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Surname	Other names
Pearson Edexcel International GCSE	Centre Number <div style="display: flex; justify-content: space-around; border: 1px solid black; height: 20px; width: 100%;"> </div>
Candidate Number <div style="display: flex; justify-content: space-around; border: 1px solid black; height: 20px; width: 100%;"> </div>	
<h1 style="margin: 0;">Further Pure Mathematics</h1> <h2 style="margin: 0;">Paper 1</h2>	
Tuesday 14 June 2016 – Morning Time: 2 hours	Paper Reference 4PM0/01
Calculators may be used.	Total Marks <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

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 TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

$$f(x) = x^3 - 7x + 6$$

(a) Show that $(x - 2)$ is a factor of $f(x)$

(2)

(b) Hence, or otherwise, factorise $f(x)$ completely.

(3)

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Question 1 continued

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(Total for Question 1 is 5 marks)



- 2 (a) Expand $(1 + 3x^2)^{-\frac{1}{3}}$, $3x^2 < 1$, in ascending powers of x , up to and including the term in x^6 , simplifying each term as far as possible.

(3)

$$f(x) = \frac{1 - kx^2}{(1 + 3x^2)^{\frac{1}{3}}} \text{ where } k \text{ is a constant}$$

- (b) Obtain a series expansion for $f(x)$ in ascending powers of x up to and including the term in x^4 .

(3)

Given that the coefficient of x^2 in the expansion of $f(x)$ is -5

- (c) find the value of k .

(1)

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Question 2 continued

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(Total for Question 2 is 7 marks)



- 3 A right pyramid $ABCDE$ has a square base $ABCD$ of side 10 cm.
The height of the pyramid is 8 cm.

(a) Find, to 3 significant figures, the length of AE .

(3)

(b) Find, in degrees to the nearest degree, the size of the angle between the plane ABE and the base $ABCD$.

(3)

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Question 3 continued

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(Total for Question 3 is 6 marks)



- 4 The n th term of an arithmetic series is t_n and the sum of the first n terms of the series is S_n

Given that $S_2 = \frac{2}{3}t_5$ and that $S_4 = t_{10} + 3$

(a) find

(i) the common difference of the series,

(ii) the first term of the series.

(5)

Given also that $S_{p+2} - S_p = 110$

(b) find the value of p .

(3)

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Question 4 continued

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(Total for Question 4 is 8 marks)



5 Using the identities

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

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

(a) show that the equation

$$3 \sin(x + \alpha) = 5 \sin(x - \alpha)$$

can be written in the form $\tan x = 4 \tan \alpha$

(5)

(b) Hence solve, to the nearest integer, the equation

$$3 \sin(2y + 30)^\circ = 5 \sin(2y - 30)^\circ \quad \text{for } 90 \leq y < 180$$

(4)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 9 marks)

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6 Solve

$$(a) \log_x 1024 = 5 \quad (2)$$

$$(b) \log_3 (7y - 3) = 4 \quad (2)$$

$$(c) \log_a 25 + 2\log_a 625 = 10 \quad (3)$$

$$(d) \log_b 7 - 2\log_7 b + 1 = 0 \quad (5)$$

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Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 12 marks)



- 7 (a) Complete the table of values for $y = 2^x - 4$, giving your answers to 2 decimal places.

x	0	0.5	1	1.5	2	2.5	2.75	3
y	-3		-2		0		2.73	4

(2)

- (b) On the grid opposite, draw the graph of $y = 2^x - 4$ for $0 \leq x \leq 3$

(2)

- (c) Use your graph to obtain an estimate, to one decimal place, of the value of $\log_2 7$
Show clearly how you used the graph.

(3)

- (d) By drawing a straight line on your graph, obtain an estimate to one decimal place of the root of the equation $2^x + 3x = 7$ in the interval $0 \leq x \leq 3$

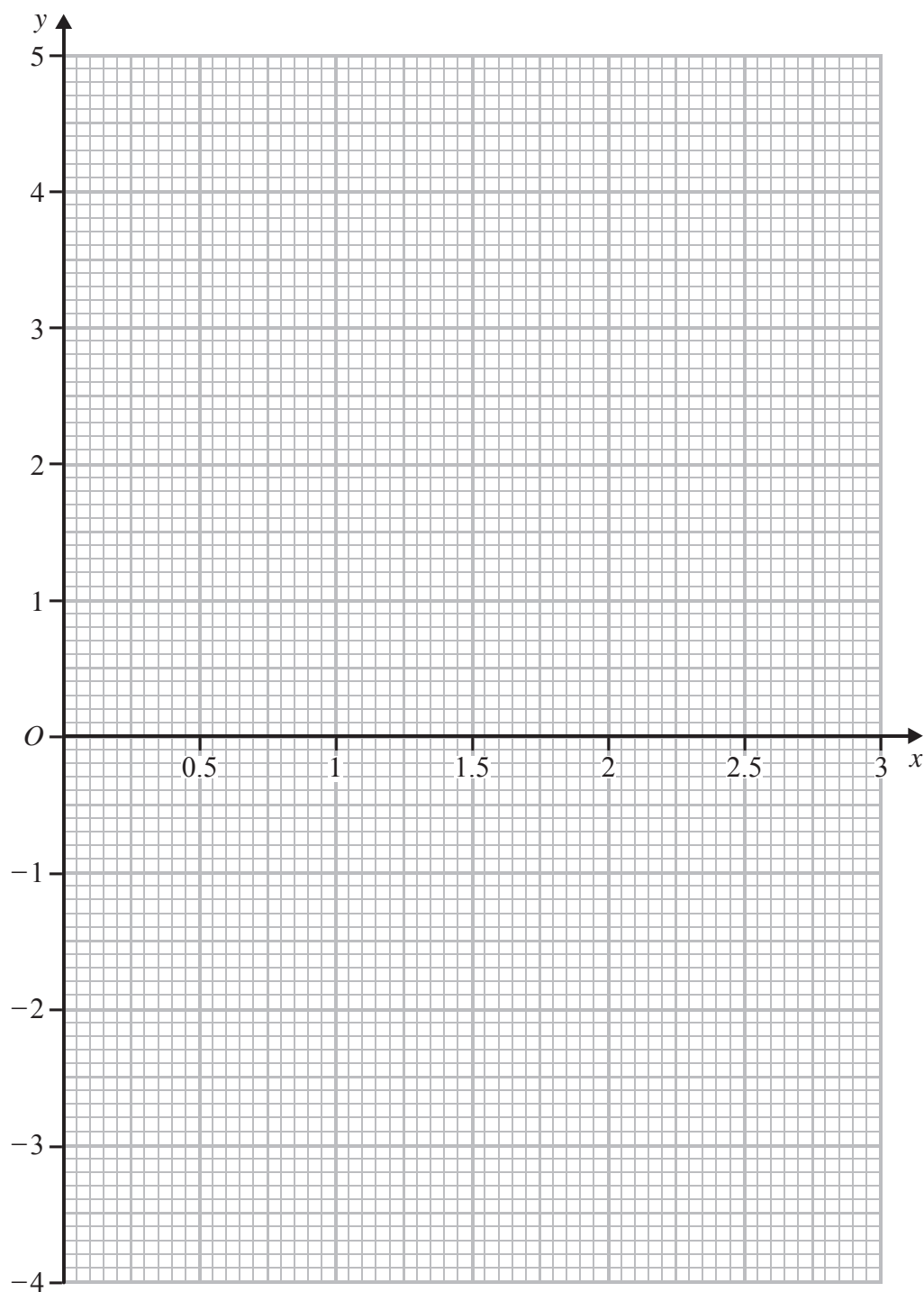
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Question 7 continued

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



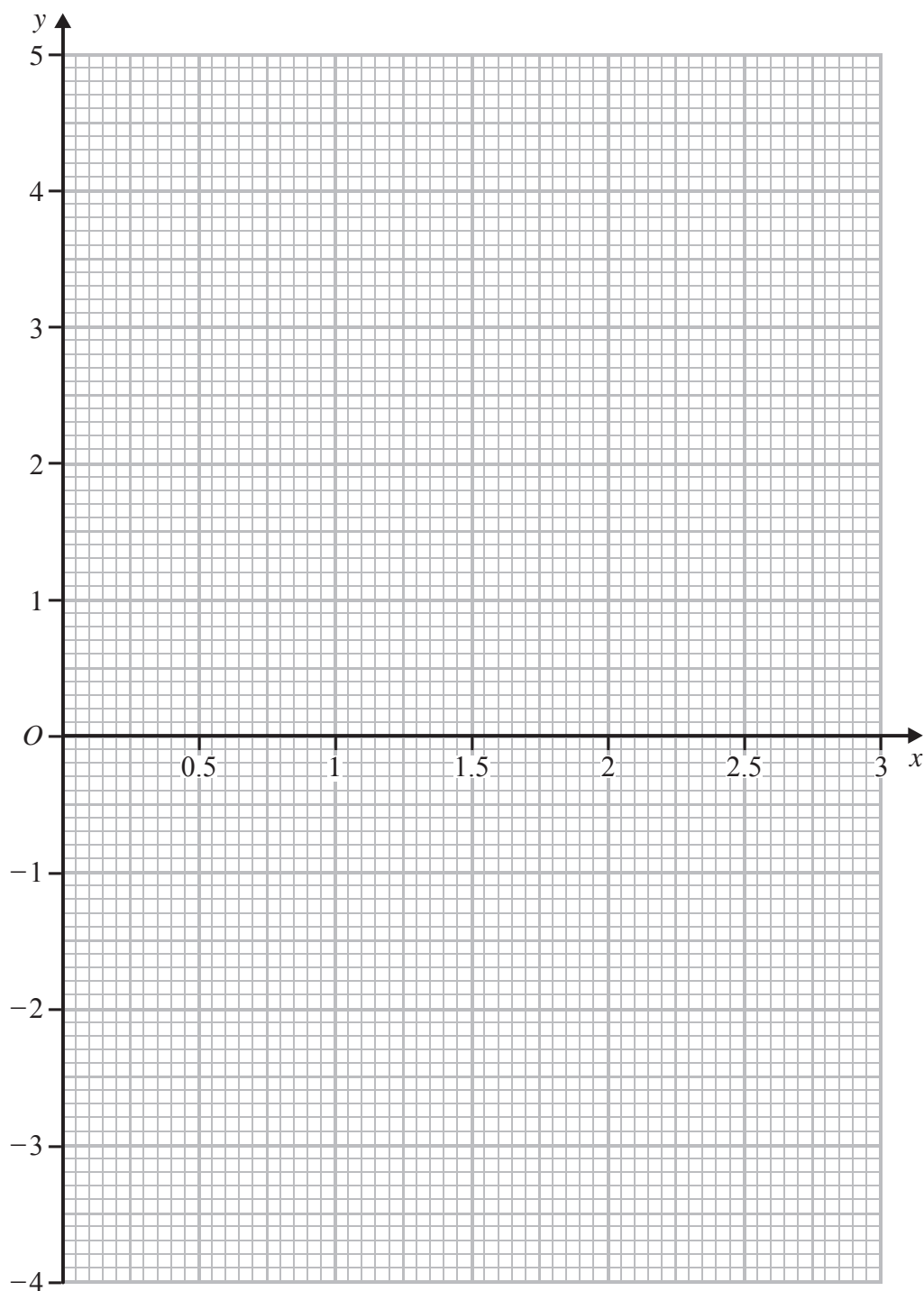
Question 7 continued

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Question 7 continued**Only use this grid if you need to redraw your graph****(Total for Question 7 is 11 marks)**

8

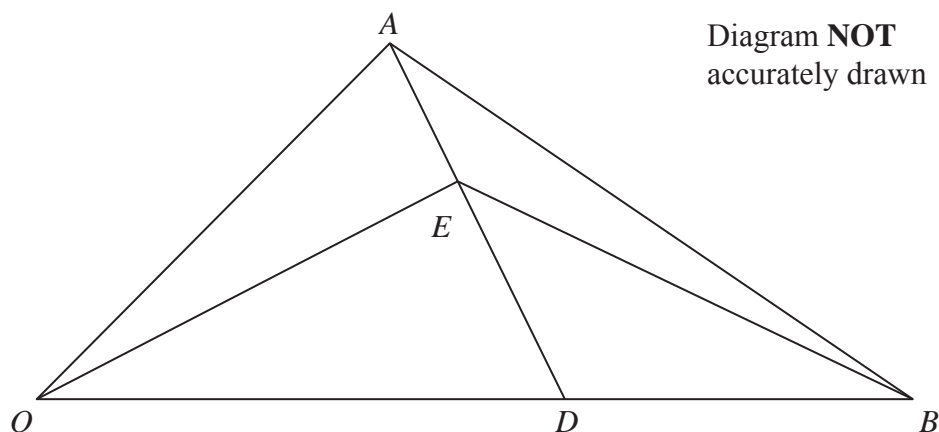


Figure 1

In Figure 1, $\vec{OA} = \mathbf{a}$, $\vec{OB} = \mathbf{b}$ and $\vec{OD} = \frac{2}{3}\mathbf{b}$

The point E divides AD in the ratio $2:3$

(a) Find as simplified expressions in terms of \mathbf{a} and \mathbf{b}

(i) \vec{AD}

(ii) \vec{OE}

(iii) \vec{BE}

(5)

The point F lies on OA such that $\vec{OF} = \lambda\vec{OA}$ and F , E and B are collinear.

(b) Find the value of λ .

(5)

The area of triangle OFB is 5 square units.

(c) Find the area of triangle OAD .

Give your answer in the form $\frac{p}{q}$, where p and q are integers.

(3)

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Question 8 continued

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 13 marks)



9

$$f(x) = 3x^2 - 5x - 4$$

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

- (a) Without solving the equation $f(x) = 0$, form an equation, with integer coefficients, which has

(i) roots $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ (6)

(ii) roots $2\alpha + \beta$ and $\alpha + 2\beta$ (5)

- (b) Express $f(x)$ in the form $A(x + B)^2 + C$, stating the values of the constants A , B and C . (3)

- (c) Hence, or otherwise, show that the equation $f(x) = -8$ has no real roots. (2)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 16 marks)



- 10** The points A and B have coordinates $(2, 4)$ and $(5, -2)$ respectively.
The point C divides AB in the ratio $1:2$

(a) Find the coordinates of C .

(2)

The point D has coordinates $(1, 1)$

(b) Show that DC is perpendicular to AB .

(3)

(c) Find the equation of DC in the form $py = x + q$

(2)

The point E is such that DCE is a straight line and $DC = CE$.

(d) Find the coordinates of E .

(2)

(e) Calculate the area of quadrilateral $ADBE$.

(4)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 13 marks)**TOTAL FOR PAPER IS 100 MARKS**