

C2 Paper D – Marking Guide

1.	$= \int (3x^2 + \frac{1}{2}x^{-2}) dx$ $= x^3 - \frac{1}{2}x^{-1} + c$	B1 M1 A2 (4)												
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2.	$(7-x)^2 = x^2 + (x+1)^2 - [2 \times x \times (x+1) \times \cos 60]$ $49 - 14x + x^2 = x^2 + x^2 + 2x + 1 - x^2 - x$ $15x = 48$ $x = \frac{16}{5}$	M1 A1 M1 A1 (4)												
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3.	<p>(i)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">x</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0.25</td> <td style="text-align: center;">0.5</td> <td style="text-align: center;">0.75</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$\frac{4x}{(x+1)^2}$</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0.64</td> <td style="text-align: center;">0.8889</td> <td style="text-align: center;">0.9796</td> <td style="text-align: center;">1</td> </tr> </table> <p>area $\approx \frac{1}{2} \times 0.25 \times [0 + 1 + 2(0.64 + 0.8889 + 0.9796)]$ $= 0.752$ (3sf)</p> <p>(ii) under-estimate the curve passes above the top edge of each trapezium</p>	x	0	0.25	0.5	0.75	1	$\frac{4x}{(x+1)^2}$	0	0.64	0.8889	0.9796	1	M1 A1 B1 M1 A1 B1 B1 (7)
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$\frac{4x}{(x+1)^2}$	0	0.64	0.8889	0.9796	1									
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4.	<p>(i)</p> $(1+kx)^7 = \dots + \binom{7}{2}(kx)^2 + \dots$ $\therefore \frac{7 \times 6}{2} \times k^2 = 525$ $k^2 = \frac{525}{21} = 25$ $k > 0 \therefore k = 5$ <p>(ii)</p> $(1+5x)^7 = \dots + \binom{7}{3}(5x)^3 + \dots$ $\therefore \text{coeff. of } x^3 = \frac{7 \times 6 \times 5}{3 \times 2} \times 125 = 4375$ <p>(iii)</p> $(1+5x)^7 = 1 + 35x + 525x^2 + \dots$ $(2-x)(1+5x)^7 = (2-x)(1+35x+525x^2+\dots)$ $= 2 + 70x + 1050x^2 - x - 35x^2 + \dots$ $= 2 + 69x + 1015x^2 + \dots$	B1 M1 A1 M1 A1 B1 M1 A1 (8)												
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5.	<p>(i)</p> $\frac{8 \sin x}{\cos x} - 3 \cos x = 0$ $8 \sin x - 3 \cos^2 x = 0$ $8 \sin x - 3(1 - \sin^2 x) = 0$ $3 \sin^2 x + 8 \sin x - 3 = 0$ <p>(ii)</p> $(3 \sin x - 1)(\sin x + 3) = 0$ $\sin x = -3 \text{ (no solutions) or } \frac{1}{3}$ $x = 0.34, \pi - 0.3398$ $x = 0.34, 2.80 \text{ (2dp)}$	M1 M1 A1 M1 A1 B1 M1 A1 (8)												

6. (a) $= f(\frac{1}{2}) = \frac{1}{4} + \frac{3}{4} - 3 + 1 = -1$ M1 A1
 (b) (i) $= f(-2) = -16 + 12 + 12 + 1 = 9$ B1
 (ii) $x = -2$ is a solution to $f(x) = 9$ i.e. $2x^3 + 3x^2 - 6x - 8 = 0$ M1 A1

$$\begin{array}{r} 2x^2 - x - 4 \\ x+2 \overline{) 2x^3 + 3x^2 - 6x - 8} \\ \underline{2x^3 + 4x^2} \\ -x^2 - 6x \\ \underline{-x^2 - 2x} \\ -4x - 8 \\ \underline{-4x - 8} \\ 0 \end{array}$$

M1 A1

$$\begin{aligned} \therefore (x+2)(2x^2 - x - 4) &= 0 \\ x = -2 \text{ or } \frac{1 \pm \sqrt{1+32}}{4} &= -2, -1.19 \text{ (3sf), } 1.69 \text{ (3sf)} \end{aligned}$$

M1 A1 (9)

7. (i) $\log_2(y-1) - \log_2 x = 1, \quad \log_2 \frac{y-1}{x} = 1$ M1

$$\frac{y-1}{x} = 2^1 = 2 \quad \text{M1}$$

$$y-1 = 2x, \quad y = 2x+1 \quad \text{A1}$$

- (ii) $2 \log_3 y = 2 + \log_3 x \Rightarrow \log_3 y^2 - \log_3 x = 2$ M1

$$\frac{y^2}{x} = 3^2 = 9 \quad \text{M1}$$

$$y^2 = 9x \quad \text{A1}$$

sub. $y = 2x+1$ $(2x+1)^2 = 9x$ M1

$$4x^2 - 5x + 1 = 0$$

$$(4x-1)(x-1) = 0 \quad \text{M1}$$

$$x = \frac{1}{4}, 1 \quad \text{A1}$$

$$\therefore x = \frac{1}{4}, y = \frac{3}{2} \text{ or } x = 1, y = 3 \quad \text{A1 (10)}$$

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) $= \frac{40}{2} [6 + (39 \times 8)] = 20 \times 318 = 6360$ 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

$$= \int_{-1}^4 (12 + 9x - 3x^2) dx \quad \text{A1}$$

$$= [12x + \frac{9}{2}x^2 - x^3]_{-1}^4 \quad \text{M1 A2}$$

$$= (48 + 72 - 64) - (-12 - \frac{9}{2} + 1) = 62\frac{1}{2} \quad \text{M1 A1 (11)}$$

Total (72)