Question	Answer	Marks	Guidance
3	$b = 243$	**B1**	Must be evaluated
	${}^5C_1 \times 3^4 \times (-a) = -81$	**M1**	Allow equivalent with no negative signs, allow sign error
	$a = \frac{1}{5}$ oe	**A1**	
	${}^5C_2 \times 3^3 \times (-a)^2$	**M1**	Allow with *their* a^2
	$c = \frac{54}{5}$ or 10.8 oe	**A1**	Must be from correct working
4	$\frac{dy}{dx} = \frac{6x}{3x^2 - 4} - \frac{x^2}{2}$	**2**	**M1** for attempt to differentiate, must have at least one term correct **A1** All correct
	When $x = 2$, $\frac{dy}{dx} = -\frac{1}{2}$	**B1**	
	When $x = 2$, $y = \ln 8 - \frac{4}{3}$, or exact equivalent	**B1**	Allow $\ln 8 - \frac{8}{6}$
	Equation of tangent $y - \left(\ln 8 - \frac{4}{3}\right) = -\frac{1}{2}(x - 2)$ oe	**M1**	Dep on first M mark, allow unsimplified, allow use of decimals
	$\left(0,\ \ln 8 - \frac{1}{3}\right)$, or exact equivalent	**A1**	Allow $x = 0, y = \ln 8 - \frac{1}{3}$
5(a)	$\frac{1}{2}\left(5 - \sqrt{3}\right)\left(2 + 4\sqrt{3}\right)$ $\frac{1}{2}\left(10 - 2\sqrt{3} + 20\sqrt{3} - 12\right)$	**M1**	Need to see $\frac{1}{2}\left(10 - 18\sqrt{3} - 12\right)$ or $\left(5 - 9\sqrt{3} - 6\right)$ minimum for M1
	$9\sqrt{3} - 1$	**A1**	
5(b)	$\tan ABC = \frac{5 - \sqrt{3}}{1 + 2\sqrt{3}} \times \frac{1 - 2\sqrt{3}}{1 - 2\sqrt{3}}$ $= \frac{5 - \sqrt{3} - 10\sqrt{3} + 6}{1 - 12}$	**M1**	Attempt at trig ratio and attempt to rationalise. Need to see $5 - 11\sqrt{3} + 6$ in the numerator as a minimum for M1 Allow one error only
	$= \sqrt{3} - 1$	**2**	**A1** for $\sqrt{3}$, **A1** for -1

Question	Answer	Marks	Guidance
5(c)	$\sec^2 ABC = \tan^2 ABC + 1$ $= \left(\sqrt{3}-1\right)^2 + 1$ oe	**M1**	Allow use of correct identity with *their* (b)
	$= 5 - 2\sqrt{3}$	**A1**	
	Alternative		
	$\sec^2 ABC = \left(\dfrac{\sqrt{\left(5-\sqrt{3}\right)^2 + \left(1+2\sqrt{3}\right)^2}}{1+2\sqrt{3}}\right)^2$ leads to $\dfrac{41-6\sqrt{3}}{13+4\sqrt{3}}$ leads to $\dfrac{533+72-242\sqrt{3}}{121}$	**(M1**	For a complete method using triangle *ABD*, with sufficient detail in the expansions and rationalisation
	$= 5 - 2\sqrt{3}$	**A1)**	
6(a)	Midpoint = $(2, 7)$	**B1**	
	Gradient of $AB = \dfrac{6}{8}$ oe	**B1**	
	Perp bisector: $y - 7 = -\dfrac{4}{3}(x-2)$	**M1**	Must be using a perp gradient and a mid-point
	$4x + 3y - 29 = 0$	**A1**	Allow in any order but must be equated to zero.
6(b)	3	**B1**	FT on *their* **(a)**
6(c)	Displacement vector $\overrightarrow{CM} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$	**M1**	Allow equivalent vectors or other methods. May be implied by one correct coordinate.
	$(-1, 11)$	**A1**	Allow $x = -1,\ y = 11$