Write your name here		
Surname	Other nam	es
Edexcel International GCSE	Centre Number	Candidate Number
Further Pu	ire Mathe	ematics
Thursday 17 January 2013 Time: 2 hours	B – Morning	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 ELEVEN questions.

# Write your answers in the spaces provided.

# You must write down all stages in your working.

(a) On the axes below sketch the lines with equations

(i) 
$$y = 8$$

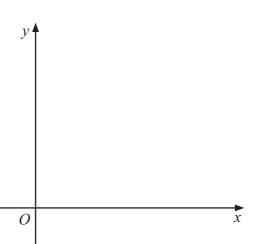
(ii) 
$$y + x = 6$$

(i) 
$$y = 8$$
 (ii)  $y + x = 6$  (iii)  $y = 3x - 4$ 

Show the coordinates of the points where each line crosses the coordinate axes.

(3)

(b) Show, by shading, the region R which satisfies  $y \ge 3x - 4$ ,  $y + x \ge 6$ ,  $x \ge 0$  and  $y \le 8$ (1)



(Total for Question 1 is 4 marks)

2	The equation $x^2 + 4px + 9 = 0$ has unequal real roots. Find the set of possible values of	p. (4)
	(Total for Question 2 is 4 ma	arks)



3	$f(x) = 3x^2 + 6x + 7$	
	Given that $f(x)$ can be written in the form $A(x + B)^2 + C$ , where A, B and C are rational numbers,	
	(a) find the value of $A$ , the value of $B$ and the value of $C$ .	(3)
	(b) Hence, or otherwise, find	
	(i) the value of x for which $\frac{1}{f(x)}$ is a maximum,	
	(ii) the maximum value of $\frac{1}{f(x)}$ .	(2)

Question 3 continued	
	(Total for Question 3 is 5 marks)



4	(a) Show that $\sum_{r=1}^{n} (3r - 4) = \frac{n}{2} (3n - 5)$ (b) Hence, or otherwise, evaluate $\sum_{r=11}^{50} (3r - 4)$	(3)
	Given that $\sum_{r=1}^{n} (3r - 4) = 186$ (c) find the value of $n$ .	(3)

Question 4 continued	
	(Total for Question 4 is 8 marks)



5	A particle <i>P</i> moves along the <i>x</i> -axis. At time <i>t</i> seconds ( $t \ge 0$ ) the velocity, $v$ m/s, of <i>P</i> is given by $v = 5\cos 2t$ . Find			
	(a) the least value of t for which P is instantaneously at rest,			
		(2)		
	(b) the magnitude of the maximum acceleration of <i>P</i> .			
		(3)		
	When $t = 0$ , $P$ is at the point $(2, 0)$ .			
	(c) Find the distance of $P$ from the origin when $P$ first comes to instantaneous rest.			
		(4)		

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



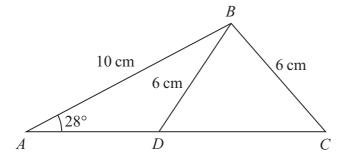


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows triangle ABC with AB = 10 cm, BC = 6 cm and  $\angle BAC$  = 28°. The point D lies on AC such that BD = 6 cm.

(a) Find, to the hearest 0.1, t	the size of $\angle DBC$ .	

(b) Find, to .	3 significant figures,	the length of AD.	
			(3)

(c) Find, to	3 significant figures, the	e area of triangle ABC.	
			(3)


Question 6 continued	
	(Total for Question 6 is 10 marks)



_	The point $C$ with coordinates $(2, 1)$ is the centre of a circle which passes through the	
7	point A with coordinates $(3, 3)$ .	
	(a) Find the radius of the circle.	(2)
	The line $AB$ is a diameter of the circle.	
	(b) Find the coordinates of <i>B</i> .	
		(2)
	The points $D$ with coordinates $(0, 2)$ and $E$ with coordinates $(4, 0)$ lie on the circle.	
	(c) Show that <i>DE</i> is a diameter of the circle.	(2)
	The point $P$ has coordinates $(x, y)$ .	
	(d) Find an expression, in terms of x and y, for the length of CP.	
	(a) I ma an expression, in terms of x and y, for the length of e1.	(2)
	Given that the point $P$ lies on the circle,	
	(e) show that $x^2 + y^2 - 4x - 2y = 0$	
		(2)

Question 7 continued	



Question 7 continued	



Question 7 continued	
	(Total for Question 7 is 10 marks)



8	Solve, for $0 \le \theta \le \pi$ , giving each solution to 3 significant figures, (a) $5 \sin \theta - 1 = 0$	
		(3)
	(b) $\tan\left(2\theta + \frac{\pi}{3}\right) = 0.4$	(4)
	(c) $4\sin^2\theta - 7\cos\theta = 2$	(4)

Question 8 continued	



Question 8 continued	



Question 8 continued	
	(Total for Question 8 is 11 marks)



9	The sum $S_n$ of the first $n$ terms of an arithmetic series is given by $S_n = n(2n + 3)$ . The first term of the series is $a$ .	
	(a) Show that $a = 5$	(2)
	(b) Find the common difference of the series.	(3)
	(c) Find the 12th term of the series.	(2)
	Given that $1 + S_{p+4} = 2 S_p$	
	(d) find the value of $p$ .	(4)

Question 9 continued	



Question 9 continued	



Question 9 continued	
	(Total for Question 9 is 11 marks)



1	4
_	. 4

$$f(x) = 2x^2 - 5x + 1$$

The equation f(x) = 0 has roots  $\alpha$  and  $\beta$ . Without solving the equation

(a) find the value of  $\alpha^2 + \beta^2$ 

(3)

(b) show that  $\alpha^4 + \beta^4 = \frac{433}{16}$ 

**(2)** 

(c) form a quadratic equation with integer coefficients which has roots

$$\left(\alpha^2 + \frac{1}{\alpha^2}\right)$$
 and  $\left(\beta^2 + \frac{1}{\beta^2}\right)$ 

**(7)** 

Question 10 continued	



Question 10 continued	



Question 10 continued	
	(Total for Question 10 is 12 marks)



11

$$f(x) = x^3 + px^2 + qx + 6 \qquad p, q \in \mathbb{Z}$$

Given that f(x) = (x - 1)(x - 3)(x + r)

(a) find the value of r.

(1)

Hence, or otherwise,

(b) find the value of p and the value of q.

(3)

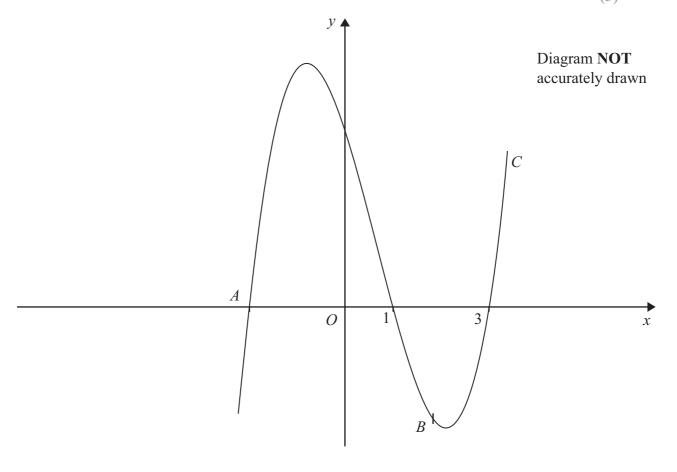


Figure 2

Figure 2 shows the curve C with equation y = f(x) which crosses the x-axis at the points with coordinates (3, 0) and (1, 0) and at the point A. The point B on C has x-coordinate 2

(c) Find an equation of the tangent to C at B.

(5)

(d) Show that the tangent at B passes through A.

**(2)** 

(e) Use calculus to find the area of the finite region bounded by C and the tangent at B.

**(5)** 

Question 11 continued	



Question 11 continued	



Question 11 continued	



uestion 11 continued	
	(Total for Question 11 is 16 marks)
	TOTAL FOR PAPER IS 100 MARKS

