C2 Paper D – Marking Guide

1.	$= \int (3x^2 + \frac{1}{2}x^{-2})\ dx$	B1	
	$= x^3 - \frac{1}{2}x^{-1} + c$	M1 A2	**(4)**

2.	$(7 - x)^2 = x^2 + (x + 1)^2 - [2 \times x \times (x + 1) \times \cos 60]$	M1 A1	
	$49 - 14x + x^2 = x^2 + x^2 + 2x + 1 - x^2 - x$		
	$15x = 48$		
	$x = \frac{16}{5}$	M1 A1	**(4)**

3. *(i)*

x	0	0.25	0.5	0.75	1
$\frac{4x}{(x+1)^2}$	0	0.64	0.8889	0.9796	1

M1 A1

area $\approx \frac{1}{2} \times 0.25 \times [0 + 1 + 2(0.64 + 0.8889 + 0.9796)]$ — B1 M1

$= 0.752$ (3sf) — A1

(ii) under-estimate — B1

the curve passes above the top edge of each trapezium — B1 **(7)**

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4. *(i)* $(1 + kx)^7 = \ldots + \binom{7}{2}(kx)^2 + \ldots$ — B1

$\therefore\ \frac{7\times6}{2} \times k^2 = 525$

$k^2 = \frac{525}{21} = 25$ — M1

$k > 0\ \therefore\ k = 5$ — A1

(ii) $(1 + 5x)^7 = \ldots + \binom{7}{3}(5x)^3 + \ldots$

$\therefore$ coeff. of $x^3 = \frac{7\times6\times5}{3\times2} \times 125 = 4375$ — M1 A1

(iii) $(1 + 5x)^7 = 1 + 35x + 525x^2 + \ldots$ — B1

$(2 - x)(1 + 5x)^7 = (2 - x)(1 + 35x + 525x^2 + \ldots)$

$= 2 + 70x + 1050x^2 - x - 35x^2 + \ldots$ — M1

$= 2 + 69x + 1015x^2 + \ldots$ — A1 **(8)**

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5. *(i)* $\frac{8\sin x}{\cos x} - 3\cos x = 0$ — M1

$8\sin x - 3\cos^2 x = 0$

$8\sin x - 3(1 - \sin^2 x) = 0$ — M1

$3\sin^2 x + 8\sin x - 3 = 0$ — A1

(ii) $(3\sin x - 1)(\sin x + 3) = 0$ — M1

$\sin x = -3$ (no solutions) or $\frac{1}{3}$ — A1

$x = 0.34,\ \pi - 0.3398$ — B1 M1

$x = 0.34,\ 2.80$ (2dp) — A1 **(8)**

6.	*(a)*	$= \text{f}(\tfrac{1}{2}) = \tfrac{1}{4} + \tfrac{3}{4} - 3 + 1 = -1$	M1 A1	
	(b)	*(i)* $= \text{f}(-2) = -16 + 12 + 12 + 1 = 9$	B1	
		(ii) $x = -2$ is a solution to $\text{f}(x) = 9$ i.e. $2x^3 + 3x^2 - 6x - 8 = 0$	M1 A1	
		$$\begin{array}{r|l} & 2x^2 - x - 4 \\ x+2 & 2x^3 + 3x^2 - 6x - 8 \\ & 2x^3 + 4x^2 \\ & \quad -x^2 - 6x \\ & \quad -x^2 - 2x \\ & \qquad -4x - 8 \\ & \qquad -4x - 8 \end{array}$$	M1 A1	
		$\therefore\ (x + 2)(2x^2 - x - 4) = 0$		
		$x = -2$ or $\frac{1 \pm \sqrt{1+32}}{4} = -2, -1.19$ (3sf), 1.69 (3sf)	M1 A1	**(9)**
7.	*(i)*	$\log_2 (y - 1) - \log_2 x = 1,\quad \log_2 \frac{y-1}{x} = 1$	M1	
		$\frac{y-1}{x} = 2^1 = 2$	M1	
		$y - 1 = 2x,\quad y = 2x + 1$	A1	
	(ii)	$2 \log_3 y = 2 + \log_3 x \Rightarrow \log_3 y^2 - \log_3 x = 2$	M1	
		$\frac{y^2}{x} = 3^2 = 9$	M1	
		$y^2 = 9x$	A1	
		sub. $y = 2x + 1$ $(2x + 1)^2 = 9x$	M1	
		$4x^2 - 5x + 1 = 0$		
		$(4x - 1)(x - 1) = 0$	M1	
		$x = \tfrac{1}{4}, 1$	A1	
		$\therefore\ x = \tfrac{1}{4}, y = \tfrac{3}{2}$ or $x = 1, y = 3$	A1	**(10)**
8.	*(a)*	*(i)* $= (t^2 - 5) - (t - 1) = t^2 - t - 4$	M1 A1	
		(ii) $= (t^2 - 5) + (t^2 - t - 4) = 2t^2 - t - 9$	M1 A1	
	(b)	$2t^2 - t - 9 = 19$		
		$2t^2 - t - 28 = 0$		
		$(2t + 7)(t - 4) = 0$	M1	
		$t > 0\ \therefore\ t = 4$	A1	
	(c)	$a = 4 - 1 = 3,\ d = 16 - 4 - 4 = 8$	B1	
		$u_{10} = 3 + (9 \times 8) = 3 + 72 = 75$	M1 A1	
	(d)	$= \tfrac{40}{2}[6 + (39 \times 8)] = 20 \times 318 = 6360$	M1 A1	**(11)**
9.	*(i)*	$2x^2 - 6x - 3 = 9 + 3x - x^2$		
		$3x^2 - 9x - 12 = 0$	M1	
		$3(x + 1)(x - 4) = 0$	M1	
		$x = -1, 4$	A1	
		$\therefore\ (-1, 5), (4, 5)$	A1	
	(ii)	area $= \int_{-1}^{4} [(9 + 3x - x^2) - (2x^2 - 6x - 3)]\ dx$	M1	
		$= \int_{-1}^{4} (12 + 9x - 3x^2)\ dx$	A1	
		$= [12x + \tfrac{9}{2}x^2 - x^3]_{-1}^{4}$	M1 A2	
		$= (48 + 72 - 64) - (-12 - \tfrac{9}{2} + 1) = 62\tfrac{1}{2}$	M1 A1	**(11)**

Total **(72)**