**Practice Paper A** 

## **CORE** FOUR

## crashMATHS

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Duration	1 HOUR & 30 MINUTES
Total Marks Available	75 MARKS

	For examiner's use only
Targets	

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	$\frac{2x+4}{x^3 - 2x^2 - 5x + 6}$	5	
	x - 2x - 3x + 0		
as partial fractions.		•	(7)

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2	It is	given	that
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$$f(x) = \frac{1}{\sqrt{4+x}}, x > -4$$

- (a) Find, in ascending powers of x, the first three terms in the binomial expansion of f(x). (5)
- (b) Using your expansion, estimate the value of  $\sqrt{7}$ .

Given also that  $\sqrt{7} \cong 2.645751$ ,

(c) State the number of significant figures to which your estimate is correct. (1)

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3	(a) Show that $\int_{0}^{\frac{\pi}{4}} \tan x \ dx = \ln(\sqrt{2})$ (b) Hence, or otherwise, using the substitution $x = \sin u$ , evaluate	(4)
<u>-</u>	$\int_{0}^{\frac{\sqrt{2}}{2}} \frac{5x}{2\sqrt{1-x^2}} dx$	(4)
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4 (a) Using logarithims, prove that	$d$ ( $\sim$	
(b) Differentiate, with respect to $x$ ,	$\frac{d}{dx}(a^x) = a^x \ln a$	(3)
	$2^x - 2y^2 = xy$	(4)
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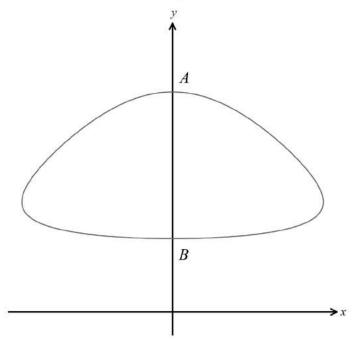
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5 The diagram below shows a sketch of the curve C.



The curve C is defined such that

$$x = \sin 3t$$
,  $y \cos 3t + 2 = 2y$ ,  $0 \le t \le 2\pi$ 

where t is a parameter.

(a) Find the coordinates of A and B.

(3)

(4)

(b) Show that

$$\frac{dy}{dx} = -\frac{2\tan 3t}{\left(2 - \cos 3t\right)^2} \tag{5}$$

(c) Find the equation of the tangent to C when  $x = \frac{\sqrt{3}}{2}$ .

(d) Hence, state the equation of the tangent to 
$$C$$
 when  $x = -\frac{\sqrt{3}}{2}$ . (1)

The tangent to C at  $x = \frac{\sqrt{3}}{2}$  crosses the x axis at the point P.

The tangent to C at  $x = -\frac{\sqrt{3}}{2}$  crosses the x axis at the point Q.

(e) Verify that AP = AQ.

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6	Two	lines l	and l	are	perpendicular	and	are	defined	such	that
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$$l_1: \mathbf{r} = \begin{pmatrix} 3 \\ a \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} b \\ 9 \\ 0 \end{pmatrix}$$

$$l_2: \mathbf{r} = \begin{pmatrix} -2\\1\\6 \end{pmatrix} + \mu \begin{pmatrix} 3\\a\\4 \end{pmatrix}$$

where  $\lambda$  and  $\mu$  are scalar parameters.

		. 1	(-11)	1
The two lines intersect at the point $M$	with position vector	$\frac{1}{4}$	3	
		7	(20)	

Find the values of $a$ and $b$ .	(6)

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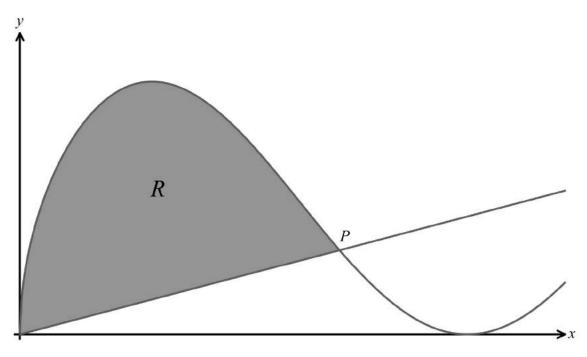
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7 [In this question, you may use the formula  $V = \frac{1}{3}\pi r^2 h$  for the volume of a cone, if necessary.]



The curve C has equation  $y = \cos^2 x \sqrt{\sin x}$  and intersects the line I at the point P.

The line *l* has equation  $y = \frac{9\sqrt{2}}{4\pi}x$ 

(a) Verify that 
$$P$$
 has coordinates  $\left(\frac{\pi}{6}, \frac{3\sqrt{2}}{8}\right)$ 

The finite region R, as shown in the figure above, is bounded by the curve C, the x axis, the y axis and the line l. The shaded region is then rotated  $2\pi$  radians about the x axis to form a solid of revolution.

(b)	Find the volume of this solid of revolution.	(8)
(0)	That the volume of this some of revolution.	(6

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8	A microbiologist is going to conduct an experiment that involves growing a culture of bacteria	ì.			
	She assumes that the number of strands of bacteria, $x$ , present in the culture $t$ days after grown	th			
	is increasing at a rate that is proportional to the number of strands present in the culture. She is				
	going to use an initial culture containing 450 strands of bacteria. Previous research data shows				
	that after 4 days, there will be 2103 strands of bacteria present.				
	(a) By forming and solving a differential equation, estimate the number of strands that will be				
	present in her culture after a week.	(8)			
	(b) Sketch a curve that shows the rate of increase of the number of bacterial strands in the culture.	ıre.			
	On your sketch, you should clearly the coordinates at which the curve crosses or meets the				
	coordinate axis.	(3)			
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