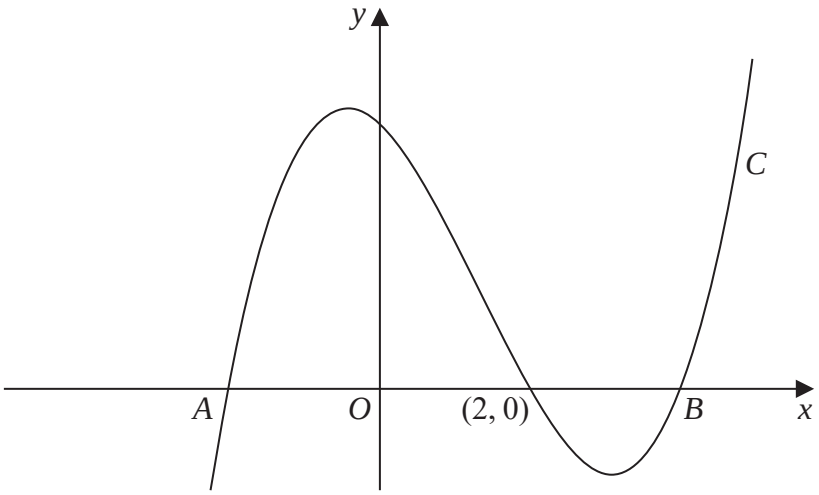


Diagram **NOT** accurately drawn

Figure 1

The curve C with equation $y = x^3 - 4x^2 - 4x + 16$ crosses the x-axis at the point with coordinates $(2, 0)$ and at the points A and B, as shown in Figure 1. The coordinates of the points A and B are $(a, 0)$ and $(b, 0)$ respectively.

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

(4)

The point D lies on C and has x coordinate 0

The line l is the tangent to C at the point D.

(b) Find an equation of l.

(5)

(c) Show that l passes through B.

(1)

(d) Use algebraic integration to find the area of the finite region bounded by l and C.

(5)

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Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 15 marks)

10

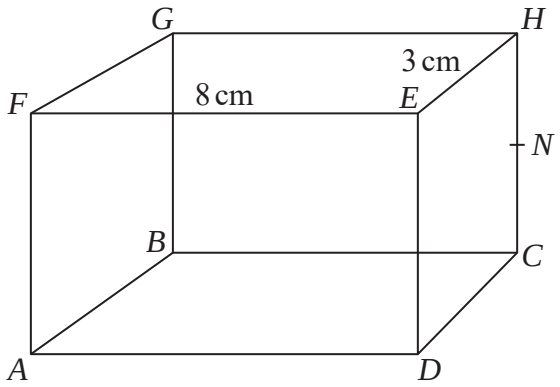

Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a solid cuboid $ABCDEFGH$ with $EF = 8\,\text{cm}$ and $EH = 3\,\text{cm}$.

The angle between the diagonal AH of the cuboid and the plane $ABCD$ is 45°.

The midpoint of CH is N.

Find, in cm to 3 significant figures,

(a) the length of CH,

(4)

(b) the length of AH,

(3)

(c) the length of FN.

(3)

Find, in degrees to 1 decimal place, the size of

(d) the angle between the plane $BCEF$ and the plane $FGHE$,

(3)

(e) angle FNG.

(3)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 16 marks)

11 (a) Show that $\log pq^4 - \log pq^2 = \log pq^6 - \log pq^4$

(3)

Given that $\log pq^2$ and $\log pq^4$ are the second and third terms of an arithmetic series, find

(b) the first term of the series,

(3)

(c) the sum of the first n terms of the series.

Give your answer in the form $n \log pq^s$, expressing s in terms of n.

(4)

Question 11 continued

Question 11 continued

(Total for Question 11 is 10 marks)

TOTAL FOR PAPER IS 100 MARKS