

Question	Answer	Marks	Partial Marks
1	Valid method to find $m$ $m = \frac{34-9}{3-0.5} [=10]$ oe	<b>M1</b>	
	Valid method to find $c$ , e.g. $34 = \text{their } 10 \times 3 + c$	<b>M1</b>	
	$\sqrt[4]{y} = (\text{their } 10) \frac{1}{x} + \text{their } 4$	<b>M1</b>	
	$y = \left(\frac{10}{x} + 4\right)^4$ oe, cao	<b>A1</b>	
2(a)	$9\left(x - \frac{2}{3}\right)^2 + 1$ oe	<b>B3</b>	<b>B1</b> for each of $p, q, r$ correct in correctly formatted expression; allow correct equivalent values If <b>B0</b> then <b>SC2</b> for $9\left(x - \frac{2}{3}\right)^2 + 1$ or <b>SC1</b> for correct values but other incorrect format
2(b)	$\text{their} \left(\frac{2}{3}, 1\right)$ oe	<b>B1</b>	<b>FT</b> <i>their</i> (a)
3(a)	Finds $p$ ( $-1$ )	<b>M1</b>	
	24	<b>A1</b>	
3(b)(i)	$p(-2) =$ $15(-8) + 22(4) - 15(-2) + 2 = 0$	<b>B1</b>	
3(b)(ii)	Attempt to find the quadratic factor	<b>M1</b>	
	$15x^2 - 8x + 1$	<b>A1</b>	
	$(x+2)(3x-1)(5x-1)$ oe, cao	<b>A1</b>	If zero scored, <b>SC1</b> for an answer of $(x+2)(3x-1)(5x-1)$ without working.
4(a)	${}^5C_2 \times {}^8C_4$ oe	<b>M1</b>	
	700	<b>A1</b>	
4(b)	$3 \times 6!$ oe	<b>M1</b>	
	2160	<b>A1</b>	
5(a)	$4\alpha - 12 = \alpha + 3$ and $4 - \beta = -2$	<b>M1</b>	
	$\alpha = 5$	<b>A1</b>	
	$\beta = 6$	<b>A1</b>	

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5(b)	$\sqrt{\text{their } (\alpha + 3)^2 + (-2)^2}$	<b>M1</b>	
	$\frac{2\mathbf{j} - \text{their } 8\mathbf{i}}{\sqrt{\text{their } 68}}$	<b>A1</b>	<b>FT</b> <i>their</i> $\alpha$
6	$3x^2 + 8x + 5 = kx - 7$	<b>M1</b>	
	$3x^2 + (8 - k)x + 12 [= 0]$ soi	<b>A1</b>	
	$(8 - k)^2 - 4(3)(12)$	<b>M1</b>	
	$k^2 - 16k - 80 = 0$	<b>M1</b>	
	Critical values: -4 and 20 soi	<b>A1</b>	
	$-4 < k < 20$	<b>A1</b>	Alternative method: <b>M1</b> for $k = 6x + 8$ oe <b>M1</b> for $y = (6x + 8)x - 7$ <b>M1</b> for $3x^2 + 8x + 5 = (6x + 8)x - 7$ <b>A1</b> for $x = \pm 2$ <b>A1</b> for $k = -4, k = 20$ <b>A1</b> for $-4 < k < 20$
7(a)	$x + 2y = \lg 5$ or $3x + 4y = \lg 50$	<b>B1</b>	
	Solves <i>their</i> linear simultaneous equations	<b>M1</b>	
	$x = \lg 2$ or equivalent simplified form	<b>A1</b>	
	$y = \frac{1}{2} \lg \frac{5}{2}$ or equivalent simplified form	<b>A1</b>	If <b>A0 A0</b> then <b>SC1</b> for a correct pair of unsimplified values or a correct pair of decimal values correct to at least 3sf
7(b)	$\left(x^{\frac{1}{3}} + 2\right)\left(2x^{\frac{1}{3}} - 5\right)$ oe	<b>M1</b>	
	$x^{\frac{1}{3}} = -2, \frac{5}{2}$	<b>M1</b>	
	$x = -8, \frac{125}{8}$	<b>A1</b>	
8(a)	$32 - 80x + 80x^2 - 40x^3 + 10x^4 - x^5$	<b>B3</b>	<b>B2</b> for any four or five terms correct or <b>B1</b> for any three terms correct or <b>M1</b> for a fully correct but unsimplified expansion

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8(b)	Combines powers sufficiently to be able to take logs or applies correct log laws	<b>M1</b>	
	For making use of <i>their</i> expansion from part (a)	<b>M1</b>	
	$40x^2(2-x) [=0]$ oe	<b>M1</b>	<b>FT</b> <i>their</i> (a) if possible
	$x=0, x=2$ cao	<b>A1</b>	
9(a)		<b>B3</b>	<b>B1</b> for correct shape with three distinct linear sections <b>B1</b> for 3 and 1.6 on vertical axis <b>B1</b> for 60, 75, 80 on horizontal axis
9(b)	$3 \times 60 + 15(1.6) + 0.5(15)(1.4) + 0.5(5)(1.6)$ or $3 \times 60 + 0.5(3 + 1.6)(15) + 0.5(5)(1.6)$	<b>M2</b>	<b>M1</b> for attempting at least two terms of the sum:
	218.5 (metres)	<b>A1</b>	
9(c)	0.32 (ms <sup>-2</sup> )	<b>B1</b>	
10(a)	$a=3, b=1$	<b>B2</b>	B1 for each
10(b)	$\int_0^{\text{their } b} 4x^{\frac{2}{3}} dx + \int_{\text{their } b}^{\text{their } a} (x-3)^2 dx$	<b>M1</b>	
	$\left[ \frac{3}{5} \times 4x^{\frac{5}{3}} \right]_0^{\text{their } b} + \left[ \frac{(x-3)^3}{3} \right]_{\text{their } b}^{\text{their } a}$ soi	<b>M2</b>	M1 for each, soi
	$\frac{12}{5}(\text{their } b) - \frac{12}{5}(0) + \frac{(\text{their } a - 3)^3}{3} - \frac{(\text{their } b - 3)^3}{3}$	<b>M1</b>	
	$\frac{76}{15}$ or $5\frac{1}{15}$ or 5.07 or 5.06 rot to four or more figs; cao	<b>A1</b>	

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11(a)		<b>B3</b>	<b>B1</b> for correct shape of f or f <sup>-1</sup> <b>B1</b> for symmetry <b>B1</b> for drawn over correct domain  <b>Maximum of 2 marks if not fully correct</b>
11(b)(i)	$[\pm]\sqrt{x-1} = y-4$ soi	<b>M1</b>	
	$g^{-1}(x) = 4 - \sqrt{x-1}$	<b>A1</b>	
	[Range] $g^{-1} \leq 4$	<b>B1</b>	
	[Domain] $x \geq 1$	<b>B1</b>	
11(b)(ii)	$\ln(2[(x-4)^2 + 1] + 1)$	<b>M1</b>	
	$\ln(2x^2 - 16x + 35)$	<b>A1</b>	
11(b)(iii)	Valid explanation, e.g. some of the values in the range of f are outside the domain of g	<b>B1</b>	
12(a)	$\frac{d(e^{3x})}{dx} = 3e^{3x}$	<b>B1</b>	
	$\frac{d(2x+3)^6}{dx} = k(2x+3)^5$	<b>M1</b>	
	<i>their</i> $(3e^{3x})(2x+3)^6 + (e^{3x})(\text{their } 12(2x+3)^5)$	<b>M1</b>	
	$(3e^{3x})(2x+3)^6 + (e^{3x})(12(2x+3)^5)$	<b>A1</b>	
	$(3e^{3x})(2x+3)^5(2x+7) = 0$	<b>M1</b>	
	$x = -1.5, -3.5$	<b>A1</b>	
12(b)	$x = 0.5 \quad f''(0.5) [= -5] < 0 \Rightarrow \text{max}$ $x = 3 \quad f''(3) [= 5] > 0 \Rightarrow \text{min}$	<b>B2</b>	<b>B1</b> for either one correct

Question	Answer	Marks	Partial Marks
12(c)	$h = \frac{10}{x^2}$	<b>B1</b>	
	$S = 8x^2 + 10x \left( \text{their } \frac{10}{x^2} \right)$	<b>B1</b>	
	$\frac{dS}{dx} = 16x - 100x^{-2}$ oe	<b>M1</b>	
	$16x - 100x^{-2} = 0, x = \sqrt[3]{\frac{25}{4}}$ oe	<b>A1</b>	<b>FT</b> <i>their</i> $\frac{dS}{dx} = 0$ if possible
	81.4 or 81.4325... rot to four or more figs	<b>A1</b>	