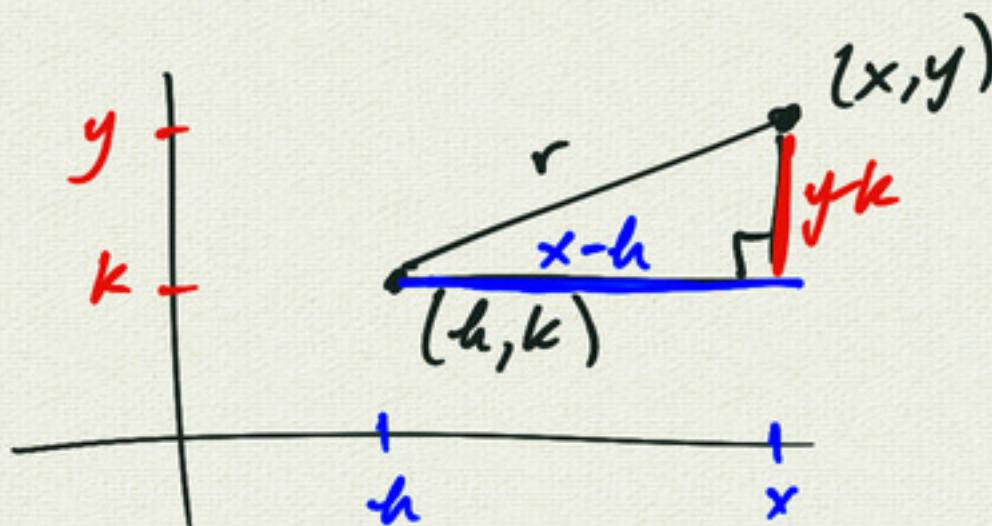


5.1 Parabolas

circle :

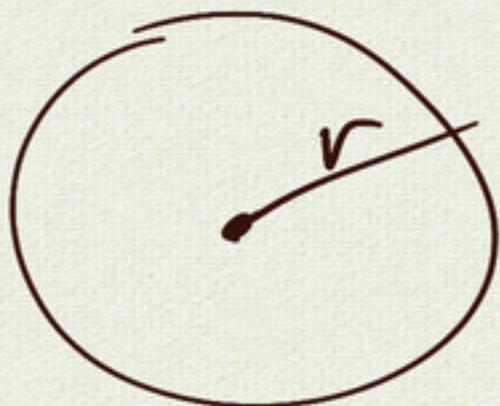
$$(x-h)^2 + (y-k)^2 = r^2$$

algebraic definition



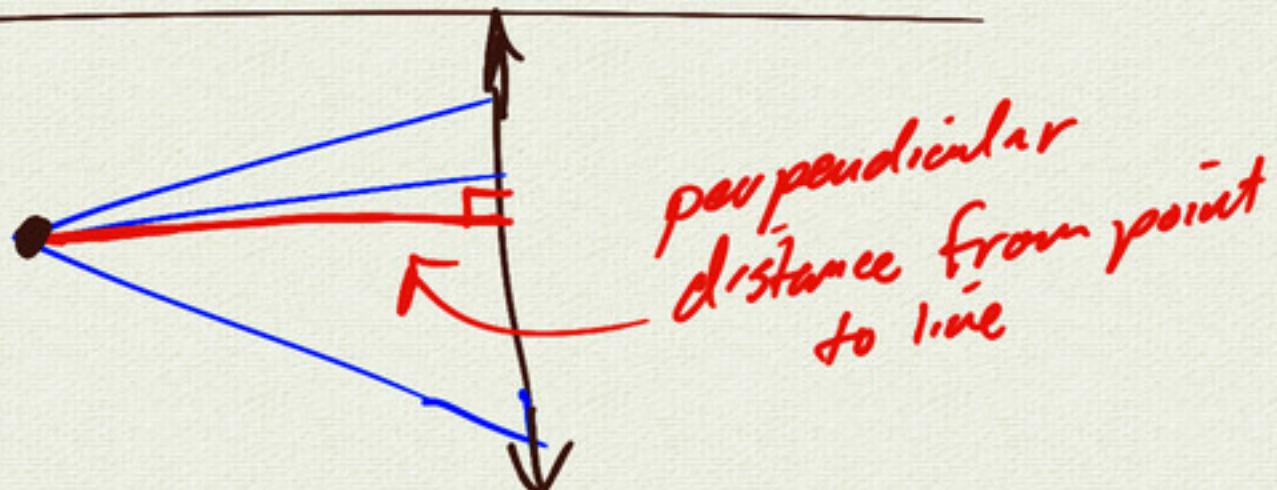
$$r = \sqrt{(x-h)^2 + (y-k)^2}$$

$$r^2 = (x-h)^2 + (y-k)^2$$



geometric definition :

a circle is the set of points equidistant from a center point



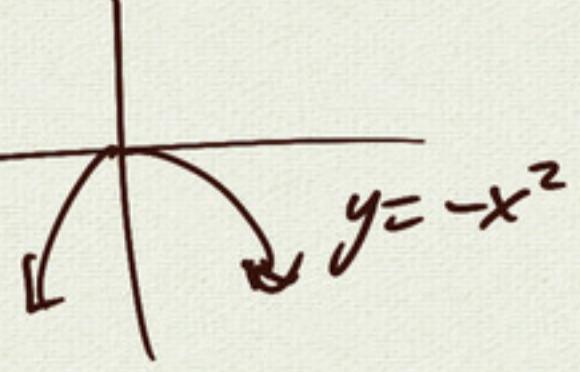
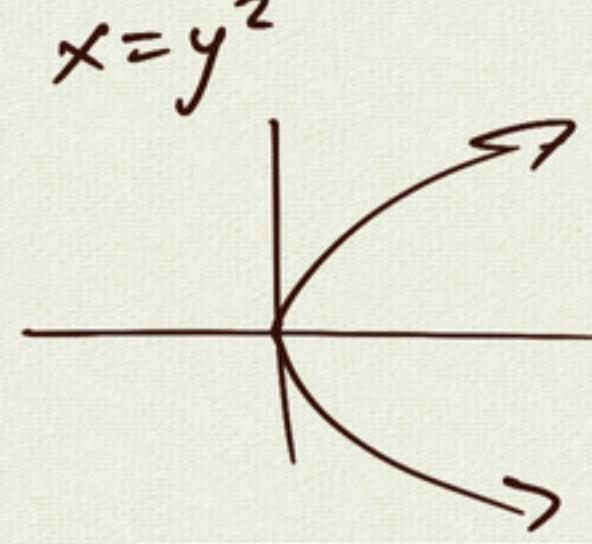
parabola:

$$y = x^2$$

$$y - k = a(x - h)^2$$

↑ ↑
scale (flip)

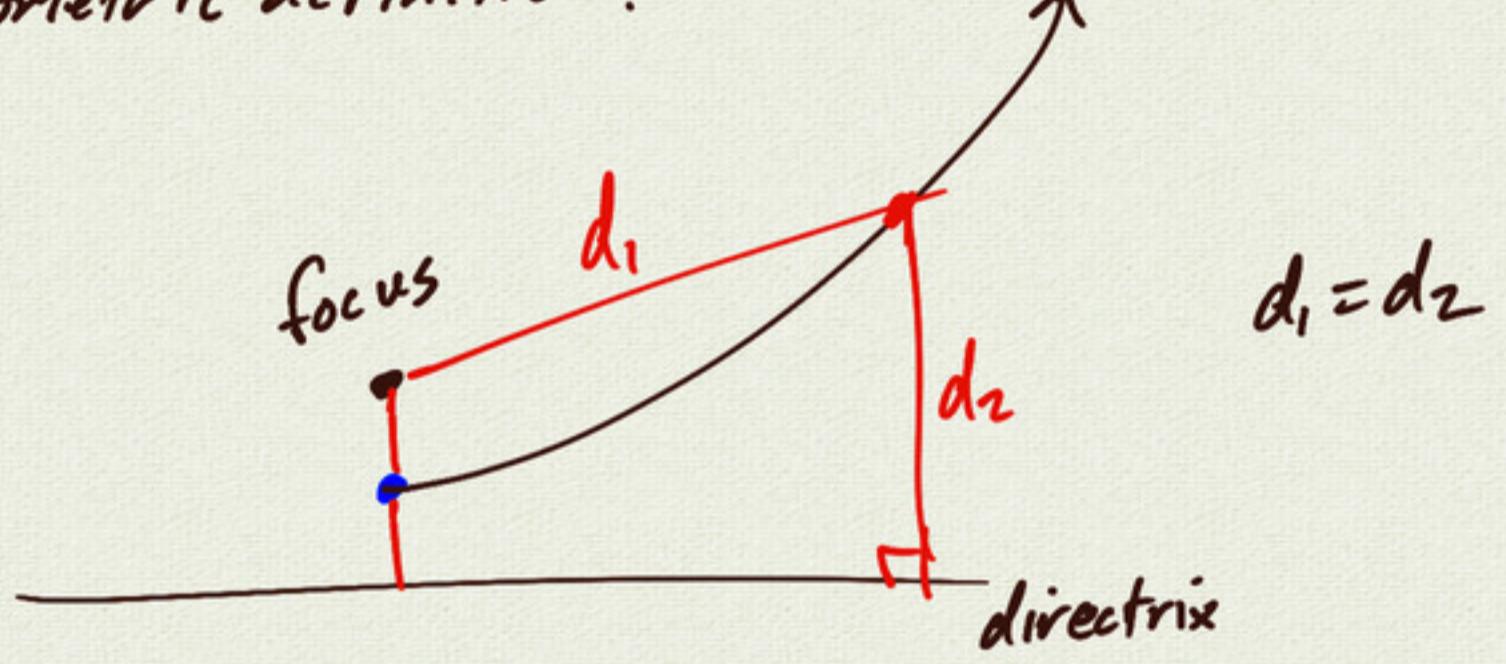
shift
(or center)



$$x = y^2$$

$$x = -y^2$$

geometric definition:



A diagram illustrating the geometric definition of a parabola. A vertical line represents the axis of symmetry, and a horizontal line represents the directrix. The vertex is marked as $(0,0)$. The focus is marked as $(0, p)$, where $p > 0$. A point (x, y) is shown on the parabola. Two red line segments are drawn: one from the vertex to the point (x, y) labeled d_1 , and another from the focus to the point (x, y) labeled d_2 . A right-angle symbol is shown at the vertex, indicating the perpendicular distance from the vertex to the directrix. The distance d_1 is also indicated by a red double-headed arrow between the vertex and the point (x, y) .

$$d_1 = d_2$$

$$\sqrt{(x-0)^2 + (y-p)^2} = y+p$$

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

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

$$\underline{x^2 = 4py}$$

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

example:

$$\text{focus } \left(4\frac{1}{16}, 3\right)$$

$$\text{directrix } x = 4 - \frac{1}{16}$$

fund equation

" $x = y^z$ "

vertex $(4, 3)$

$$x-4 = \left[\frac{1}{4p} (y-3) \right]^2$$

$$p = \frac{1}{k} \quad (\text{distance from vertex to focus})$$

$$\Rightarrow x-4 = 4(y-3)^2$$

