- Practice Paper A —

## **CORE** THREE

## crashMATHS

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Duration	1 HOUR & 30 MINUTES
Total Marks Available	75 MARKS

Targets	
	For examiner's use on

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1	The equation	
	$x^4 + x^2 - 8x - 9 = 0$	
	has two roots. One of its roots is $\alpha$ .	
		(2)
	(a) Show that $\alpha$ lies in the interval [2.1,2.2].	(2)
	(b) Show also that	
	$x = \sqrt[4]{9 + 8x - x^2}$	(1)
	(c) Starting with $x_0 = 2.1$ , use the iterative formula	
	$x_{n+1} = \sqrt[4]{9 + 8x_n - x_n^2}$	
	to find $x_1$ , $x_2$ and $x_3$ to three decimal places.	(3)
	(d) Hence, state the value of $\alpha$ to one decimal place.	(1)
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2	(a)	Show	that

$$\frac{x^3 + 6x^2 - 8}{x + 1} \equiv ax^2 + bx + c + \frac{d}{x + 1}$$

where a, b, c and d are constants to be found.

(4)

(b) Hence, or otherwise, given that

$$f(x) = \frac{x^3 + 6x^2 - 8}{x + 1}$$

Orthodox	2.3	
Find	f'(x), giving each term in its simplest form.	(4)

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3 The curve y = f(x) is defined such that

$$y = \frac{5}{e^{2x}} - 4$$

- (a) Solve f(x) = 0.
- (b) Sketch y = f(x).

On your sketch, you should indicate clearly any coordinates at which the curve crosses or meets the coordinate axis.

You should state the equation of any asymptotes to the curve. (3)

(c) Find the range of values of x for which f(x) = |f(x)|. (1)

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4	A factory produces party hats in the shape of a cone.	
	The machines are programmed so that all of the party hats have a height of 16 cm and	
	a variable radius $x$ cm.	
	(a) Show that the total surface area A of the cone is given by	
	$A = \pi x^2 + \pi x \sqrt{256 + x^2}$	(3)
	(b) Find $\frac{dA}{dx}$ when the radius of the cone is 12 cm.	(5)
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5	It is given that	
	$4\cos\theta - 7\sin\theta \equiv R\cos(\theta - \alpha)$	
	where $lpha$ is measured in radians.	
	(a) Find the value of	
	(i) α	
	(ii) R	(4)
	(b) Solve, for $0 < \theta \le 2\pi$ ,	10.50
	$8\cos 2\theta - 14\sin 2\theta = 15\sin(2\theta - \alpha)$	
		(6)
	(c) Given also that	
	$p(\theta) = 10 - (7\sin\theta - 4\cos\theta)^2$	
	Find	
	(i) the maximum value of $p(\theta)$ .	
	(ii) the smallest value of $\theta$ for which $p(\theta)$ is maximum.	(4)
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	e mass $M$ , in grams, of a radioactive isotope decreases exponentially with time.	
Initially, the mass of the isotope is 120.0g and, 4 years later, its mass is 72.9g. Find		
the	e mass of the substance at a time 10 years after the initial value.	(5)



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7	(:) Differentiate with manual to		
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	(a) $e^{3x^2} \sin x$		(4)
	(b) $\cos\left(\ln\left(2x^3\right)\right)$		(4)
	(ii) Given that		
		$y = \sec^3 x$	
	Show that		
		$\frac{d^2y}{dx^2} = 9y + 3y^{\frac{3}{5}} - 9y^{\frac{1}{3}}$	(6)
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8	(a) Solve, for $0 < x \le 2\pi$ , $\sec\left(x + \frac{\pi}{3}\right) = \csc\left(x + \frac{\pi}{4}\right)$	(8)
	(b) Given that	
	$\arcsin x = k \ , \ 0 < k < \frac{\pi}{2}$	
<u></u>	Find, in terms of x, tan k, for $-\frac{\pi}{2} < k < 0$ .	(4)
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