FP1 - Conics Questions

[June 2013] 4.

The rectangular hyperbola H has Cartesian equation xy = 4.

The point $P\left(2t, \frac{2}{t}\right)$ lies on H, where $t \neq 0$.

(a) Show that an equation of the normal to H at the point P is

$$ty - t^3x = 2 - 2t^4 (5)$$

The normal to H at the point where $t = -\frac{1}{2}$ meets H again at the point Q.

(b) Find the coordinates of the point Q.

[June 2013] 6. A parabola C has equation $v^2 = 4ax$, a > 0

The points $P(ap^2, 2ap)$ and $Q(aq^2, 2aq)$ lie on C, where $p \neq 0$, $q \neq 0$, $p \neq q$.

(a) Show that an equation of the tangent to the parabola at P is

$$\rho_y - x = a\rho^2$$
(4)

(40)

(1)

(2)

(b) Write down the equation of the tangent at Q.

The tangent at P meets the tangent at Q at the point R.

(c) Find, in terms of p and q, the coordinates of R, giving your answers in their simplest form.
(4)

Given that R lies on the directrix of C,

(d) find the value of pq.

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