Write your name here

Surname		Other names

Edexcel International GCSE

Centre Number

Candidate Number

Further Pure Mathematics
Paper 2

Monday 25 January 2016 – Morning
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 ▶

Answer all TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   Find the exact solution of

$$4^{(x-2)} = 8^{(3x-1)}$$

(4)

(Total for Question 1 is 4 marks)

2 The sector OAB of a circle, centre O, has area 48 cm².

The length of the arc AB is 8 cm and the size of angle AOB is θ radians.

Find

(i) the radius of sector OAB

(ii) the value of θ

(5)

(Total for Question 2 is 5 marks)

3 Solve the equations

$$3y = 12 - 4x$$

$$(x + 1)^2 + (y - 2)^2 = 4$$

(7)

Question 3 continued

(Total for Question 3 is 7 marks)

4 Given that $y = e^{2x}\sqrt{x+1}$

show that $\dfrac{dy}{dx} = \dfrac{e^{2x}(4x+5)}{2\sqrt{x+1}}$

(6)

Question 4 continued

(Total for Question 4 is 6 marks)

5 Given that $\alpha + \beta = 5$ and $\alpha^2 + \beta^2 = 19$

(a) show that $\alpha\beta = 3$

(2)

(b) Hence form a quadratic equation, with integer coefficients, which has roots α and β

(2)

(c) Form a quadratic equation, with integer coefficients, which has roots $\dfrac{\alpha}{\beta}$ and $\dfrac{\beta}{\alpha}$

(5)

Question 5 continued

(Total for Question 5 is 9 marks)

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6

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\frac{\sin A}{\cos A} = \tan A$$

Using the above formulae, show that

(a) $\sin 2x = 2\sin x \cos x$

(1)

(b) $\cos 2x = \cos^2 x - \sin^2 x$

(1)

(c) $\dfrac{\sin 2x}{1 + \cos 2x} = \tan x$

(4)

Question 6 continued

(Total for Question 6 is 6 marks)

7

Figure 1

Figure 1 shows the curve with equation $y = \dfrac{x^2 - 2}{2x - 3}$ where $x \neq \dfrac{3}{2}$

(a) Write down an equation of the asymptote to the curve which is parallel to the y-axis.

(1)

(b) Find $\dfrac{dy}{dx}$

(3)

(c) Find the coordinates of the stationary points on the curve.

(5)

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Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 9 marks)

8 The nth term of an arithmetic series is t_n where $t_n = 2n - 3$

The sum of the first n terms of the series is S_n

(a) Show that $S_n = n(n - 2)$

(4)

(b) Find the value of n such that $5t_{n+2} = 3S_{n-3}$

(5)

P 4 6 2 4 1 A 0 1 6 3 6

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 9 marks)

9
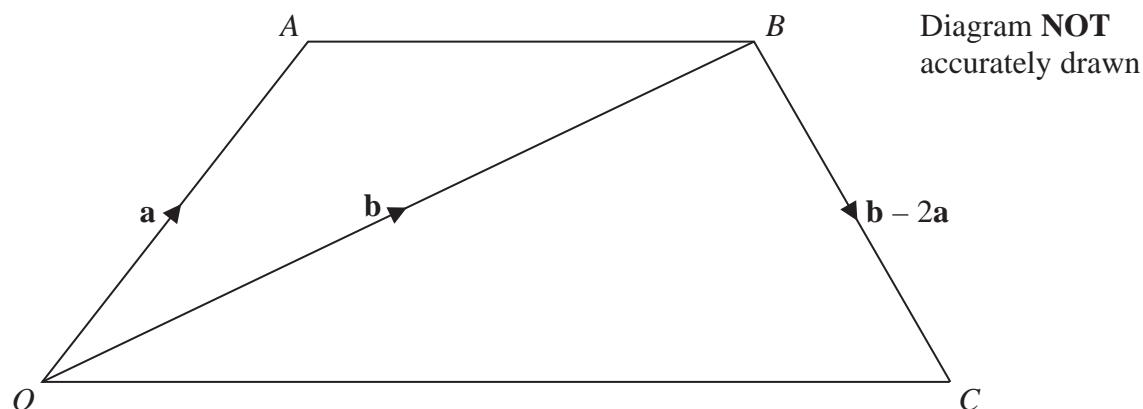
Figure 2

Figure 2 shows a quadrilateral $OABC$

$$\overrightarrow{OA} = \mathbf{a}, \ \overrightarrow{OB} = \mathbf{b} \text{ and } \overrightarrow{BC} = \mathbf{b} - 2\mathbf{a}$$

(a) (i) Prove that $\overrightarrow{AB}$ is parallel to $\overrightarrow{OC}$

  (ii) Show that $AB:OC = 1:2$

(4)

The point D lies on OB such that $OD:DB = 2:3$

(b) Find the ratio of the area of $\triangle ODC$: the area of $\triangle OAB$.

(6)

Question 9 continued

P 4 6 2 4 1 A 0 2 1 3 6

Question 9 continued

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Question 9 continued

(Total for Question 9 is 10 marks)

10 $$f(x) = 2x^3 - px^2 - 13x - q$$

When $f(x)$ is divided by $(x - 2)$ the remainder is -20

Given that $(x - 3)$ is a factor of $f(x)$

(a) find the value of p and the value of q

(7)

(b) Hence use algebra to solve the equation $f(x) = 0$

(5)

Question 10 continued

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Question 10 continued

P 4 6 2 4 1 A 0 2 6 3 6

Question 10 continued

(Total for Question 10 is 12 marks)

11 (a) Complete the table of values for $y = e^{(x-1)} + 2$

Give your answers to 2 decimal places where appropriate.

x	-2	-1	0	1	2	3
f(x)	2.05				4.72	9.39

(2)

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

(2)

(c) Use your graph to obtain an estimate, to 1 decimal place, of the root of the equation $4 = e^{(x-1)}$ in the interval $-2 \leqslant x \leqslant 3$

(2)

(d) By drawing a straight line on the grid, obtain an estimate, to 1 decimal place, of the root of the equation $\ln(4x - 4) = x - 1$ in the interval $-2 \leqslant x \leqslant 3$

(5)

Question 11 continued
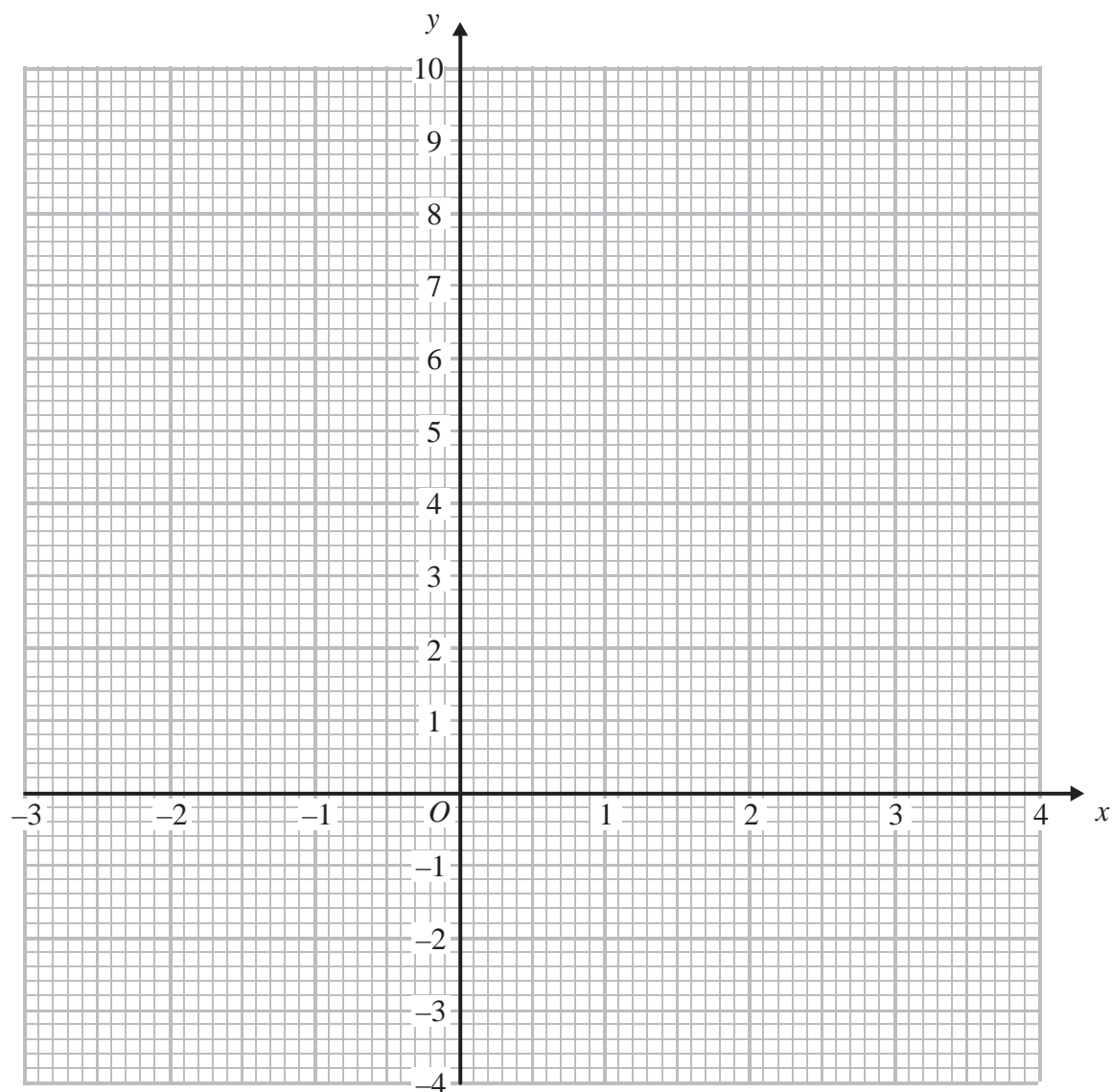
Turn over for a spare grid if you need to redraw your graph.

Question 11 continued

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Question 11 continued

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

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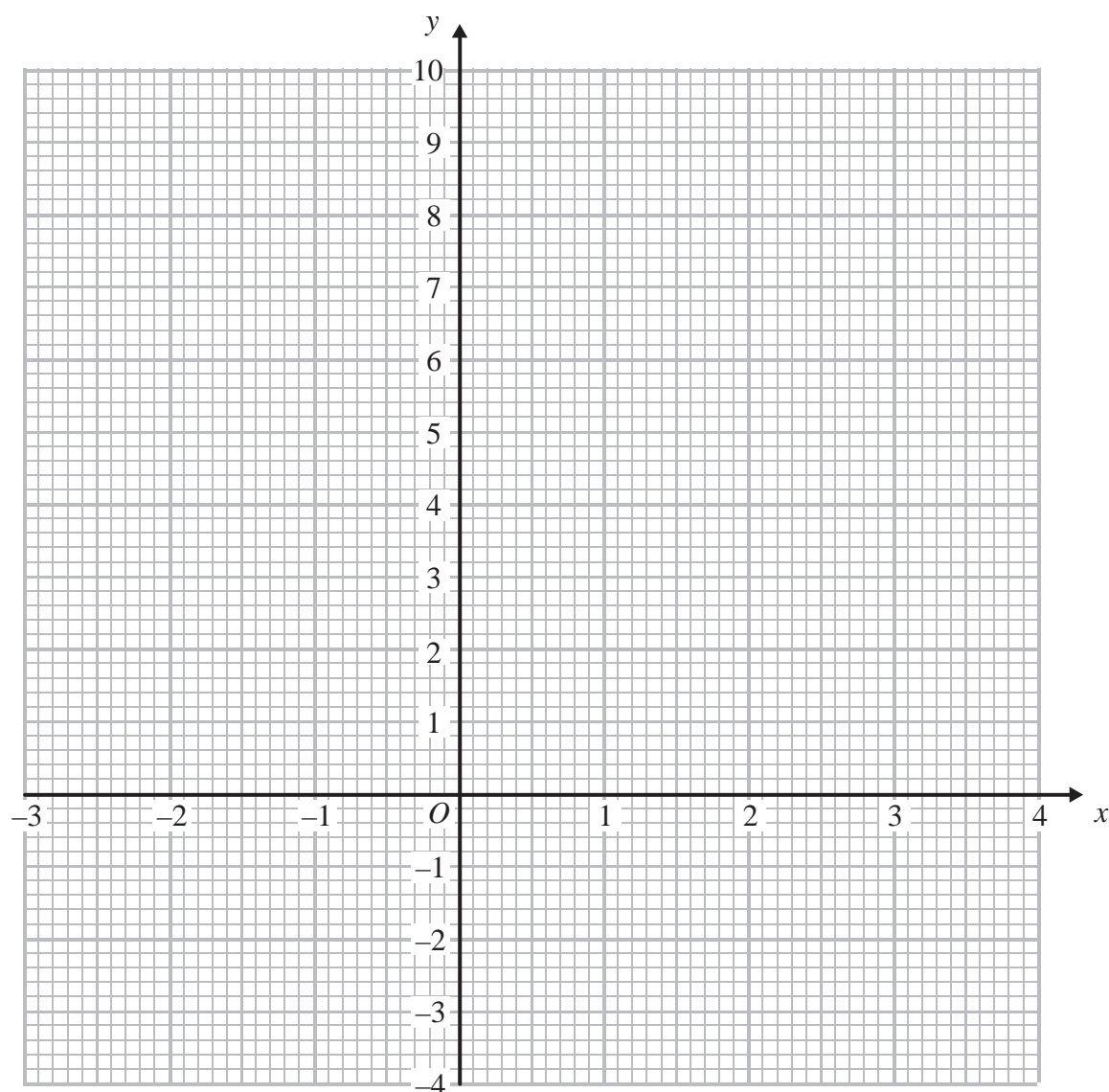
(Total for Question 11 is 11 marks)

P 4 6 2 4 1 A 0 3 1 3 6

12

Diagram **NOT**
accurately drawn
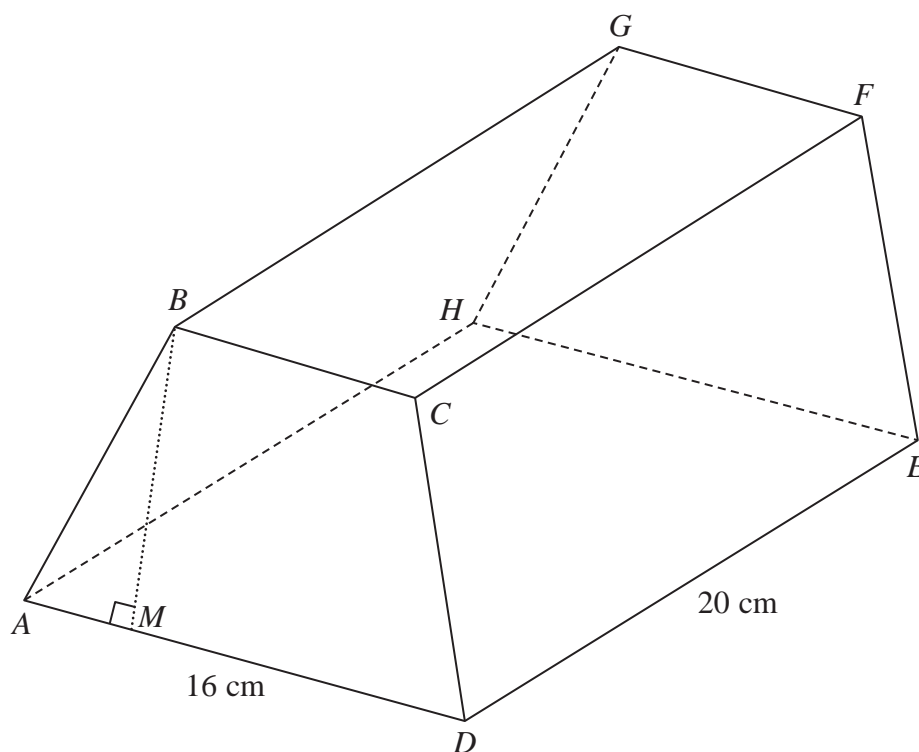
Figure 3

Figure 3 shows a right prism *ABCDEFGH*. The cross section *ABCD* of the prism is a trapezium with *AB = DC*. The point *M* lies on *AD* and *BM* is perpendicular to *AD*.

AB = 8 cm   *CD* = 8 cm   *BC* = 8 cm   *AD* = 16 cm   *DE* = 20 cm

Given that $BM = p\sqrt{q}$ cm where *q* is a prime number,

(a) find the value of *p* and the value of *q*.

(3)

(b) Find the size of angle *BAM* in degrees.

(2)

Find, in degrees to the nearest 0.1°

(c) the size of the angle between *EB* and the plane *ADEH*,

(4)

(d) the size of the angle between the plane *BCEH* and the plane *ADEH*.

(3)

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Question 12 continued

Question 12 continued

Question 12 continued

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(Total for Question 12 is 12 marks)

TOTAL FOR PAPER IS 100 MARKS