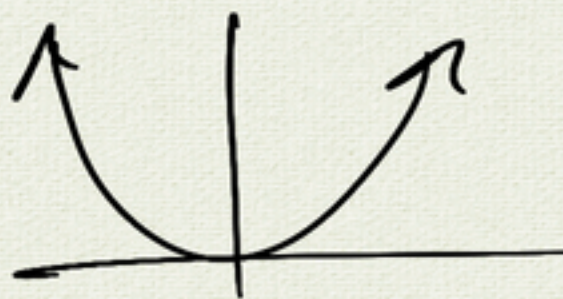


## 5.1 Parabolas

$$y = x^2$$

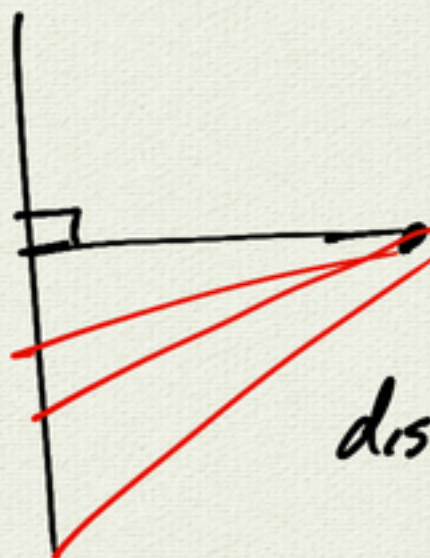
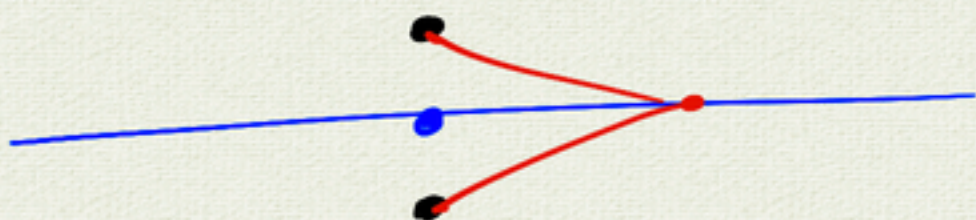


geometry

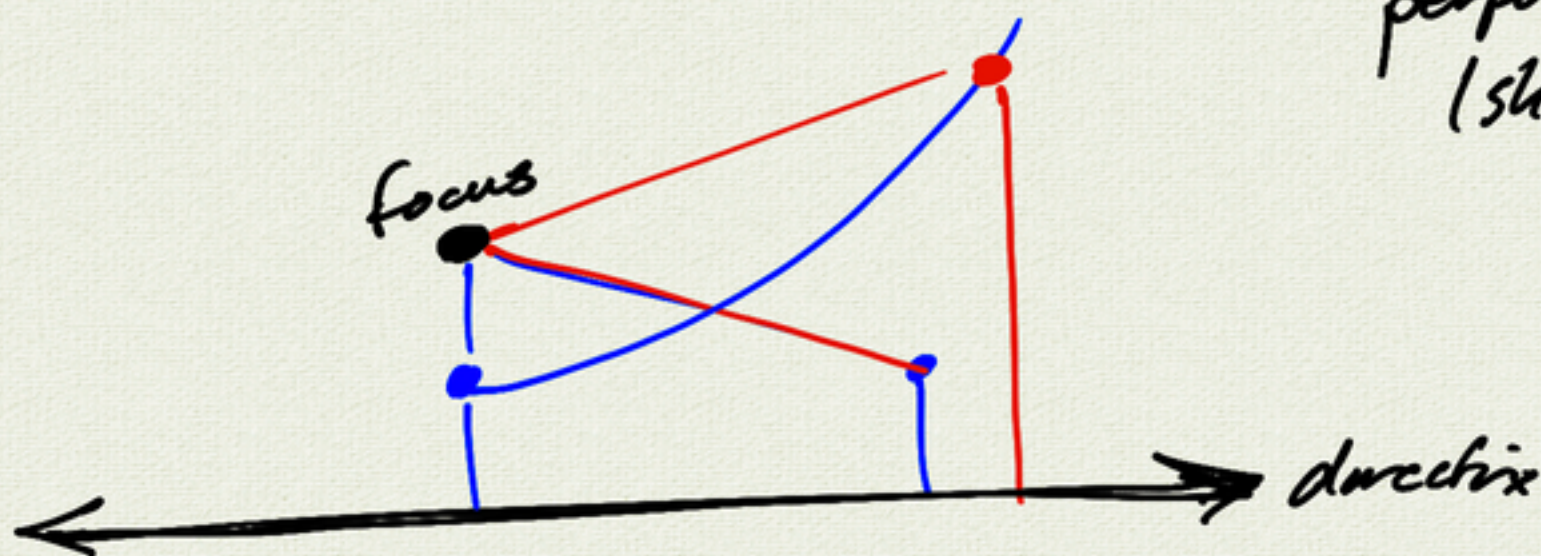


circle:

set of all points  
equidistant from some  
center



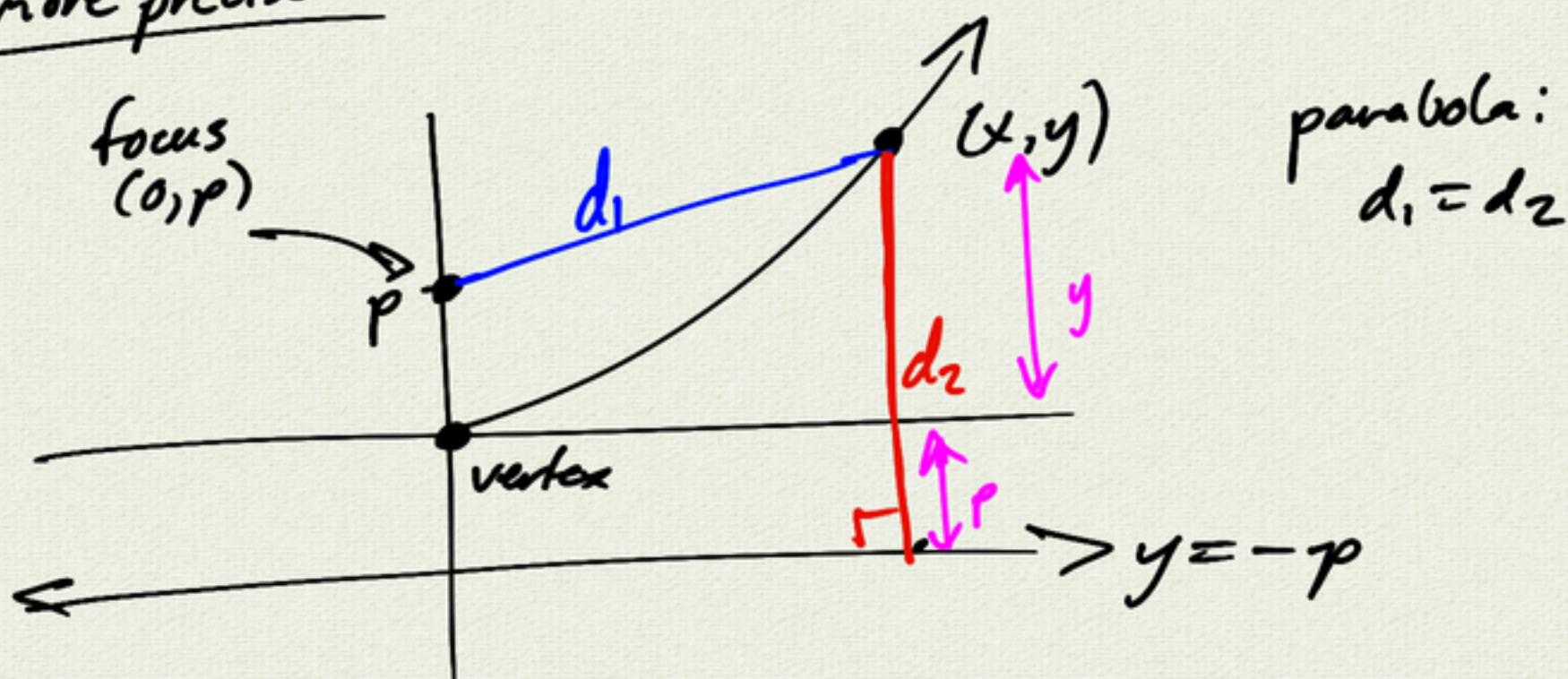
distance to  
line?  
perpendicular  
(shortest)



parabola: set of points equidistant  
from a point and a line  
focus directrix



more precise



parabola  $\Rightarrow d_1 = d_2$

$$\sqrt{x^2 + (y-p)^2} = y+p$$

$$x^2 + (y-p)^2 = (y+p)^2$$

$$x^2 + \underline{y^2} - 2py + \underline{p^2} = \underline{y^2} + 2py + \underline{p^2}$$

$$x^2 = 4py$$

$$y = \boxed{\frac{1}{4p}} x^2$$

parabola

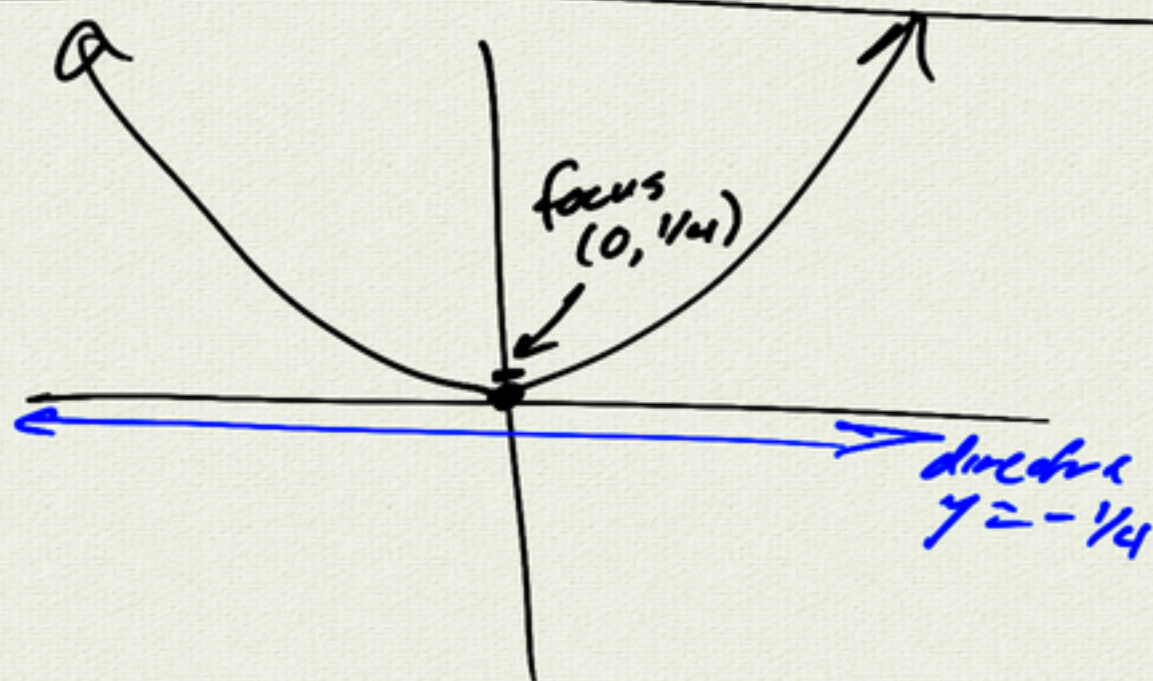
example:

$$y = x^2$$

$$y = \boxed{\frac{1}{4p}} x^2$$

$$\Rightarrow \frac{1}{4p} = 1$$

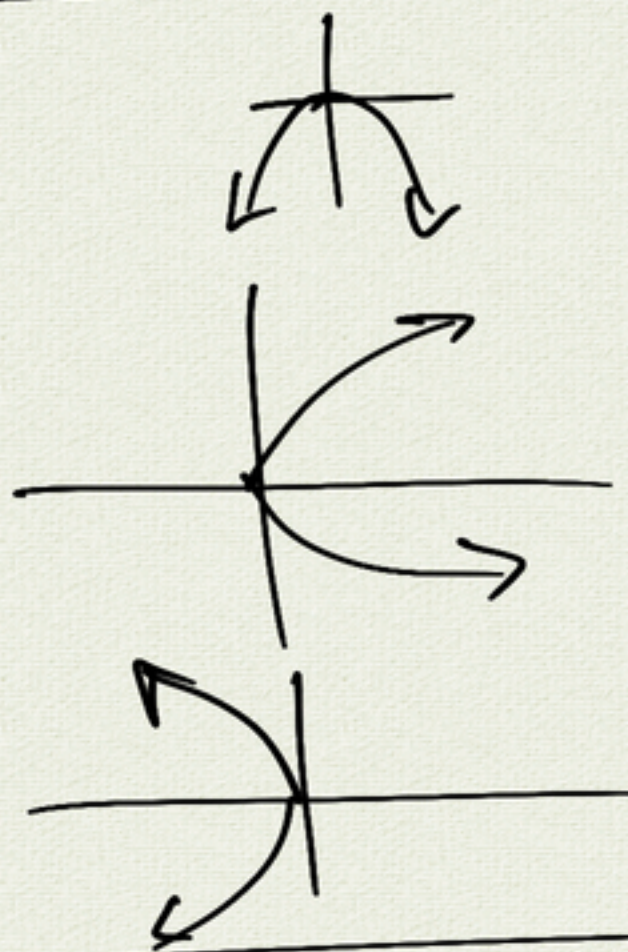
$$p = 1/4$$



$$y = -x^2$$

$$x = y^2$$

$$x = -y^2$$



vertex  $(h, k)$

$$y - k = \frac{1}{4p} (x - h)^2$$

$$y = k + \frac{1}{4p} (x - h)^2$$

vertical shift

book:

$$x^2 = 4py$$

$$(x - h)^2 = 4p(y - k)$$

?

$$y = \frac{1}{4p} x^2$$

$$y - k = \frac{1}{4p} (x - h)^2$$



(35)

$$(y-2)^2 = -\frac{4}{3}(x+2)$$

$$= -\frac{4}{3}x - \frac{8}{3}$$

$$(y-2)^2 + \frac{8}{3} = -\frac{4}{3}x$$

$$x = \left(-\frac{3}{4}\right)(y-2)^2 + \left(-\frac{3}{4}\right)\left(\frac{8}{3}\right)$$

$$x = -\frac{3}{4}(y-2)^2 - 2$$

$$x+2 = -\frac{3}{4}(y-2)^2$$

vertex  $(-2, 2)$

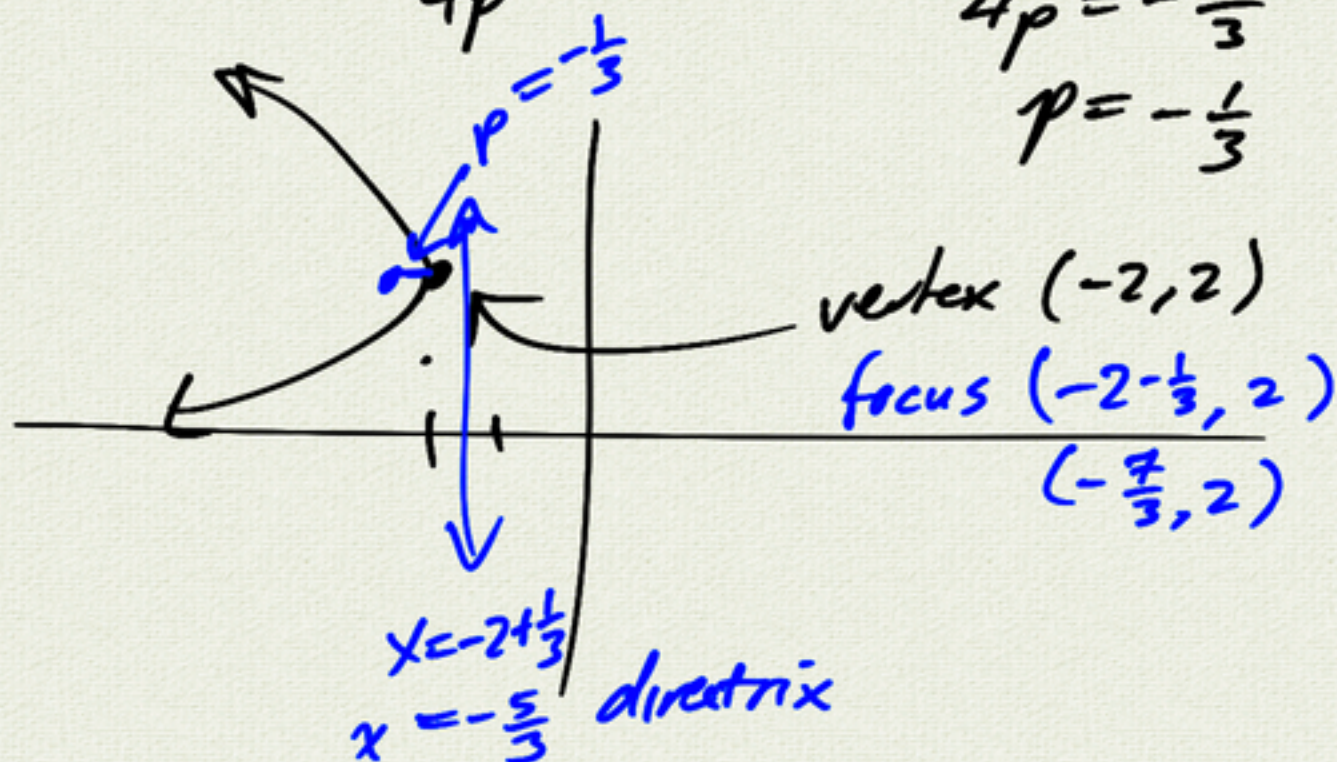


$$\frac{1}{4p}$$

$$\frac{1}{4p} = -\frac{3}{4}$$

$$4p = -\frac{4}{3}$$

$$p = -\frac{1}{3}$$



vertex  $(-2, 2)$

focus  $(-2 - \frac{1}{3}, 2)$

$(-\frac{7}{3}, 2)$

$x = -2 + \frac{1}{3}$   
 $x = -\frac{5}{3}$  directrix