Question	Scheme	Marks
7(a)	$\frac{dy}{dx} = -\frac{36}{x^2}$ oe	B1
	$m_t = -\frac{36}{4^2} \Rightarrow m_n = \frac{16}{36} = \frac{4}{9}$	M1
	Normal is $y - 9 = \frac{4}{9}(x-4)$	M1
	$\Rightarrow 9y - 81 = 4x - 16 \Rightarrow 4x - 9y + 65 = 0$ *	A1*
		(4)
(b)	Normal meets H again when $4x - 9 \times \frac{36}{x} + 65 = 0$ or $4 \times \frac{36}{y} - 9y + 65 = 0$	M1
	$\Rightarrow 4x^2 + 65x - 324 = 0 \Rightarrow x = ...$ or $9y^2 - 65y - 144 = 0 \Rightarrow y = ...$	dM1
	$\Rightarrow Q = \left(-\frac{81}{4}, -\frac{16}{9}\right)$	A1
	At $x = -\frac{81}{4}$, $\frac{dy}{dx} = -\frac{36}{\left(-\frac{81}{4}\right)^2} = ...$ so tangent is $y - \left(-\frac{16}{9}\right) = -\frac{64}{729}\left(x - \left(-\frac{81}{4}\right)\right)$	M1
	$y = -\frac{64}{729}x - \frac{32}{9}$	A1(5)
		(9 marks)

Notes:

(a)

B1: Correct expression for $\frac{dy}{dx}$, or any equivalent correct expression including it, such as $x\frac{dy}{dx} + y = 0$ or $\frac{dy}{dx} = -\frac{1}{t^2}$

M1: Attempts negative reciprocal gradient at the point P

M1: Uses their normal (changed from tangent) gradient and $P(4,9)$ to find the equation of the normal. Look for $y - 9 = "m_n"(x-4)$ Working must be shown for their constant if $y = mx + c$ is used as this is a "show that" question.

A1*: Correct equation achieved from correct working with intermediate step.

(b)

M1: Substitutes hyperbola equation into the **given** normal to obtain an equation in one variable. Other valid means of obtaining an equation in a single variable are acceptable.

dM1: Gathers terms and solves the 3 term quadratic to find a value $\neq 4$ for x or $\neq 9$ for y. Solution by calculator allowed if correct roots (or values $\neq 4$ for x or $\neq 9$ for y) are shown

A1: Correct coordinates of intersection.

M1: Uses their x value to find the gradient at Q and then uses the intersection point with their gradient to form the equation of the line.

A1: Correct equation.