C2 Paper C – Marking Guide

1. $\tan^2\theta = \frac{1}{3}$ M1

$\tan\theta = \pm\frac{1}{\sqrt{3}}$ A1

$\theta = \frac{\pi}{6}, \frac{\pi}{6} - \pi$ or $\pi - \frac{\pi}{6}, -\frac{\pi}{6}$ B1 M1

$\theta = -\frac{5\pi}{6}, -\frac{\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$ A1 **(5)**

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2. *(i)* $= \log_2 (3^2 \times 5)$ B1

$= 2\log_2 3 + \log_2 5 = 2p + q$ M1 A1

(ii) $= \log_2 \frac{3}{5\times 2} = \log_2 3 - \log_2 5 - \log_2 2$ M1

$= p - q - 1$ B1 A1 **(6)**

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3. *(i)* $= 1 + n(\frac{1}{4}x) + \frac{n(n-1)}{2}(\frac{1}{4}x)^2 + \ldots$ B1 M1

$= 1 + \frac{1}{4}nx + \frac{1}{32}n(n-1)x^2 + \ldots$ A1

(ii) $\frac{1}{4}n = \frac{1}{32}n(n-1)$ M1

$8n = n(n-1)$

$n[8 - (n-1)] = 0$ M1

$n \neq 0 \;\therefore\; n = 9$ A1 **(6)**

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4. *(i)* $7 - 2x - 3x^2 = \frac{2}{x}$

$7x - 2x^2 - 3x^3 = 2$ M1

$3x^3 + 2x^2 - 7x + 2 = 0$ A1

(ii) $x = -2$ is a solution $\therefore$ $(x + 2)$ is a factor B1

$$\begin{array}{r|l} & 3x^2 - 4x + 1 \\ \hline x+2 & 3x^3 + 2x^2 - 7x + 2 \\ & 3x^3 + 6x^2 \\ \hline & \quad -4x^2 - 7x \\ & \quad -4x^2 - 8x \\ \hline & \qquad\quad x + 2 \\ & \qquad\quad x + 2 \\ \hline \end{array}$$

M1 A1

$\therefore\; (x + 2)(3x^2 - 4x + 1) = 0$

$(x + 2)(3x - 1)(x - 1) = 0$ M1

$x = -2$ (at P), $\frac{1}{3}$, 1 A1

$\therefore\; (\frac{1}{3}, 6), (1, 2)$ A1 **(8)**

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5. *(i)* $f(x) = \int (-\frac{4}{x^3})\, dx$

$f(x) = 2x^{-2} + c$ M1 A1

$(-1, 3) \;\therefore\; 3 = 2 + c$

$c = 1$ M1

$f(x) = 2x^{-2} + 1$ A1

(ii) $= \int_1^4 (2x^{-2} + 1)\, dx$

$= [-2x^{-1} + x]_1^4$ M1 A1

$= (-\frac{1}{2} + 4) - (-2 + 1) = 4\frac{1}{2}$ M1 A1 **(8)**

6.	*(i)*	$\frac{\sin A}{8} = \frac{\sin 1.7}{14}$	M1	
		$\sin A = \frac{4}{7}\sin 1.7$		
		$\angle BAC = 0.5666$	A1	
		$\angle ACB = \pi - (1.7 + 0.5666) = 0.875$ (3sf)	M1 A1	
	(ii)	$AB^2 = 8^2 + 14^2 - (2 \times 8 \times 14 \times \cos 0.875)$	M1	
		$AB = 10.79$	A1	
		$P = 10.79 + (14 - 8) + (8 \times 0.875) = 23.8$ cm (3sf)	M1 A1	**(8)**
7.	*(a)*	*(i)* $= 3^1 \times 3^x = 3y$	M1 A1	
		(ii) $= 3^{-1} \times (3^x)^2 = \frac{1}{3}y^2$	M1 A1	
	(b)	$3y - \frac{1}{3}y^2 = 6$		
		$y^2 - 9y + 18 = 0$		
		$(y - 3)(y - 6) = 0$	M1	
		$y = 3, 6$	A1	
		$3^x = 3, 6$		
		$x = 1, \frac{\lg 6}{\lg 3}$	B1 M1	
		$x = 1, 1.63$ (3sf)	A1	**(9)**
8.	*(i)*	$\int_1^3 (x^2 - 2x + k)\ dx = [\frac{1}{3}x^3 - x^2 + kx]_1^3$	M1 A2	
		$= (9 - 9 + 3k) - (\frac{1}{3} - 1 + k)$	M1	
		$= 2k + \frac{2}{3}$		
		$\therefore\ 2k + \frac{2}{3} = 8\frac{2}{3}$		
		$k = 4$	M1 A1	
	(ii)	$= \lim_{k\to\infty} [-4x^{-\frac{3}{2}}]_2^k$	M2 A1	
		$= \lim_{k\to\infty} \{-\frac{4}{k^{\frac{3}{2}}} - (-\frac{4}{2\sqrt{2}})\}$	M1	
		$= \lim_{k\to\infty} (\sqrt{2} - \frac{4}{k^{\frac{3}{2}}}) = \sqrt{2}$	A1	**(11)**
9.	*(i)*	$ar = -48,\ ar^4 = 6$	B1	
		$r^3 = \frac{6}{-48} = -\frac{1}{8}$	M1	
		$r = \sqrt[3]{-\frac{1}{8}} = -\frac{1}{2}$	A1	
		$a = \frac{-48}{-\frac{1}{2}} = 96$	A1	
	(ii)	$= \frac{96}{1-(-\frac{1}{2})} = 64$	M1 A1	
	(iii)	$S_n = \frac{96[1-(-\frac{1}{2})^n]}{1-(-\frac{1}{2})} = 64[1 - (-\frac{1}{2})^n]$	M1 A1	
		$S_\infty - S_n = 64 - 64[1 - (-\frac{1}{2})^n]$	M1	
		$= 64(-\frac{1}{2})^n = 2^6 \times (-1)^n \times 2^{-n} = (-1)^n \times 2^{6-n}$	M1	
		difference is magnitude, $\therefore = 2^{6-n}$	A1	**(11)**
			Total	**(72)**