Surname	Other na	imes				
Pearson Edexcel International GCSE	Centre Number	Candidate Number				
Further Pure Mathematics						
D		I				
Paper 1						
Paper 1						
Tuesday 14 June 2016 – M	lorning	Paper Reference				
-	lorning	Paper Reference 4PM0/01				

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 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)				

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)

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

3 A right pyramid <i>ABCDE</i> has a square base <i>ABCD</i> 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 <i>ABE</i> and the base <i>ABCD</i> .					
		(3)				

- 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)

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

$$3\sin(2y + 30)^\circ = 5\sin(2y - 30)^\circ$$
 for $90 \le y < 180$

(4)

- 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)

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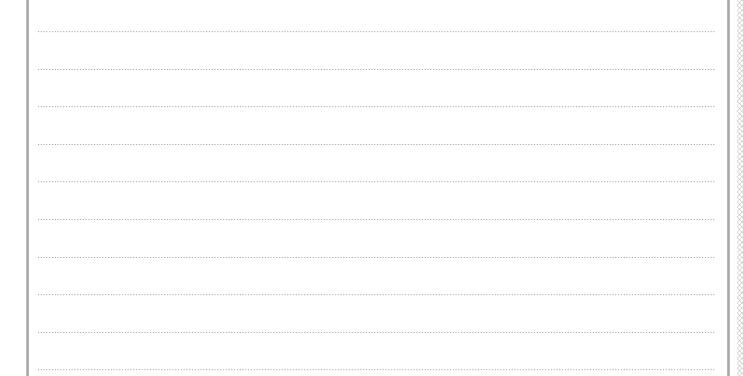
7 (a) Complete the table of values for $y = 2^x - 4$, giving your answers to 2 decimal places.

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

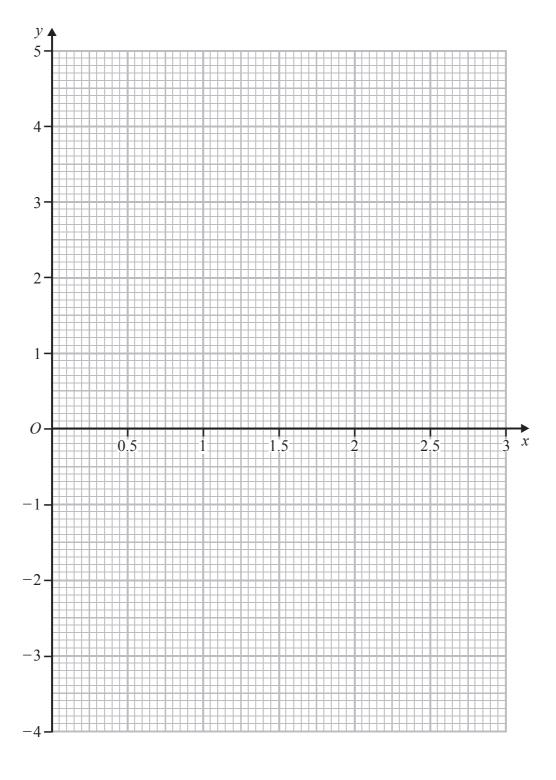
(2)

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

- (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 $0 \le x \le 3$
- **(4)**

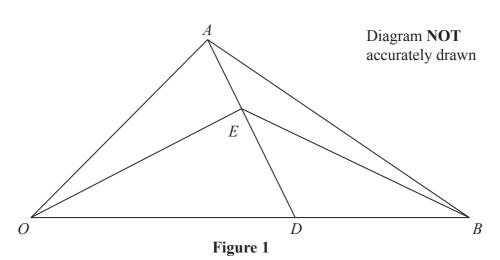


Question 7 continued



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





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)

- (a) Without solving the equation f(x) = 0, form an equation, with integer coefficients, which has
 - (i) roots $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$
 - (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.
- (c) Hence, or otherwise, show that the equation f(x) = -8 has no real roots.

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 <i>C</i> .	(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 .	(0)
	() () () () () () () () () ()	(2)
	(e) Calculate the area of quadrilateral <i>ADBE</i> .	(4)

