Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 1

Tuesday 14 June 2016 – Morning
Time: 2 hours

Paper Reference
4PM0/01

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 6 9 0 1 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 $f(x) = x^3 - 7x + 6$

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

(2)

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

(3)

Question 1 continued

(Total for Question 1 is 5 marks)

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

(3)

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

(b) Obtain a series expansion for $\mathrm{f}(x)$ 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 $\mathrm{f}(x)$ is -5

(c) find the value of k.

(1)

Question 2 continued

(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)

Question 3 continued

(Total for Question 3 is 6 marks)

4 The nth 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)

Question 4 continued

(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

$$3\sin(2y + 30)° = 5\sin(2y - 30)° \qquad \text{for } 90 \leqslant y < 180$$

(4)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 9 marks)

6 Solve

(a) $\log_x 1024 = 5$

(2)

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

(2)

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

(3)

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

(5)

Question 6 continued

Question 6 continued

Question 6 continued

(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 $0 \leqslant x \leqslant 3$

(2)

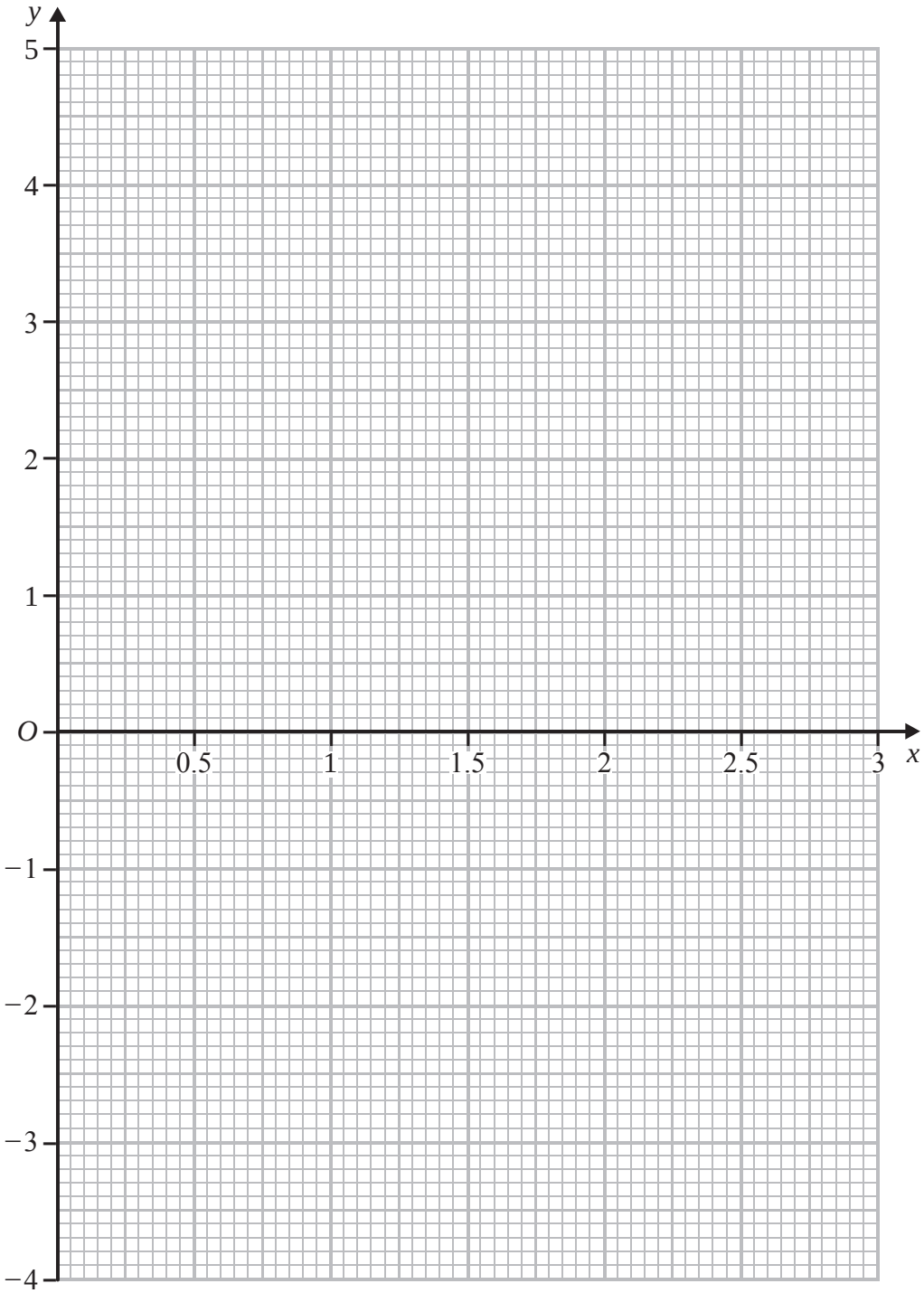
(c) Use your graph to obtain an estimate, to one decimal place, of the value of $\log_2 7$
Show clearly how you used the graph.

(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 $0 \leqslant x \leqslant 3$

(4)

Question 7 continued

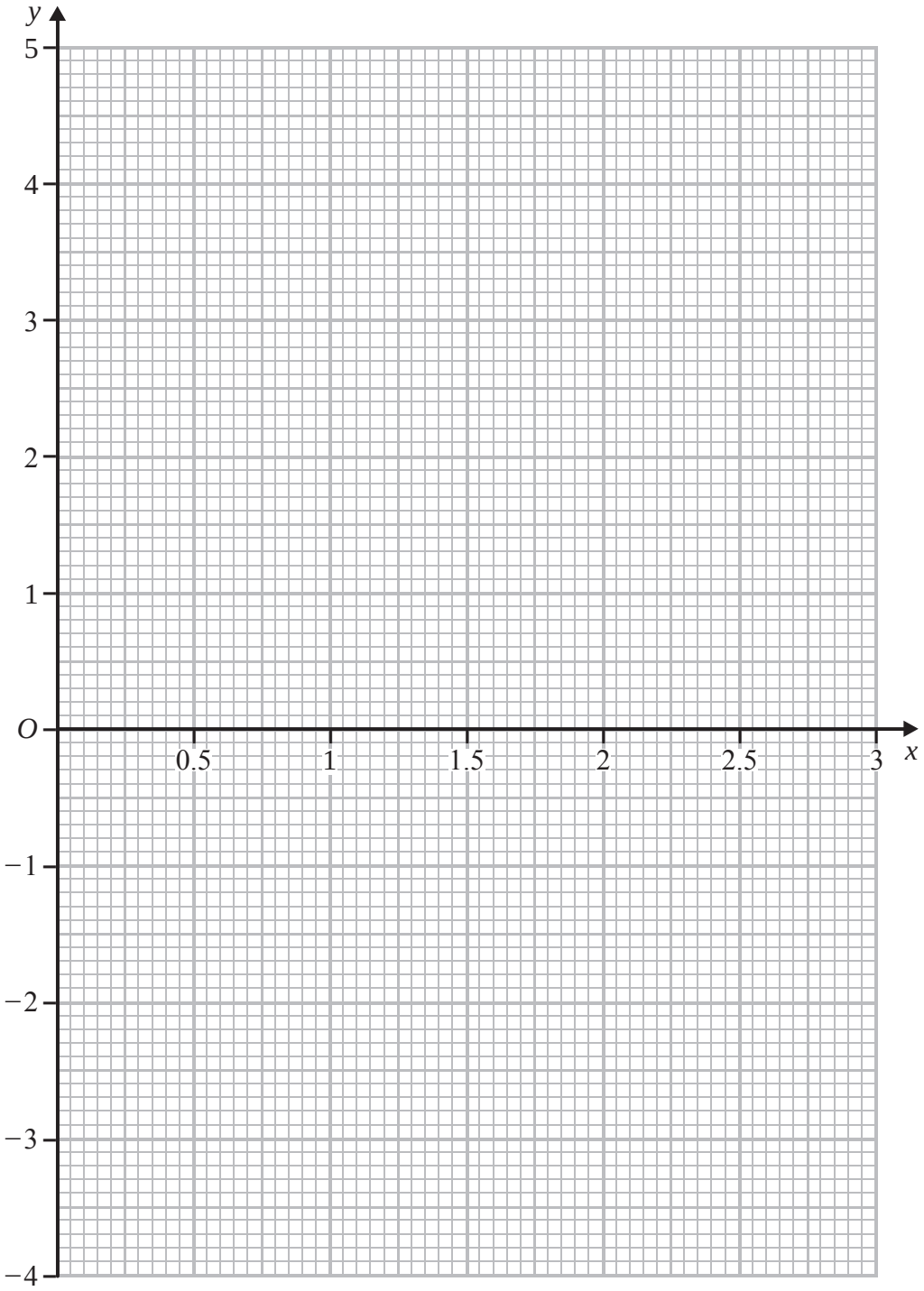


Turn over for a spare grid if you need to redraw your graph.

Question 7 continued

Question 7 continued

Only use this grid if you need to redraw your graph



(Total for Question 7 is 11 marks)

8

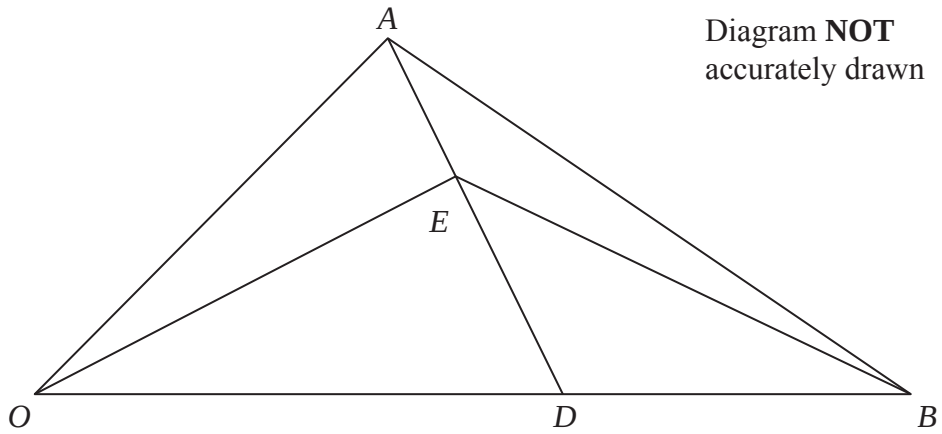


Diagram **NOT** accurately drawn

Figure 1

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

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

(a) Find as simplified expressions in terms of **a** and **b**

(i) $\overrightarrow{AD}$ (ii) $\overrightarrow{OE}$ (iii) $\overrightarrow{BE}$

(5)

The point F lies on OA such that $\overrightarrow{OF} = \lambda\overrightarrow{OA}$ 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)

Question 8 continued

Question 8 continued

Question 8 continued

(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)

Question 9 continued

Question 9 continued

Question 9 continued

(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)

Question 10 continued

Question 10 continued

(Total for Question 10 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS