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 ▶

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)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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)

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

(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)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 4 6 9 0 1 A 0 1 0 3 2

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Question 6 continued

Question 6 continued

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

Question 6 continued

(Total for Question 6 is 12 marks)

P 4 6 9 0 1 A 0 1 7 3 2

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)

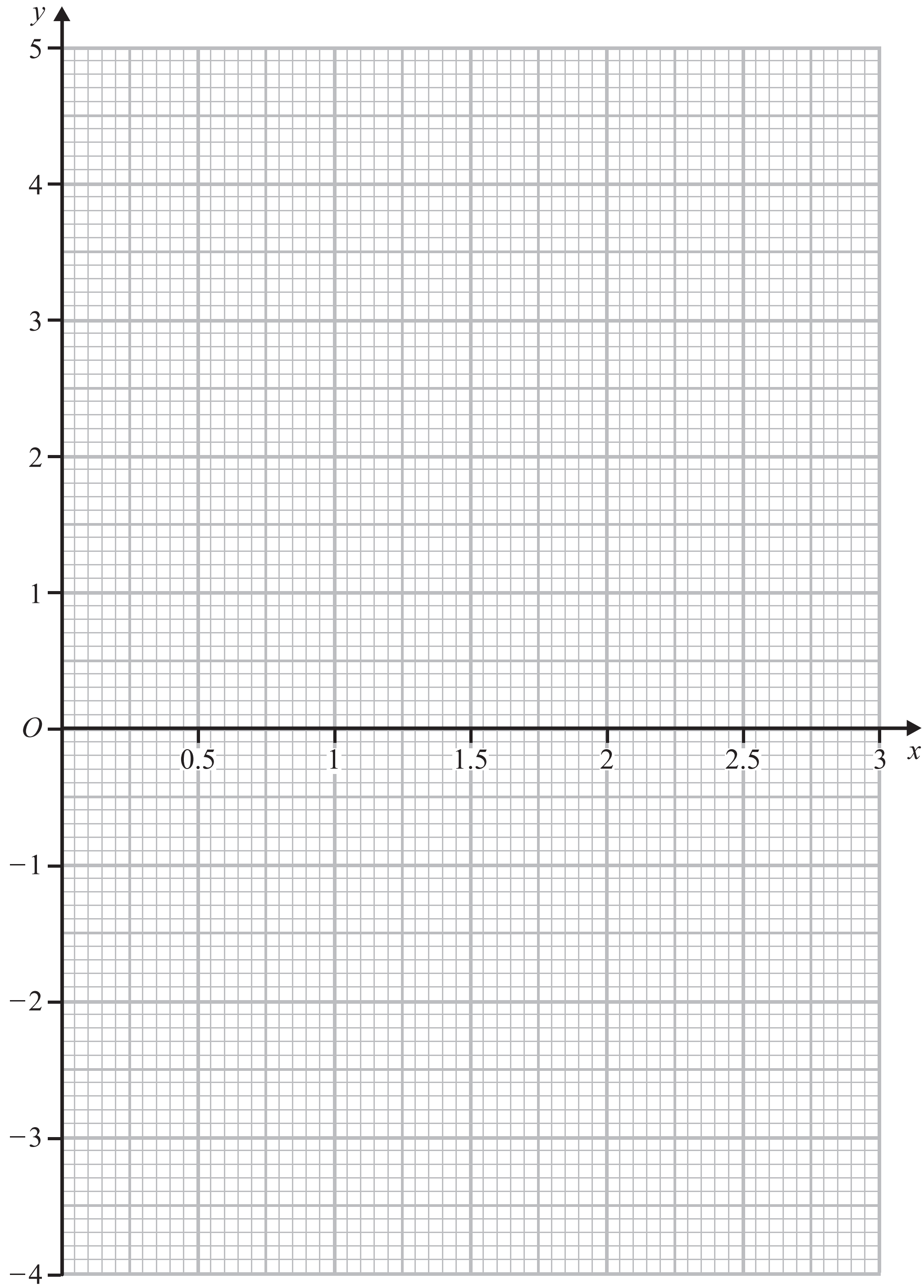
(c) Use your graph to obtain an estimate, to one decimal place, of the value of $\log_2 7$
Show clearly how you used the graph.

(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



....

....

....

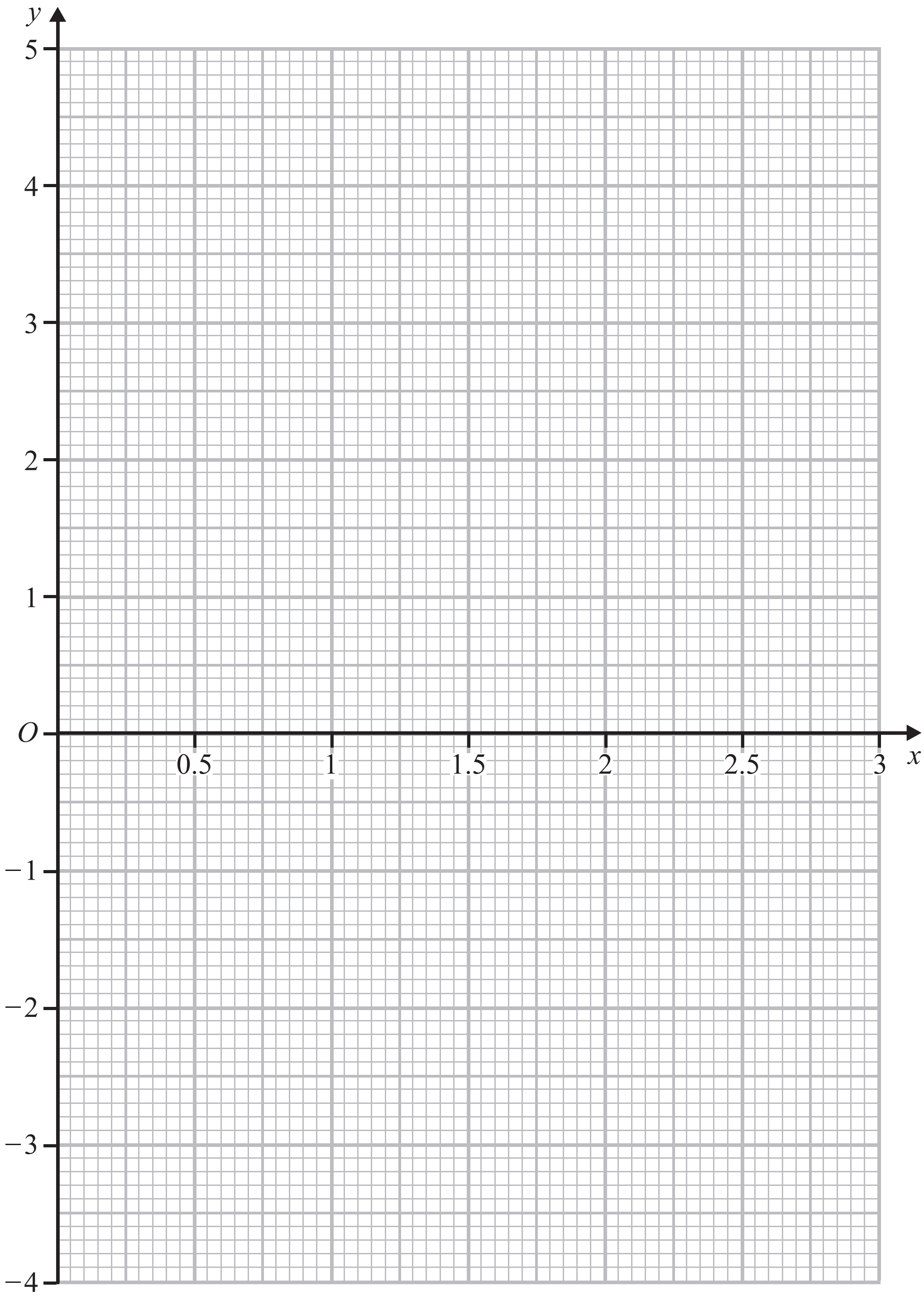
....

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

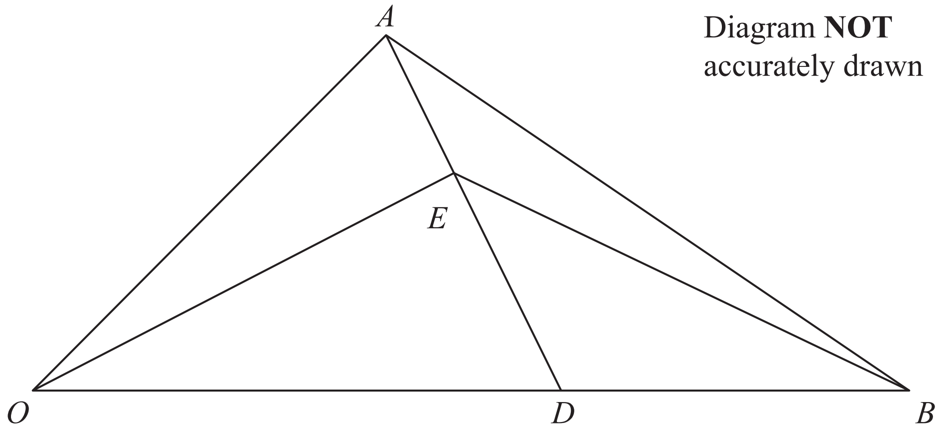


Figure 1

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)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 4 6 9 0 1 A 0 2 2 3 2

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 $\dfrac{\alpha}{\beta}$ and $\dfrac{\beta}{\alpha}$

(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)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 10 continued

Question 10 continued

(Total for Question 10 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS