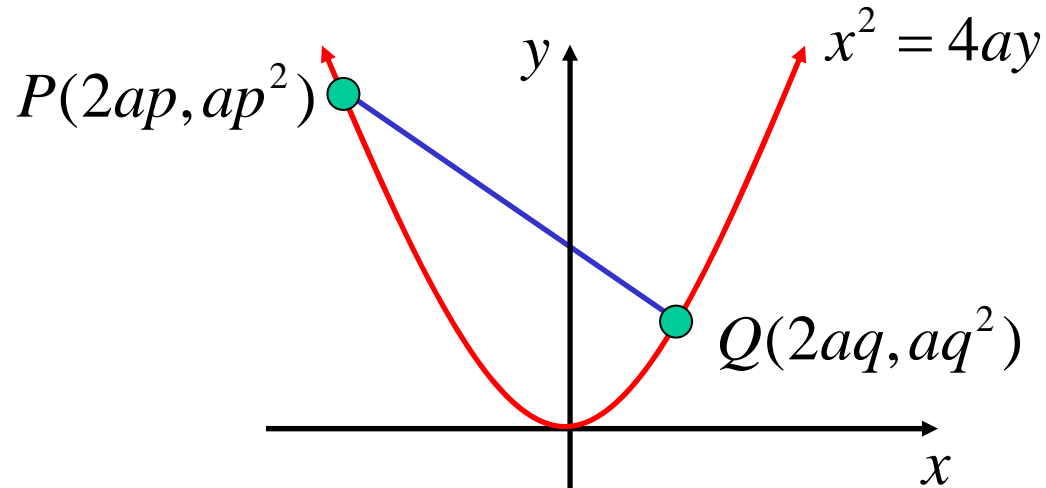


# Chords of a Parabola

## (1) Chord



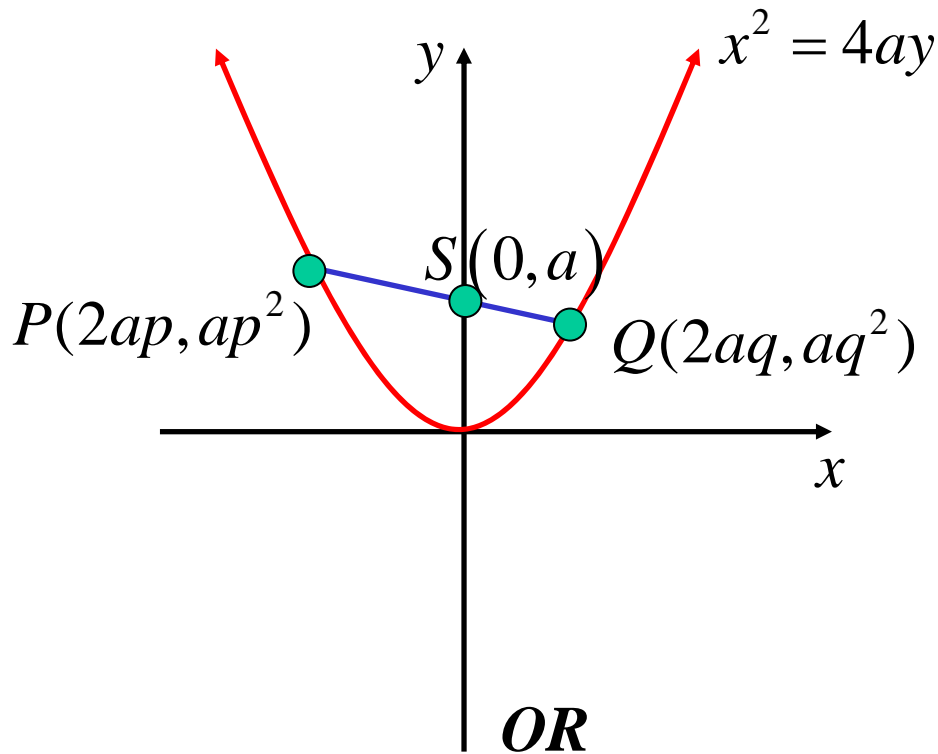
$$\begin{aligned} m_{PQ} &= \frac{ap^2 - aq^2}{2ap - 2aq} \\ &= \frac{a(p+q)(p-q)}{2a(p-q)} \\ &= \frac{p+q}{2} \end{aligned}$$

$$y - ap^2 = \frac{p+q}{2}(x - 2ap)$$

$$2y - 2ap^2 = (p+q)x - 2ap^2 - 2apq$$

$$(p+q)x - 2y = 2apq$$

## (2) Focal Chord (*chord passes through focus*)



① Prove  $m_{PQ} = \frac{p+q}{2}$

② 
$$m_{PS} = \frac{ap^2 - a}{2ap - 0}$$

$$= \frac{a(p^2 - 1)}{2ap}$$

$$= \frac{p^2 - 1}{2p}$$

If  $PQ$  is a focal chord

$$m_{PQ} = m_{PS}$$

$$\frac{p^2 - 1}{2p} = \frac{p+q}{2}$$

$$p^2 - 1 = p^2 + pq$$

$$pq = -1$$

(if you have derived equation of chord already)

①  $(p+q)x - 2y = 2apq$

②  $(0, a)$  lies on the chord:  $-2a = 2apq$

$$pq = -1$$

**Exercise 9E; 1ac, 2, 3, 4, 5, 7**