Practice Paper B \_

## **CORE** THREE

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Duration	1 HOUR & 30 MINUTES
Total Marks Available	75 MARKS

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at satisfy the equation	
x+1  = x(x+1)	
	(3)



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2 (a) Solve the equation	
$4\cos 2x = 1 - 2\sin x$	
for $0 < x \le 360^{\circ}$ .	(5)
(b) (i) Express	
$2\sin\theta + 7\cos\theta$	
in the form $R\sin(\theta+\alpha)$ , where $R>0$ and $\alpha$ is acute.	(3)
(ii) Find the values of $\theta$ that satisffy	
$2\sin\left(\frac{\theta}{2}\right) + 7\cos\left(\frac{\theta}{2}\right) = 6$	(4)
(iii) Find the greatest possible value of $k$ such that	
$4\sin 2\theta + 14\cos 2\theta = k$	
has real solutions. You should justify your answer.	(2)

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3	A curve <i>C</i> is defined such that	
	$f(x) = e^{2x} - 3e^x + 2$	
	Given that the curve $C$ intersects the $x$ axis at the points $(a,0)$ and $(b,0)$ , where $a < b$ ,	
	(a) Find the values of $a$ and $b$ .	(3)
	(b) Find the coordinates of any stationary points on the curve $C$ .	(3)
	(c) Determine the nature of any stationary points on the curve $C$ . Justify your answer.	(3)
	(d) Hence, sketch the curve $C$ .	
	On your sketch, you should clearly the coordinates of any points where the curve meets or	
	crosses the coordinate axis and the equations of any asymptotes to $C$ .	(3)
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4 (a) Show, by sketching, that the equation

$$8 - 2x^2 = \ln x \tag{*}$$

has exactly one real root.

- (3)
- (b) Using your sketches, explain why the root of the equation (\*) lies in the interval [1, 2].
- (c) The root of (\*) can be approximated using the following iterative formula

$$x_{n+1} = \sqrt{4 - \frac{1}{2} \ln x_n}$$

Starting with  $x_0 = 1$ , use this iterative formula a suitable number of times to find the value of the root correct to 3 decimal places. (5)



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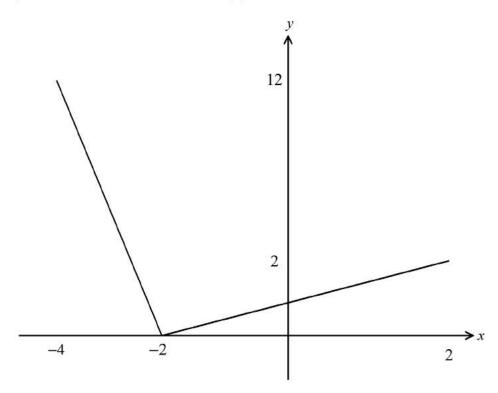
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5 A function f has domain  $-4 \le x \le 2$  and is linear from (-4,12) to (-2,0) and from (-2,0) to (2,2). A sketch of the function y = f(x) is shown in the diagram below.



(b) Find 
$$ff(-2)$$
.

Another function g is defined such that

$$g: x \to \frac{2+2x}{1-x}$$

(c) Find the largest domain and range of the function g. (2)

(d) Find 
$$g^{-1}(x)$$
. (3)

(e) Write down the domain and range of  $g^{-1}$ . (1)

(f) Solve the equation 
$$gf(x) = 6$$
. (5)

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6	(a)	Prove	that

(i) 
$$\frac{\sin 2x}{\sin x + \cos x - 1} \equiv \sin x + \cos x + 1$$
 (4)

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(ii) 
$$\frac{\sin x - \cos x - 1}{\sin x + \cos x - 1} \equiv -\frac{1 + \cos x}{\sin x}$$
 (5)

(b) Hence, or otherwise, solve

$$\frac{\sin 2x}{\sin x + \cos x - 1} + \frac{\sin^2 x - \sin x \cos x - \sin x}{\sin x + \cos x - 1} = \frac{5}{12}$$





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7 It is given without proof that

$$\frac{d^2y}{dx^2} = -\frac{d^2x}{dy^2} \times \left[\frac{dy}{dx}\right]^{-3}$$

You may use this result at any point in the question if necessary.

Given that

$$x = \cot y + \csc^2 y$$

(a) Show that

$$\frac{dx}{dy} = -\csc^2 y - 2\csc^2 y \cot y \tag{3}$$

(b) Find 
$$\frac{d^2x}{dy^2}$$
.

(c) Hence, or otherwise, show further that

$$\frac{d^2y}{dx^2} = 2(\gamma^2 + 1)(3\gamma^2 + \gamma + 1)(2\gamma^3 + \gamma^2 + 2\gamma + 1)^3$$

where $\gamma = \cot y$ .	(3)
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