

## FP1 Parabola And Hyperbola

Patrons are reminded that the general parabola is given by

$$y^2 = 4ax.$$

They are also reminded that the rectangular hyperbola is given by

$$xy = c^2.$$

In practice (before you've studied Core 4) these are more easily thought of as

$$y = \pm 2\sqrt{ax}^{\frac{1}{2}} \quad \text{and} \quad y = \frac{c^2}{x}.$$

1. Find the equations of the tangents to  $y^2 = 16x$  when  $x = 4$ . Give your answers in the form  $y = mx + c$ .  $y = x + 4, y = -x - 4$
2. The normal to  $y^2 = 36x$  when  $y = 3$  intersects the  $x$ -axis at  $A$  and the  $y$ -axis at  $B$ . Find the area of triangle  $OAB$ , where  $O$  is the origin.  $\frac{5329}{192}$
3. The tangent to  $xy = 4$  when  $x = 1$  intersects the tangent to the same curve when  $x = 2$  at the point  $P$ . Find  $P$ .  $P = (\frac{4}{3}, \frac{8}{3})$
4. Find the equation of the tangent (where  $y > 0$ ) to the curve  $y^2 = 4ax$  when  $x = p$ .  $\sqrt{ax} - \sqrt{py} + \sqrt{ap} = 0$
5. Find the equation of the normal (where  $y < 0$ ) to the curve  $y^2 = 4ax$  when  $x = p$ .  $\sqrt{p}x - \sqrt{a}y = p\sqrt{p} + 2a\sqrt{p}$
6. Find the equation of the tangent to the curve  $xy = c^2$  when  $x = p$ .  $c^2x + p^2y = 2c^2p$
7. Find the equation of the normal to the curve  $xy = c^2$  when  $x = p$ .  $p^3x - c^2py = p^4 - c^4$
8. (a) Find tangent to  $xy = c^2$  when  $x = 1$ .  $y = -c^2x + 2c^2$   
(b) This tangent crosses the  $x$ -axis at  $A$  and the  $y$ -axis at  $B$ . Find the area of triangle  $OAB$ , where  $O$  is the origin.  $2c^2$