Question			Answer	Marks	AO	Guidance	
12	(a)		$\frac{dx}{dt} = \frac{-1}{t^2}$, $\frac{dy}{dt} = 2$ $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$	**M1**	**1.1a**	Attempt correct process to find gradient in terms of t or p	Correctly combine attempts at two derivatives Need $\frac{dx}{dt} = kt^{-2}$ and $\frac{dy}{dt} = 2$ **SC B1** for gradient of $-2x^{-2}$ if it is never seen in terms of t or p
			$\frac{dy}{dx} = -2t^2$	**A1**	**2.1**	Obtain correct gradient	In terms of t or p
			$y - 2p = -2p^2\left(x - \frac{1}{p}\right)$	**M1**	**1.1a**	Attempt equation of tangent	Condone still working in terms of t Allow mixture of t and p as long as convincingly recovered Using their gradient from a differentiation attempt, but not dependent on first M1 Substitution into $y - y_1 = m(x - x_1)$ or equation involving c from $y = mx + c$
			$y = -2p^2x + 4p$ **A.G.**	**A1**	**2.1**	Obtain given answer	Must now be in terms of p Expand brackets and simplify to given answer, or find c and substitute back into equation
				[4]			

Question			Answer	Marks	AO	Guidance	
12	(b)		$m' = \frac{1}{2p^2}$	**B1FT**	**1.1a**	Correct (unsimplified) gradient of normal, following their derivative	Gradient in terms of t or p, but not x Could either FT on their incorrect derivative or deduce the gradient from the equation given in (a)
			$y - 2p = \frac{1}{2p^2}\left(x - \frac{1}{p}\right)$ $y = \frac{1}{2p^2}x + 2p - \frac{1}{2p^3}$	**M1**	**1.1**	Attempt equation of normal	Attempt to use their gradient and P Allow mixture of t and p as long as convincingly recovered Substitution into $y - y_1 = m(x - x_1)$ or equation involving c from $y = mx + c$
				M1	**3.1a**	Use $y = 0$ to attempt x-coordinate of B	Using their attempt at normal equation As far as finding an expression for x
			at B, $y = 0$ so $x = 2p^2\left(\frac{1}{2p^3} - 2p\right) = \frac{1}{p} - 4p^3$	**A1**	**2.1**	Correct x-coordinate for B	Any equivalent form
			at A, $y = 0$ so $x = \frac{4p}{2p^2} = \frac{2}{p}$	**B1**	**2.1**	Correct x-coordinate for A	Any equivalent form
			$PA = \sqrt{\left(\frac{1}{p}\right)^2 + (2p)^2}$ $PB = \sqrt{\left(4p^3\right)^2 + (2p)^2}$	**M1**	**3.1a**	Attempt length of PA or PB	Or **M1** for attempting one of $(PA)^2$ or $(PB)^2$ Must correct distance formula Using the given P, and their coordinates for A and/or B, which must involve a function of p
				A1	**2.1**	Correct PA and PB	Or correct $(PA)^2$ and $(PB)^2$
			$PA : PB = \frac{1}{p}\sqrt{4p^4 + 1} : 2p\sqrt{4p^4 + 1}$ $= \frac{1}{p} : 2p$ $= 1 : 2p^2$ **A.G.**	**A1**	**2.1**	Simplify ratio to obtain given answer	Must show clear method, such as same expression in each square root before cancelling Could also consider fraction and then cancel to deduce given ratio Could simplify $(PA)^2 : (PB)^2$, and then square root to obtain ratio
				[8]			