Question	Answer	Marks	Guidance
4(a)	$\frac{e^{2x+2}}{e^{\frac{x}{2}}} = 10$ oe, soi	**B1**	
	$e^{1.5x+2} = 10$ oe	**M1**	**FT** $\frac{e^{2x+k}}{e^{\frac{x}{2}}} = 10$ oe or $\frac{e^{kx+2}}{e^{\frac{x}{2}}} = 10$ oe where k is an integer and $k > 0$ or $\frac{e^{2x+2}}{e^{\frac{x}{n}}} = 10$ oe where n is an integer and $n > 1$ or $n = -2$
	$1.5x + 2 = \ln 10$ oe	**M1**	**FT** an expression of, or equivalent to, the form $e^{ax+b} = 10$ oe where a and b are non-zero constants
	$x = \frac{2}{3}(\ln 10 - 2)$ oe, isw or 0.202 or 0.2017[23…] rot to 4 or more dp isw	**A1**	
4(b)	$\frac{y^2}{4y-9} = 9^{\frac{1}{2}}$ nfww or $\log_9 \frac{y^2}{4y-9} = \log_9 9^{\frac{1}{2}}$ oe	**M2**	**M1** for at least one correct log law used in a correct equation e.g. $\log_9 y^2 - \log_9(4y-9) = \frac{1}{2}$ or $\log_9 \frac{y^2}{4y-9} = \frac{1}{2}$ or $2\log_9 y - \log_9(4y-9) = \frac{1}{2}\log_9 9$
	$y^2 - 12y + 27$ [= 0] nfww	**A1**	
	$(y-3)(y-9) = 0$	**DM1**	**dep** on at least **M1** previously awarded
	$y = 3, y = 9$ nfww	**A1**	
5(a)	Correct first derivative: $3x^2 - 14x + 12$	**M2**	**M1** for two terms of $x^3 - 7x^2 + 12x - 5$ differentiated correctly
	[At $x = 1$] gradient of tangent: 1	**A1**	
	$y - 1 = their(-1)(x - 1)$ oe or $y = -x + c$ **and** $1 = -1 + c$ soi	**M1**	**FT** $\frac{-1}{their \left.\frac{dy}{dx}\right\|_{x=1}}$
	$y - 1 = -1(x - 1)$ or $y = -x + 2$ oe, isw	**A1**	

Question	Answer	Marks	Guidance
5(b)	$x^3 - 7x^2 + 12x - 5 = their(-x + 2)$	**B1**	**FT** *their* $y = ax + b$ where a is a non-zero constant
	Uses the correct linear factor $x - 1$ and the correct cubic $x^3 - 7x^2 + 13x - 7[=0]$ to find a quadratic factor with at least two terms correct	**M1**	
	$x^2 - 6x + 7$	**A1**	
	Correct use of formula or completing the square on *their* 3-term quadratic, e.g., $x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4[1](7)}}{2[1]}$ or $x = \frac{6 \pm \sqrt{36 - 4[1](7)}}{2}$	**M1**	**FT** *their* 3-term quadratic providing it is from an attempt at finding a quadratic factor and the discriminant is not negative
	$x = 3 \pm \sqrt{2}$	**A1**	
6	$\left[\frac{(x+2)^2}{x} =\right] \quad x + 4 + \frac{4}{x}$ soi	**B2**	**B1** for two terms correct or for $\frac{x^2 + 4x + 4}{x}$
	$\left[\frac{x^2}{2} + 4x + 4\ln x\right]_2^3$	**B2**	**B1** for $\left[\frac{x^2}{2} + ... + 4\ln x\right]_2^3$ or $\left[... + 4x + 4\ln x\right]_2^3$ or $\left[\frac{x^2}{2} + 4x + k\ln x\right]_2^3$ with $k \neq 0$
	$\left[\frac{9}{2} + 12 + 4\ln 3\right] - \left[\frac{4}{2} + 8 + 4\ln 2\right]$	**M1**	**dep** on at least previous **B1** for integration
	$6.5 + 4\ln\left(\frac{3}{2}\right)$ or exact equivalent	**A1**	
7(a)	Velocity: $3e^{2t} - 4e^{-2t} - 1$ isw	**B2**	**B1** for $3e^{2t}$ or $-4e^{-2t}$
	Acceleration: $6e^{2t} + 8e^{-2t}$ isw	**B1**	**FT** $me^{2t} + ne^{-2t} + k$ where m, n and k are constants