Write your name here	1	
Surname	Other nam	es
Edexcel International GCSE	Centre Number	Candidate Number
Further Pu	ire Mathe	ematics
Thursday 17 May 2012 – A Time: 2 hours	Afternoon	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 stages in your working.		
1 Find the set of values of x for which $(2x + 1)(4 - x) > (x - 4)(2x - 3)$		
	(4)	

Question 1 continued	
	(Total for Question 1 is 4 marks)



2	In triangle $ABC$ , $AB = 8$ cm, $BC = 5$ cm and $CA = 7$ cm.	
	(a) Find, to the nearest $0.1^{\circ}$ , the size of angle <i>BAC</i> .	
		(3)
	(b) Find, to 3 significant figures, the area of triangle <i>ABC</i> .	(2)

Question 2 continued	
	(Total for Question 2 is 5 marks)



3	(a) Find the full binomial expansion of $(1 + x)^5$ , giving each coefficient as an integer	(2)
	(b) Hence find the exact value of $(1 - 2\sqrt{3})^5$ , giving your answer in the form $a + b\sqrt{3}$ where a and b are integers.	$\sqrt{3}$ ,
		(3)

Question 3 continued	
( <sup>r</sup>	Total for Question 3 is 5 marks)



4	The equation $2x^2 - 7x + 4 = 0$ has roots $\alpha$ and $\beta$		
	Without solving this equation, form a quadratic equation with integer coefficients which has roots $\alpha + \frac{1}{\beta}$ and $\beta + \frac{1}{\alpha}$		
	eta a	(8)	

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



5	The first four terms of an arithmetic series, S, are	
	$\log_a 2 + \log_a 4 + \log_a 8 + \log_a 16$	
	(a) Write down an expression for the $r$ th term of $S$ .	(1)
	(h) Find an assuración fantha aguman difference of C	(1)
	(b) Find an expression for the common difference of <i>S</i> .	(2)
	The sum of the first $n$ terms of $S$ is $S_n$	
	(c) Show that $S_n = \frac{1}{2}n(n+1)\log_a 2$	
	$\frac{1}{2} (1)^{n} \log_{a} 2$	(2)
	The first four terms of a second arithmetic series, <i>T</i> , are	
	$\log_a 6 + \log_a 12 + \log_a 24 + \log_a 48$	
	The sum of the first $n$ terms of $T$ is $T_n$	
	(d) Find $T_n - S_n$ and simplify your answer.	
		(4)

Question 5 continued	



Question 5 continued	



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



6

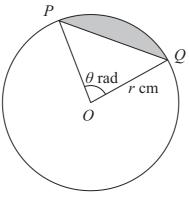


Figure 1

The points P and Q lie on the circumference of a circle with centre O and radius r cm. Angle  $POQ = \theta$  radians. The segment shaded in Figure 1 has area A cm<sup>2</sup>.

(a) Show that 
$$A = \frac{1}{2} r^2 (\theta - \sin \theta)$$
 (3)

When angle POQ is increased to  $(\theta + \delta\theta)$  radians, where  $\delta\theta$  is small, the area of the shaded segment is increased to  $(A + \delta A)$  cm<sup>2</sup>, where  $\delta A$  is small.

(b) Show that 
$$\delta A \approx \frac{1}{2} r^2 (1 - \cos \theta) \delta \theta$$
 (3)

For a circle of radius 4 cm, the area of the shaded segment is increased by  $0.05 \text{ cm}^2$  when angle POQ increases by 0.02 radians.

(c) Find, to 1 decimal place, an estimate for  $\theta$ 

(4)

Question 6 continued		



Question 6 continued	



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



7	$\cos(A+B) = \cos A \cos B - \sin A \sin B$	
	(a) Express $\cos(2x + 45^\circ)$ in the form $M\cos 2x + N\sin 2x$ , where $M$ and $N$ are constants, giving the exact value of $M$ and the exact value of $N$ .	
		(2)
	(b) Solve, for $0^{\circ} \leqslant x \leqslant 180^{\circ}$ , the equation $\cos 2x - \sin 2x = 1$	(5)
	The maximum value of $\cos 2x - \sin 2x$ is $k$ .	
	(c) Find the exact value of $k$ .	
	(c) I find the exact value of $\kappa$ .	(2)
	(d) Find the smallest positive value of $x$ for which a maximum occurs.	
		(3)

Question 7 continued		



Question 7 continued	



Question 7 continued	
	(Total for Question 7 is 12 marks)



 $f(x) = ax^3 + bx^2 + cx + d$ , where a, b, c and d are integers. 8 Given that f(0) = 6(a) show that d = 6(1) When f(x) is divided by (x-1) the remainder is -6When f(x) is divided by (x + 1) the remainder is 12 (b) Find the value of b. **(4)** Given also that (x - 3) is a factor of f(x), (c) find the value of a and the value of c, **(6)** (d) express f(x) as a product of linear factors. (3)

Question 8 continued	



Question 8 continued	



Question 8 continued	
	(Total for Question 8 is 14 marks)



	1.	
9	The point P with coordinates (4, 4) lies on the curve C with equation $y = \frac{1}{4}x^2$	
	(a) Find an equation of	
	(i) the tangent to $C$ at $P$ ,	
	(ii) the normal to C at P.	
		(6)
	The point $Q$ lies on the curve $C$ . The normal to $C$ at $Q$ and the normal to $C$ at $P$ intersed at the point $R$ . The line $RQ$ is perpendicular to the line $RP$ .	et
	(b) Find the coordinates of Q.	
		(2)
	(c) Find the <i>x</i> -coordinate of <i>R</i> .	
		(4)
	The tangent to $C$ at $P$ and the tangent to $C$ at $Q$ intersect at the point $S$ .	
	(d) Show that the line RS is parallel to the y-axis.	
		(5)

Question 9 continued	



Question 9 continued	



Question 9 continued	
	(Total for Question 9 is 17 marks)



10	The point $A$ has coordinates $(-3, 4)$ and the point $C$ has coordinates $(5, 2)$ . The mid-point of $AC$ is $M$ . The line $l$ is the perpendicular bisector of $AC$ .	t
	(a) Find an equation of $l$ .	
		(4)
	(b) Find the exact length of AC.	
		(2)
	The point B lies on the line l. The area of triangle ABC is $17\sqrt{2}$	
	(c) Find the exact length of <i>BM</i> .	
		(2)
	(d) Find the exact length of AB.	
		(2)
	(e) Find the coordinates of each of the two possible positions of <i>B</i> .	
		(6)

Question 10 continued	



Question 10 continued	
	(Total for Question 10 is 16 marks)
	TOTAL FOR PAPER IS 100 MARKS

