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Edexcel
International GCSE

Centre Number

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Candidate Number

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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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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

$$y \leq 2x, \quad y \leq 6 - x, \quad 2y \geq x - 2, \quad y \geq 0$$

(1)

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

$$P = y + 2x$$

(c) Find the greatest value of P .

(1)

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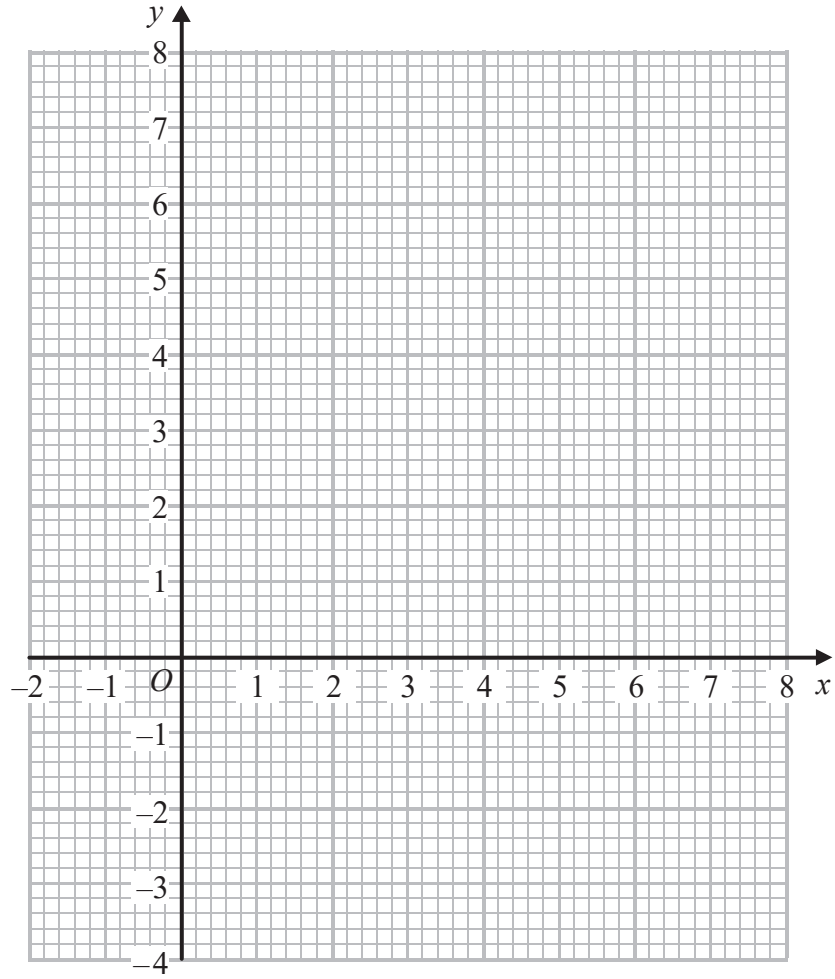
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Question 1 continued



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(Total for Question 1 is 5 marks)



2 Solve the equations

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

$$y + x = 11$$

(5)

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(Total for Question 2 is 5 marks)



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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)

Area with horizontal dotted lines for writing answers.

(Total for Question 3 is 6 marks)



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- 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)

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Question 4 continued

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(Total for Question 4 is 6 marks)



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

Find, to 3 significant figures,

(a) the value of x ,

(5)

(b) the area of triangle ABC .

(3)

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Question 5 continued

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(Total for Question 5 is 8 marks)



6

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

- (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 $f(1) = 15625$

- (b) find the possible pairs of values of p and q . (6)

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Question 6 continued

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(Total for Question 6 is 9 marks)



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Question 7 continued

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Area with horizontal dotted lines for writing.

(Total for Question 7 is 9 marks)



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8

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

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)

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Question 8 continued

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Handwriting practice area with 25 horizontal dotted lines.



Question 8 continued

Area with horizontal dotted lines for writing.

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Question 8 continued

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(Total for Question 8 is 11 marks)



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Diagram NOT accurately drawn

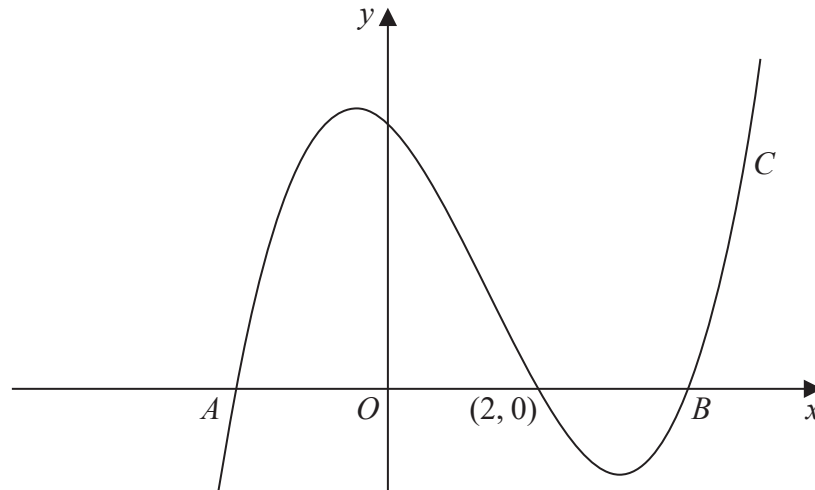


Figure 1

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

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Question 9 continued

Handwriting practice area consisting of 20 horizontal dotted lines.

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Question 9 continued

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Area with horizontal dotted lines for writing.

(Total for Question 9 is 15 marks)



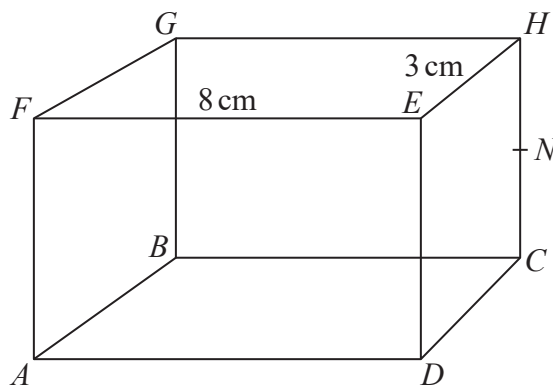


Figure 2

Diagram NOT accurately drawn

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)

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Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 16 marks)



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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

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Handwriting practice area consisting of 25 horizontal dotted lines.



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Question 11 continued

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(Total for Question 11 is 10 marks)

TOTAL FOR PAPER IS 100 MARKS

