Question	Answer	Marks	Guidance
2	$2x^2+4x+k-1=kx+3$ $2x^2+(4-k)x+(k-4)=0$	**2**	**M1** for attempt to equate the line and curve and simplify to a 3 term quadratic equation = 0 **A1** for a correct equation, allow equivalent form
	$(4-k)^2=4\times2\times(k-4)$	**M1**	Use of discriminant in any form
	$k^2-16k+48=0$ $k=12,\ k=4$ Do not isw	**2**	Dep **M1** on previous M mark, for attempt to solve a quadratic equation in k **A1** for both
	Alternative 1		
	$2x^2+4x+k-1=kx+3$ $2x^2+(4-k)x+(k-4)=0$	**(2**	**M1** for attempt to equate the line and curve and simplify **A1** for a correct equation, allow equivalent form
	$k=4x+4$ $2\left(\frac{k-4}{4}\right)^2+(4-k)\left(\frac{k-4}{4}\right)+(k-4)=0$	**M1**	Equating gradients and substitution to obtain a quadratic equation in terms of k
	$k^2-16k+48=0$ $k=12$ and $k=4$ Do not isw	**2)**	Dep **M1** on previous M mark, for attempt to solve a quadratic equation in k **A1** for both
	Alternative 2		
	$2x^2+4x+k-1=kx+3$ $2x^2+(4-k)x+(k-4)=0$	**(2**	**M1** for attempt to equate the line and curve and simplify **A1** for a correct equation, allow equivalent form
	$k=4x+4$ $2x^2-4x=0$ $x=0,\ 2$	**M1**	Equating gradients and substitution to obtain a quadratic equation in terms of x and solution of this equation to obtain 2 x values
	$k=4x+4$ $k=12$ and $k=4$ Do not isw	**2)**	Dep **M1** on previous M mark, for substitution of their x values to obtain k values **A1** for both

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