Question	Answer	Marks	Partial Marks
2(b)	Correct second derivative: $\frac{d^2y}{dx^2} = 64 + \frac{3}{4}x^{-4}$ oe, isw	**M1**	**FT** *their* $\frac{dy}{dx} = mx + nx^{-3}$ where $m \neq 0$ and $n \neq 0$ seen in part (a)
	$64 + \frac{3}{4}\left(\frac{1}{4}\right)^{-4} = 256$ or $64 + \frac{3}{4}\left(\frac{1}{4}\right)^{-4} > 0$ or when $x = 0.25$ $\frac{d^2y}{dx^2} = 256$ or $\frac{d^2y}{dx^2} > 0$ oe **and** minimum [points] oe OR $64 + \frac{3}{4}\left(-\frac{1}{4}\right)^{-4} = 256$ or $64 + \frac{3}{4}\left(-\frac{1}{4}\right)^{-4} > 0$ or when $x = -0.25$ $\frac{d^2y}{dx^2} = 256$ or $\frac{d^2y}{dx^2} > 0$ oe **and** minimum [points] oe OR $\frac{d^2y}{dx^2} = 64 + \frac{3}{4x^4}$ and this is positive for any value of x **and** minimum [points]	**A2**	**dep** on $x = \pm 0.25$ nfww in part **(a)** **A1 dep** on $x = 0.25$ or $x = -0.25$ nfww in part (a) for correctly showing or stating $\frac{d^2y}{dx^2}\left[= 64 + \frac{3}{4x^4}\right]$ is positive
3(a)	$-12 - 69 + 27 + 54 = 0$	**B1**	

Question	Answer	Marks	Partial Marks
3(b)	$10x+7=-2x^3+3x^2+33x-5$ oe, soi	**M1**	
	Uses the correct factor $x + 3$ to find a quadratic factor of the polynomial from part (a) oe with at least 2 terms correct	**M1**	
	$-2x^2+9x-4$ or $2x^2-9x+4$	**A1**	
	Factorises or solves *their* 3-term quadratic factor = 0: $(2x-1)(-x+4)$ or $(-2x+1)(x-4)$ or $(2x-1)(x-4)$ oe	**DM1**	**dep** on previous **M1**
	$x = -3$, $x = 0.5$, $x = 4$ nfww	**A1**	**dep** on at least **M0 M1 A1 DM1** awarded
	$A(-3, -23)$, $B(0.5, 12)$, $C(4, 47)$ oe **and** correct method to show mid-point e.g.: $\left(\frac{-3+4}{2},\frac{-23+47}{2}\right)=\left(\frac{1}{2},12\right)$ oe or $\left[\overrightarrow{AB}=\right]\begin{pmatrix}0.5\\12\end{pmatrix}-\begin{pmatrix}-3\\-23\end{pmatrix}=\begin{pmatrix}3.5\\35\end{pmatrix}$ and $\left[\overrightarrow{BC}=\right]\begin{pmatrix}4\\47\end{pmatrix}-\begin{pmatrix}0.5\\12\end{pmatrix}=\begin{pmatrix}3.5\\35\end{pmatrix}$ oe OR [x-coordinate mid-point] $\frac{-3+4}{2}=\frac{1}{2}$ oe **and** valid comment e.g. The points are collinear [so B is the mid-point of AC].	**B2**	**dep** on $x = -3$, $x = 0.5$, $x = 4$ nfww **B1 dep** on $x = -3$, $x = 0.5$, $x = 4$ nfww for $A(-3, -23)$, $B(0.5, 12)$, $C(4, 47)$ oe or [x-coordinate of the mid-point] $\frac{-3+4}{2}=\frac{1}{2}$ oe

Question	Answer	Marks	Partial Marks
4	$\frac{dy}{dx} = -\sec^2(1-x)$ oe	**B2**	**must be seen** **B1** for $\frac{dy}{dx} = k\sec^2(1-x)$ oe, $k \neq -1$ or **SC1** for $\frac{dy}{dx} = -\sec^2 1-x$ or $\frac{dy}{dx} = -\sec^2(1-x)+c$
	Solves $3 = 2 + \tan(1-x)$ as far as $1 - x = \tan^{-1}1$	**M1**	
	$1-x = \frac{\pi}{4}$ isw or 0.7853[98…] $x = 1-\frac{\pi}{4}$ isw or 0.2146[01…]	**A1**	
	Correct use of chain rule **and** correctly writes in terms of cosine or tangent: $\frac{their(-1)}{\cos^2\left(their\frac{\pi}{4}\right)} \times 0.04$ oe, soi or $their(-1)\left\{1+\tan^2\left(their\frac{\pi}{4}\right)\right\} \times 0.04$ oe soi	**M1**	**dep** on at least **B1** and an attempt to solve $3 = 2 + \tan(1-x)$
	−0.08 oe, nfww	**A1**	**dep** on all previous marks awarded
5(a)	$\lg P = \lg A + T\lg b$ oe nfww **and** correct comparison with $y = mx + c$ soi	**B2**	Must be seen and not from wrong working **B1** for $\lg P = \lg A + T\lg b$ isw, nfww
5(b)	$A = 10^6$ oe isw and $b = 10^{\frac{3}{7}}$ oe isw	**4**	**B2** for $A = 10^6$ oe isw **or B1**correct method which could be used to find A e.g. $\lg A = 6$ or $12 = \frac{3}{7}\times 14 + \lg A$ **B2** for $b = 10^{\frac{3}{7}}$ oe isw or **B1**correct method which could be used to find b e.g. $\lg b = \frac{12-6}{14-0}$ oe or $12 = 14\lg b + 6$