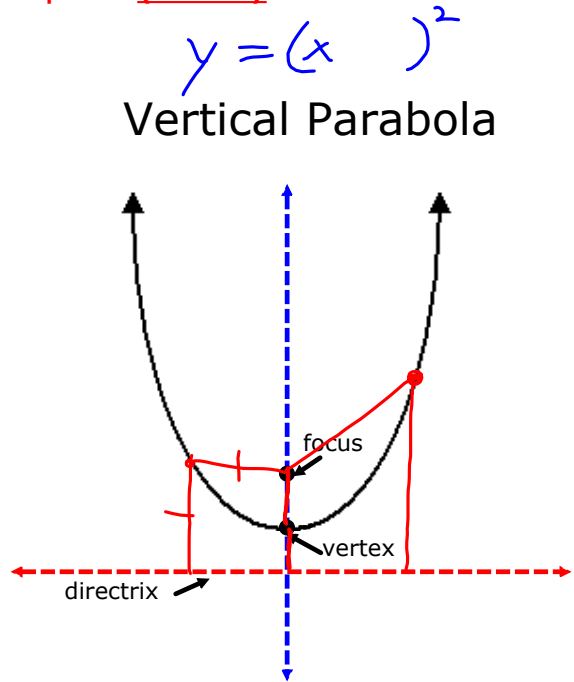
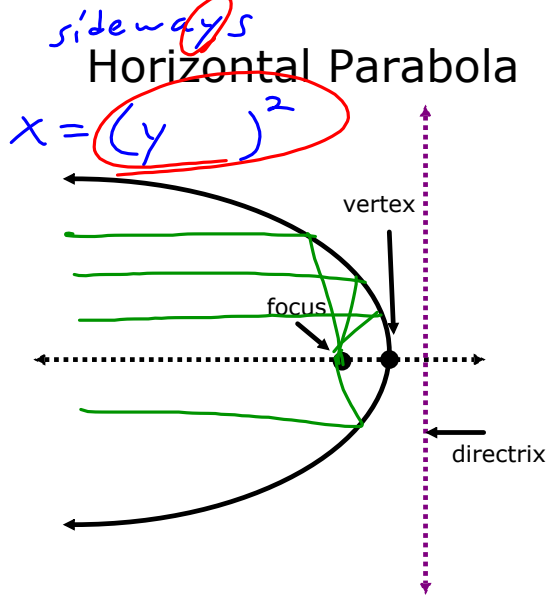


# 4.2 Parabolas - Day 1

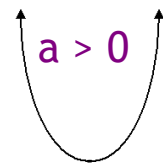
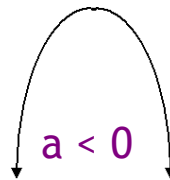
**Parabola** - the set of points in a plane that are the same distance (equidistant) from both a given point (**focus**) and a given line (**directrix**).



## Vertex Form of a Vertical Parabola

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

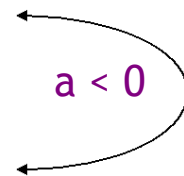
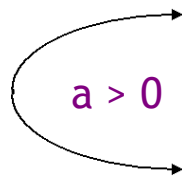
vertex  $(h, k)$



## Vertex Form of a Horizontal Parabola

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

vertex  $(h, k)$



Write each equation in vertex form. Name the vertex, identify the parabola as vertical or horizontal, and state the direction it opens.

1)  $y = x^2 + 6x - 3$  *up/down*

$$y = x^2 + 6x + \frac{9}{-3} - \frac{9}{-3}$$

$$y = (x + 3)^2 - 12$$

$V(-3, -12)$   
vertical  
positive  $\rightarrow$  up

2)  $x = y^2 - 6y + 11$  *sideways horiz.*

$$x = y^2 - 6y + \frac{9}{+1} + 11 - \frac{9}{+1}$$

$$x = (y - 3)^2 + 2$$

$V(2, 3)$   
positive open right

3)  $x = 4y^2 + 24y$

$$x = 4(y^2 + 6y + \frac{9}{+4}) - \frac{36}{+4}$$

$$x = 4(y + 3)^2 - 36$$

$V(-36, -3)$   
 $y^2 \rightarrow$  sideways horizontal  
4 positive  $\rightarrow$  right

4)  $y = -x^2 - 4x + 8$

$$y = -1(x^2 + 4x + \frac{4}{-1}) + 8 + 4$$

$$y = -(x + 2)^2 + 12$$

$V(-2, 12)$  *up/down vertical*  
negative  $\rightarrow$  down

5)  $y^2 - 8y + 4x - 6 = 0$   
 $-y^2 + 8y + 4x - 6 = 0$

$-1(4x) = (-y^2 + 8y + 6) - 1$

$-4x = y^2 - 8y + 16 - 6 - 16$

$-4x = (y - 4)^2 - 22$

$x = -\frac{1}{4}(y - 4)^2 + \frac{11}{2}$   
*sideways left or right*  
*negative → left*

$V(\frac{11}{2}, 4)$

6)  $x^2 - 12y - 2x + 25 = 0$   
 $-x^2 + 2x - 25 = 0$

$-12y = -x^2 + 2x - 25$

$12y = x^2 - 2x + 1 + 25 - 1$

$12y = (x - 1)^2 + 24$

$y = \frac{1}{12}(x - 1)^2 + 2$

$V(1, 2)$   
*vertical up or down*  
 *$\frac{1}{12}$  is positive*

7)  $4(x - 2) = (y + 3)^2$

$4x - 8 = (y + 3)^2$

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

$x = \frac{1}{4}(y + 3)^2 + 2$

$V(2, -3)$   
*left or right*  
*positive right*

8)  $x^2 = y + 2x$

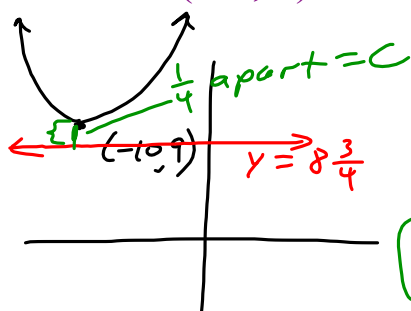
$x^2 - 2x = y$

$y = x^2 - 2x + 1 - 1$

$y = (x - 1)^2 - 1$

$V(1, -1)$   
*vertical up or down*  
 *$1 \rightarrow$  positive*

Ex. 9 Write the vertex form equation of the parabola with a vertex at  $(-10, 9)$  and a directrix at  $y = \frac{35}{4} = 8\frac{3}{4}$



$$y = 1(x + 10)^2 + 9$$

$$a = \frac{1}{4c} = \frac{1}{4(\frac{1}{4})} = 1$$