Question Number	Scheme	Notes	Marks
8.	$H: xy = 16;\ P\left(4t, \frac{4}{t}\right), t \neq 0,$ and $A: t = 2$ lies on H. $A(8, 2)$		
(a)	$y = \frac{16}{x} = 16x^{-1} \Rightarrow \frac{dy}{dx} = -16x^{-2}$ or $-\frac{16}{x^2}$	$\frac{dy}{dx} = \pm k x^{-2};\ k \neq 0$	M1
	$xy = 16 \Rightarrow x\frac{dy}{dx} + y = 0$	Uses implicit differentiation to give $\pm x\frac{dy}{dx} \pm y$	
	$x = 4t,\ y = \frac{4}{t} \Rightarrow \frac{dy}{dx} = \frac{dy}{dt}.\frac{dt}{dx} = -\left(\frac{4}{t^2}\right)\left(\frac{1}{4}\right)$	their $\frac{dy}{dt} \times \frac{1}{\text{their } \frac{dy}{dt}}$; **Condone** $p \equiv t$	
	So at P, $m_T = -\frac{1}{t^2}$	Correct calculus work leading to $m_T = -\frac{1}{t^2}$	A1
	So, $m_N = t^2$	Applies $m_N = \frac{-1}{m_T}$, where m_T is found using calculus	M1
	• $y - \frac{4}{t} = "t^2"(x - 4t)$ • $\frac{4}{t} = "t^2"(4t) + c \Rightarrow y = "t^2"x +$ their c	Correct straight line method for an equation of a normal where $m_N\ (\neq m_T)$ is found by using calculus	M1
	Correct algebra leading to $ty - t^3x = 4 - 4t^4$ *	Correct solution only	A1 cso
			(5)
(b)	$\{t = 2 \Rightarrow\}$ **N**: $2y - 8x = 4 - 64$ $\{\Rightarrow y = 4x - 30\}$	Uses $t = 2$ to find the equation of the normal to H at A	M1
	• $x(4x - 30) = 16$ $\{\Rightarrow 2x^2 - 15x - 8 = 0\}$ • $\left(\frac{y + 30}{4}\right)y = 16$ $\{\Rightarrow y^2 + 30y - 64 = 0\}$ • $\frac{4}{t} = 4(4t) - 30$ $\{\Rightarrow 8t^2 - 15t - 2 = 0\}$	Substitutes the equation of the normal into the equation of the curve H to obtain an equation in x only or y only or t only	M1
	• $(x - 8)(2x + 1) = 0 \Rightarrow x_B = -\frac{1}{2}$ • $(y - 2)(y + 32) = 0 \Rightarrow y_B = -32$ • $(t - 2)(8t + 1) = 0 \Rightarrow t_B = -\frac{1}{8}$	**dependent on the first two M marks** Solves their 3 TQ $= 0$ to obtain a value for the x (or y) coordinate of B or a value of t at B	ddM1
	$B(-0.5, -32)$	Correct coordinates for B	A1
	$AB = \sqrt{(8 - -0.5)^2 + (2 - -32)^2}$	**dependent on the second M mark** Correct Pythagoras method to find the length of AB	dM1
	$= \frac{17\sqrt{17}}{2}$ or $\frac{\sqrt{4913}}{2}$ or $\sqrt{\frac{4913}{4}}$ or $\sqrt{1228.25}$	Correct exact length	A1
			(6)
(c)	$y - 2 = -\frac{1}{4}(x - 8)$ and $x = 0 \Rightarrow y_C = 2 + 2 = 4$	Finds the equation of the tangent at $(8, 2)$ to H, and sets $x = 0$ to find $y_C = ...$	M1
	$AC = \sqrt{(8 - 0)^2 + (2 - 4)^2}$ $\{= \sqrt{68}\}$ Area $ABC = \frac{1}{2}\left(\frac{17\sqrt{17}}{2}\right)\left(\sqrt{68}\right)$	Uses the points $(8, 2)$, $(-0.5, -32)$ and $(0, 4)$ in a complete method to find the area of triangle ABC	M1
	$= 144.5$ or $\frac{289}{2}$	Correct answer	A1
			(3)
			14

	Question 8 Notes	
8. (b)	**Note**	The correct coordinates of B can be implied. e.g. embedded in the distance expression for AB
	Note	An incorrect **N**: $y = 4x + 30$ leads to the correct length AB for $A(-8, -2)$ and $B(0.5, 32)$
	Note	Condone final dM1 for $x_B = -\frac{1}{2}$ leading to $B(-2, -8)$ and $AB = \sqrt{(8--2)^2 + (2--8)^2}$
(c)	**Note**	Give 1st M0 for setting $x = 0$ in the equation of the normal to find $y_C = ...$
	Note	The 2nd M mark can only be gained by using all 3 correct points $(8, 2), (-0.5, -32)$ and $(0, 4)$. Complete area methods include • Area $ABC = \frac{1}{2}\left(\frac{17\sqrt{17}}{2}\right)\left(\sqrt{68}\right)\{= 144.5\}$ • AB crosses y-axis at $(0, -30)$ and so Area $ABC = \frac{1}{2}(34)\left(\frac{1}{2}\right) + \frac{1}{2}(34)(8)\{= 8.5 + 136 = 144.5\}$ • Area $ABC = \frac{1}{2}\begin{vmatrix} 8 & -0.5 & 0 & 8 \\ 2 & -32 & 4 & 2 \end{vmatrix} = \frac{1}{2}\lvert(-256 - 2 + 0) - (-1 + 0 + 32)\rvert \left\{= \frac{1}{2}\lvert(-289)\rvert = 144.5\right\}$ • Area $ABC = (32 + 4)\left(\frac{1}{2} + 8\right) - \frac{1}{2}(32 + 2)\left(\frac{1}{2} + 8\right) - \frac{1}{2}(32 + 4)\left(\frac{1}{2}\right) - \frac{1}{2}(2)(8)$ $\{= 306 - 144.5 - 9 - 8 = 144.5\}$ • Area $ABC = \frac{1}{2}(8 + 8.5)(36) - \frac{1}{2}(32 + 2)\left(\frac{1}{2} + 8\right) - \frac{1}{2}(2)(8)$ $\{= 297 - 144.5 - 8 = 144.5\}$
	Note	**Helpful Sketch** 