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Pearson Edexcel International GCSE	Centre Number	Candidate Number
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Further Pu	ure Mati	nematics
Paper 1 Tuesday 14 June 2016 – N		Paper Reference
Paper 1		

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.	(2)
		(3)

Question 1 continued	
	(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)

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

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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)

Question 3 continued	
	(Total for Question 3 is 6 marks)



- 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.

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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

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

(4)

Question 5 continued		

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Question 5 continued	

Question 5 continued	
	(Total for Question 5 is 9 marks)



(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		

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Question 6 continued	

	Question 6 continued	
(Total for Question 6 is 12 marks)	(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.

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(2)

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

(2)

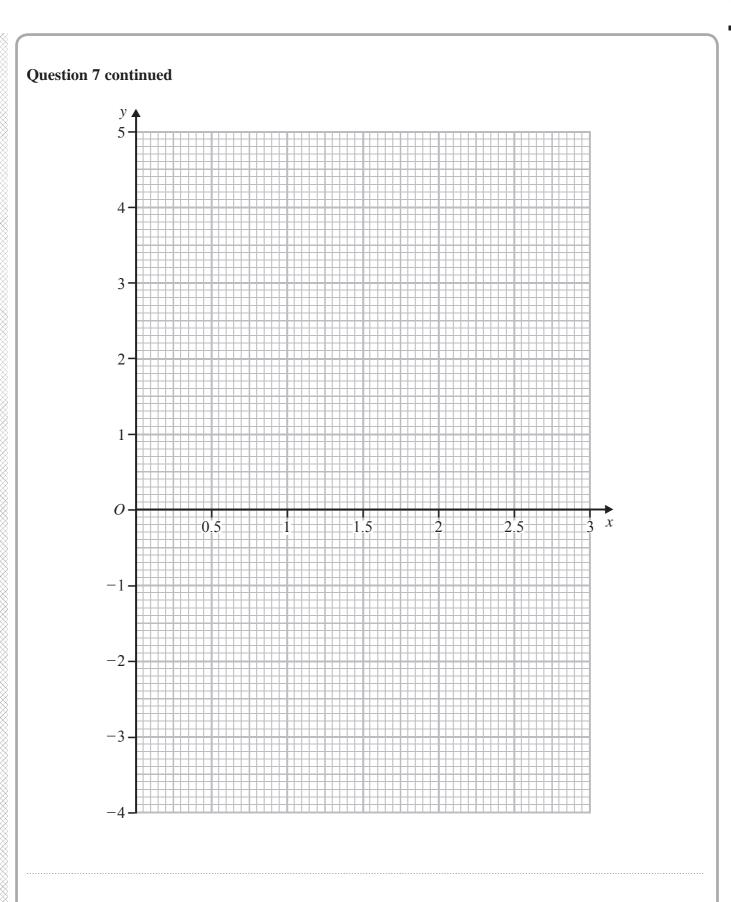
(c) Use your graph to obtain an estimate, to one decimal place, of the value of  $\log_2 7$  Show clearly how you used the graph.

(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)





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

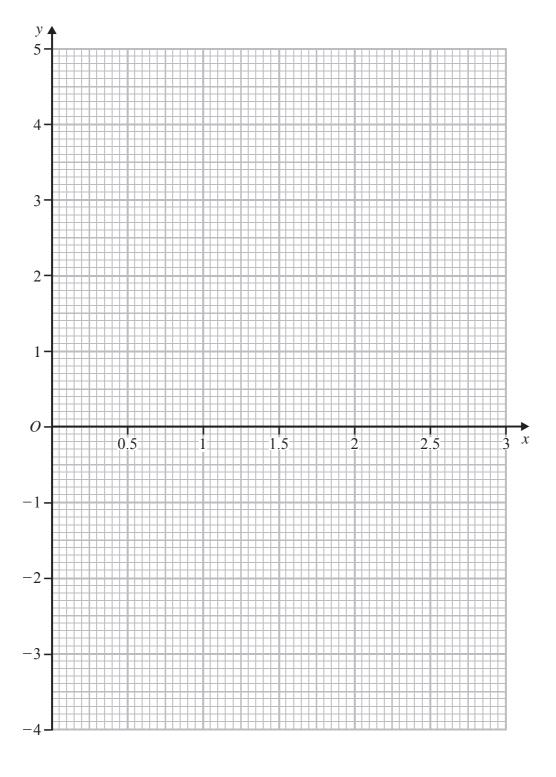


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Question 7 continued	



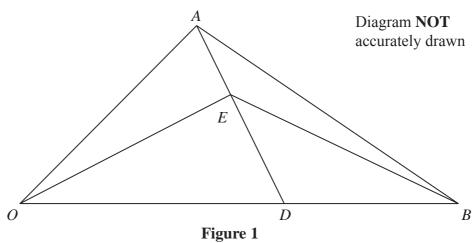
# Only use this grid if you need to redraw your graph



(Total for Question 7 is 11 marks)



8



2 _

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  ${\bf a}$  and  ${\bf b}$ 
  - (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  $\lambda$ .

(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	

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Question 8 continued	

Question 8 continued	
	(Total for Question 8 is 13 marks)



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

The roots of the equation f(x) = 0 are  $\alpha$  and  $\beta$ 

- (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.

(3)

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

(2)

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 <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 <i>DC</i> in the form $py = x + q$	(2)
	The point E is such that DCE is a straight line and $DC = CE$.	(2)
	(d) Find the coordinates of E .	(2)
	(e) Calculate the area of quadrilateral <i>ADBE</i> .	(2)
		(4)

Question 10 continued		

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