Warmup

Evaluate each expression if x = -3 and y = 4.

1. $2x - 5y$ $\quad -26$

2. $-x^2y$ $\quad -36$

3. $|x - y|$ $\quad 7$

4. $(x - 2)(y + 1)$ $\quad -25$

5. $\dfrac{3x + 1}{y}$ $\quad -2$

6. $|xy|$ $\quad 12$

7. $x + 3y$ $\quad 9$

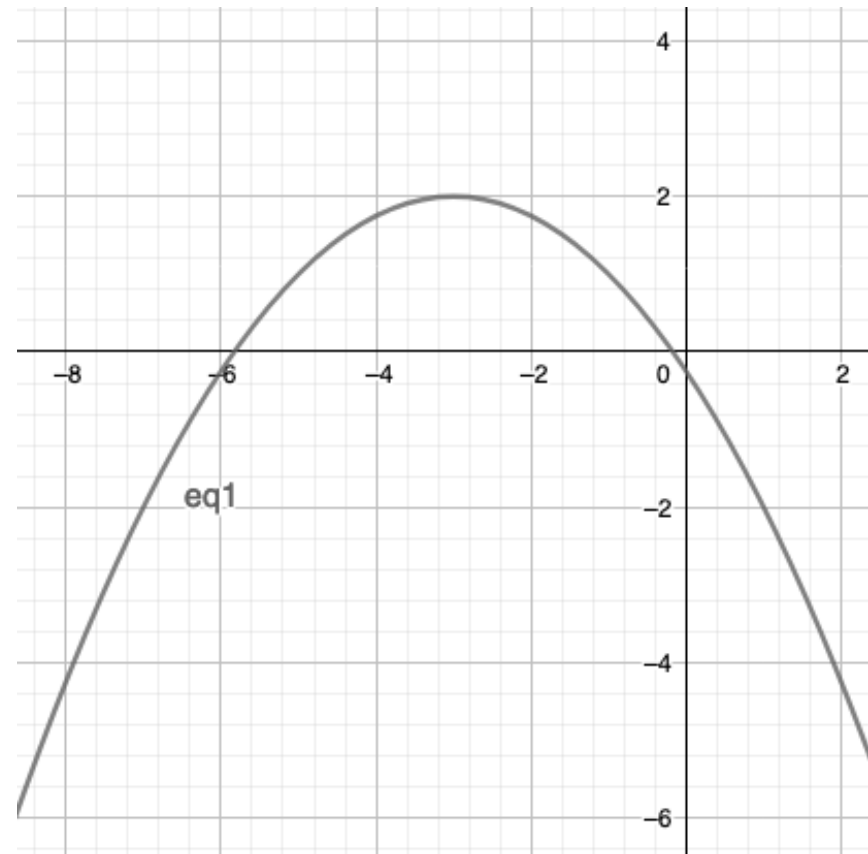8. $\dfrac{x - y}{x + y}$ $\quad -7$

Chapter 2
Quadratic Functions

2.1 - Transformations of Quadratic Functions

Determine transformations

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

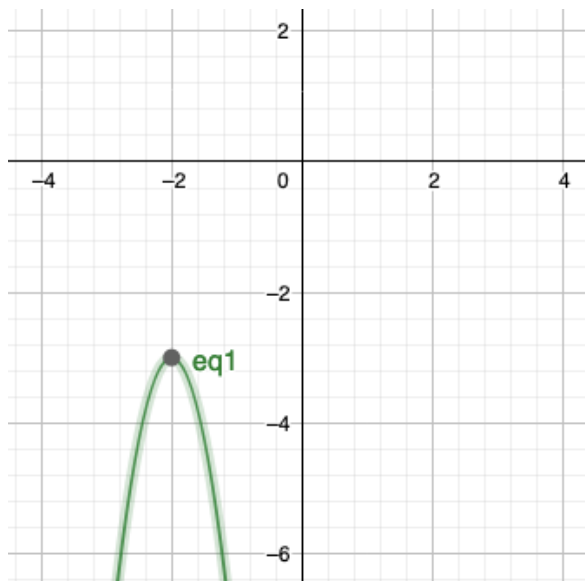1) Left 3
2) Vertical Shrink 1/4
3) Reflect x-axis
4) Up 2

eq1

2.1 - Transformations of Quadratic Functions
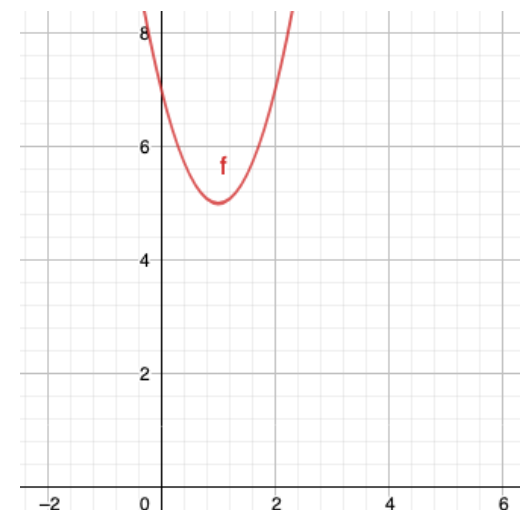
Determine transformations

$$y + 3 = -5(x + 2)^2$$

1) Left 2
2) Vertical stretch by 5
3) Reflect x-axis
4) Down 3

$$y = 2x^2 - 4x + 7$$

$$y - 7 = 2(x^2 - 2x)$$

$$y - 7 + 2 = 2(x^2 - 2x + 1)$$

$$y - 5 = 2(x - 1)^2$$

1) Right 1
2) Vertical stretch by 2
3) Up 5

2.1 - Transformations of Quadratic Functions

Determine transformations (harder!)

$$y - 2 = -5(-x + 3)^2$$

$$y - 2 = -5(-(x - 3))^2$$

$$y - 2 = -5(x - 3)^2$$

$$y + 3 = -5(-2x + 2)^2$$

$$y + 3 = -5(-2(x - 1))^2$$

$$y + 3 = -20(x - 1)^2$$

1) Right 3
2) Vertical Stretch 5
3) Reflect x-axis
4) Up 2

1) Right 1
2) Vertical Stretch 20
3) Reflect x-axis
4) Down 3

2.1 - Transformations of Quadratic Functions

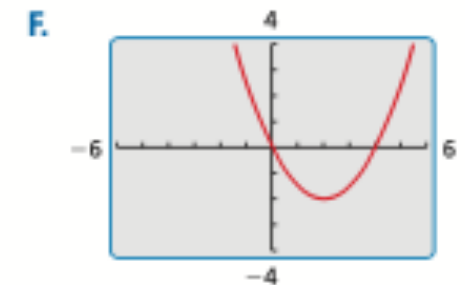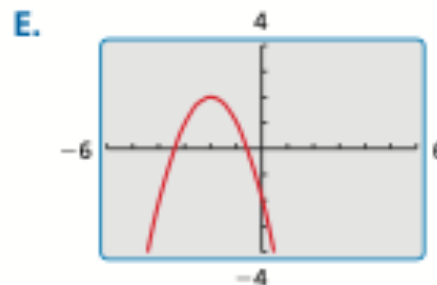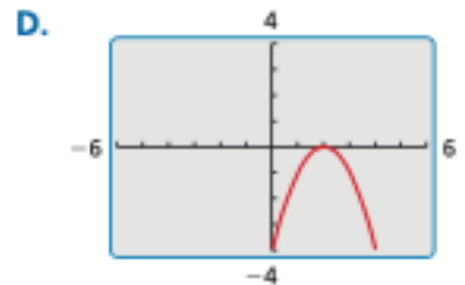Practice - Identify graphs with functions

a. $g(x) = -(x-2)^2$ D

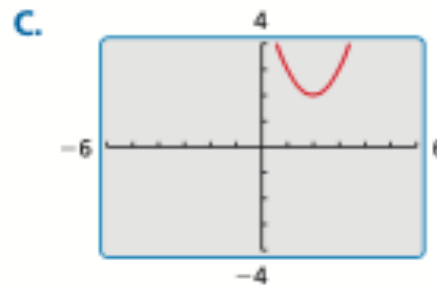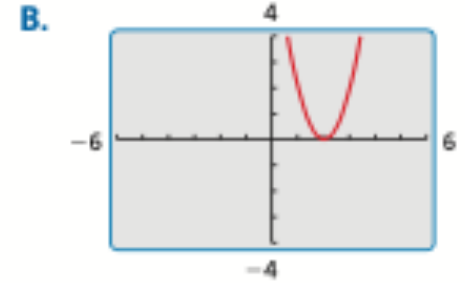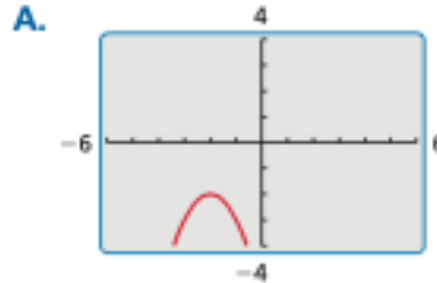b. $g(x) = (x-2)^2 + 2$ C

c. $g(x) = -(x+2)^2 - 2$ A

d. $g(x) = 0.5(x-2)^2 - 2$ F
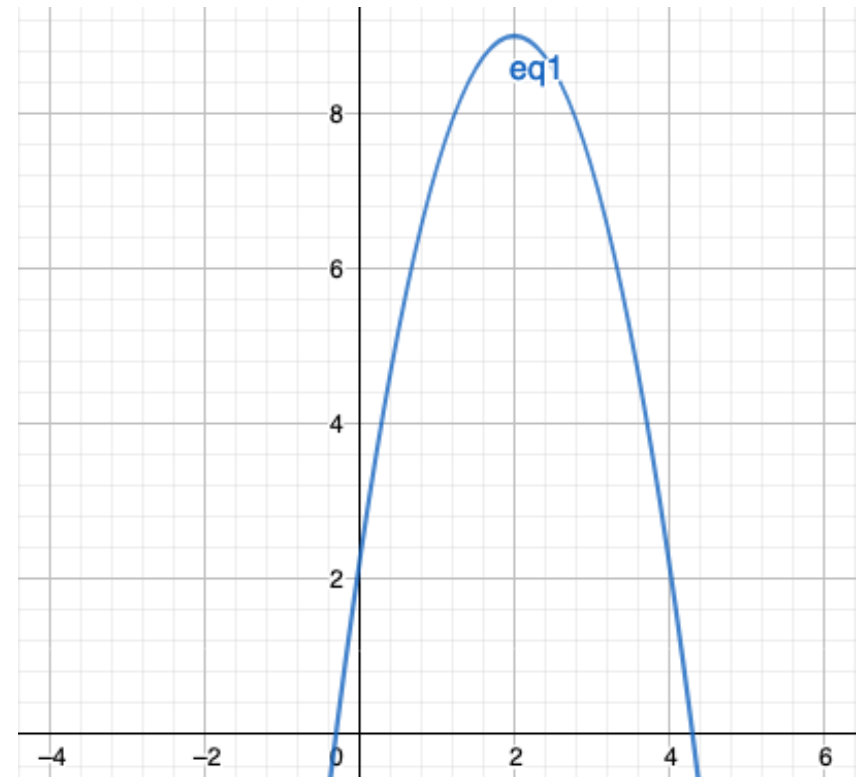
e. $g(x) = 2(x-2)^2$ B

f. $g(x) = -(x+2)^2 + 2$ E

2.1 - Transformations of Quadratic Functions

Determine the quadratic equation

1) Right 2
2) Vertical stretch by 1.7
3) Reflect x-axis
4) Up 9

$$y - 9 = -1.7(x - 2)^2$$

2.1 - Transformations of Quadratic Functions

Practice - Determine equation

1) Right 3
2) Vertical stretch by 3
3) Down 5

$$y + 5 = 3(x - 3)^2$$

1) Right 1
2) Horizontal stretch by 2
3) Reflect x-axis
4) Up 2

$$y - 2 = -\left(\frac{1}{2}(x - 1)\right)^2$$

2.2 - Characteristics of Quadratic Functions

Axis of Symmetry - A line that divides a parabola into mirror images and passes through the vertex. The axis of symmetry is the vertical line $x = h$.
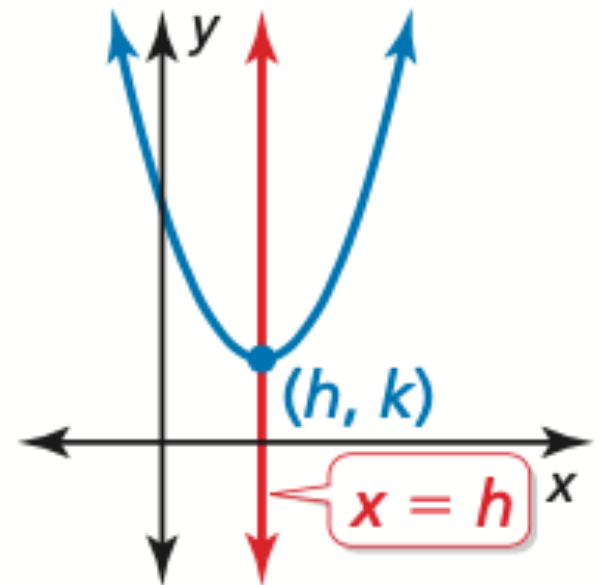
Vertex form $\quad f(x) = a(x - h)^2 + k$

AOS: $\quad x = h$

or

Standard form $\quad f(x) = ax^2 + bx + c$

AOS:

$$x = -\frac{b}{2a}$$

2.2 - Characteristics of Quadratic Functions

Find Vertex and Axis of Symmetry (AOS)

$$y = 2x^2 - 3x + 1 \qquad\qquad y - 9 = -1.7(x-2)^2$$

$$V : \left(\frac{3}{4}, -\frac{1}{8} \right) \qquad\qquad V : (2,9)$$

$$AOS : x = \frac{3}{4} \qquad\qquad AOS : x = 2$$

2.2 - Characteristics of Quadratic Functions

Practice - Find Vertex and Axis of Symmetry (AOS)

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

$y = -2x^2 - 4x + 7$

$V : (1,2)$

$V : (-1,9)$

$AOS : x = 1$
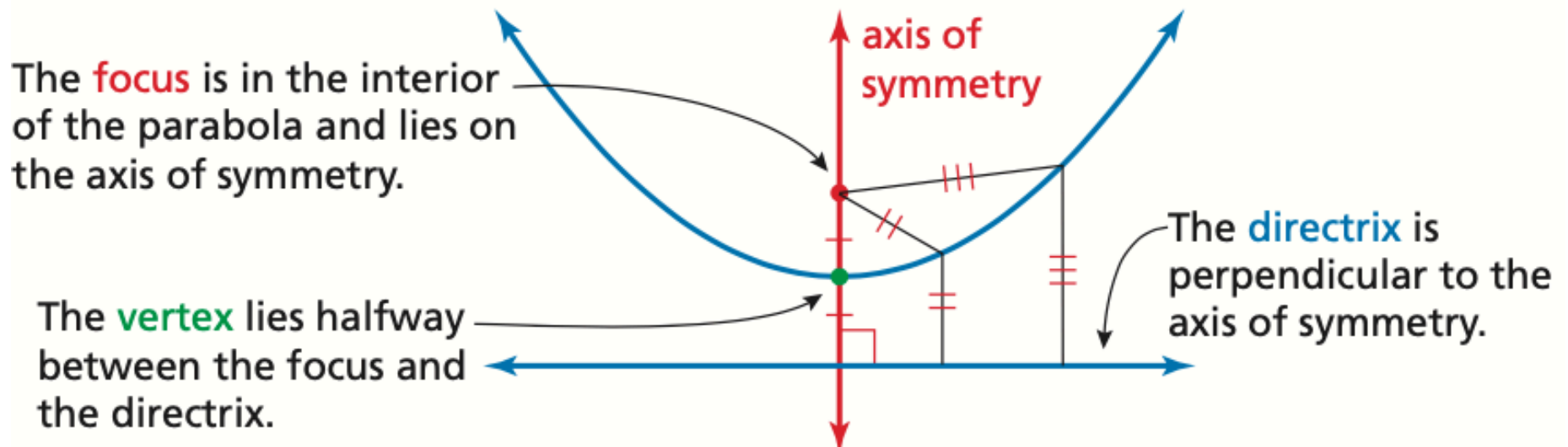
$AOS : x = -1$

2.3 - Focus of a Parabola

A parabola can be defined as the set of all points in a plane equidistant from a fixed point called the **focus** and a fixed line called the **directrix**.

The **focus** is in the interior of the parabola and lies on the axis of symmetry.

The **vertex** lies halfway between the focus and the directrix.

axis of symmetry

The **directrix** is perpendicular to the axis of symmetry.

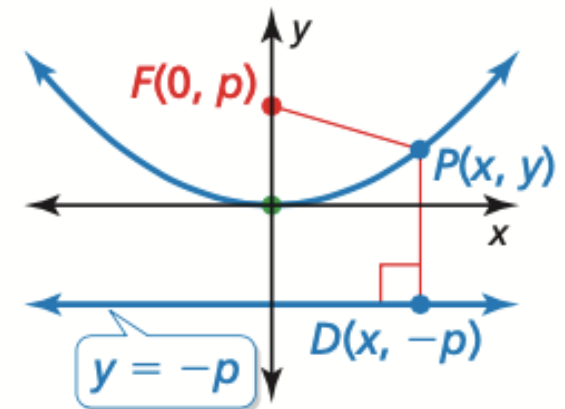# 2.3 - Focus of a Parabola

Deriving the equation for the parabola.

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

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

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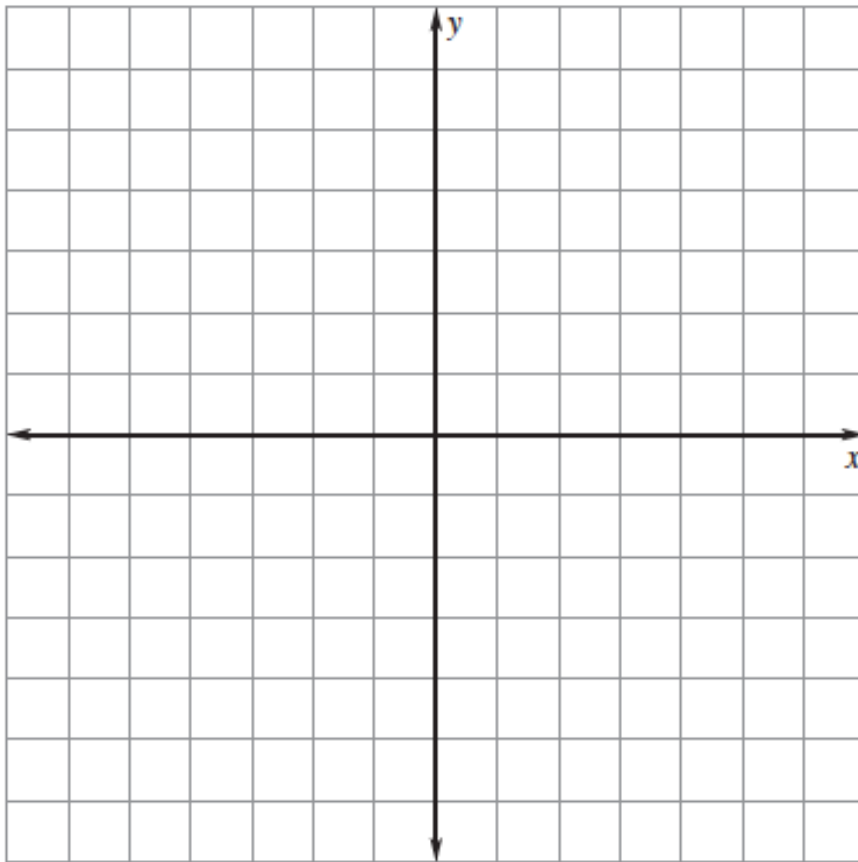
$$4py = x^2$$
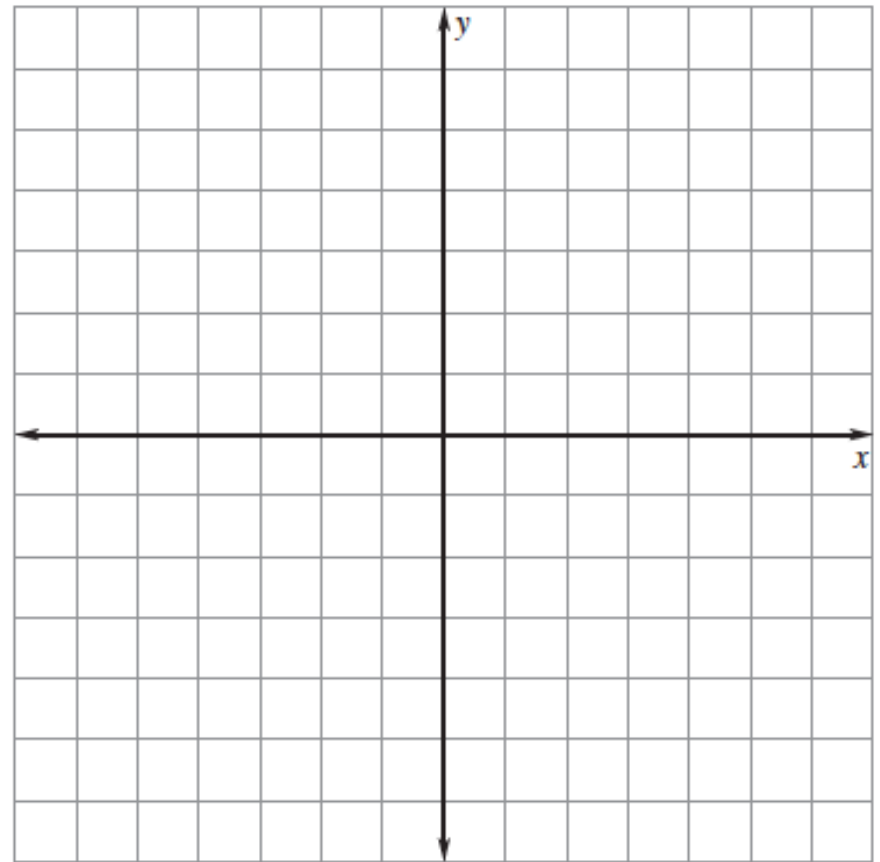
$$y = \frac{1}{4p}x^2$$

2.3 - Focus of a Parabola

$V : (2,0) \quad F : (2,4)$

What is the directrix?   D: y = -4

$V : (2,0) \quad D : x = -1$

What is the focus?   F: (5, 0)
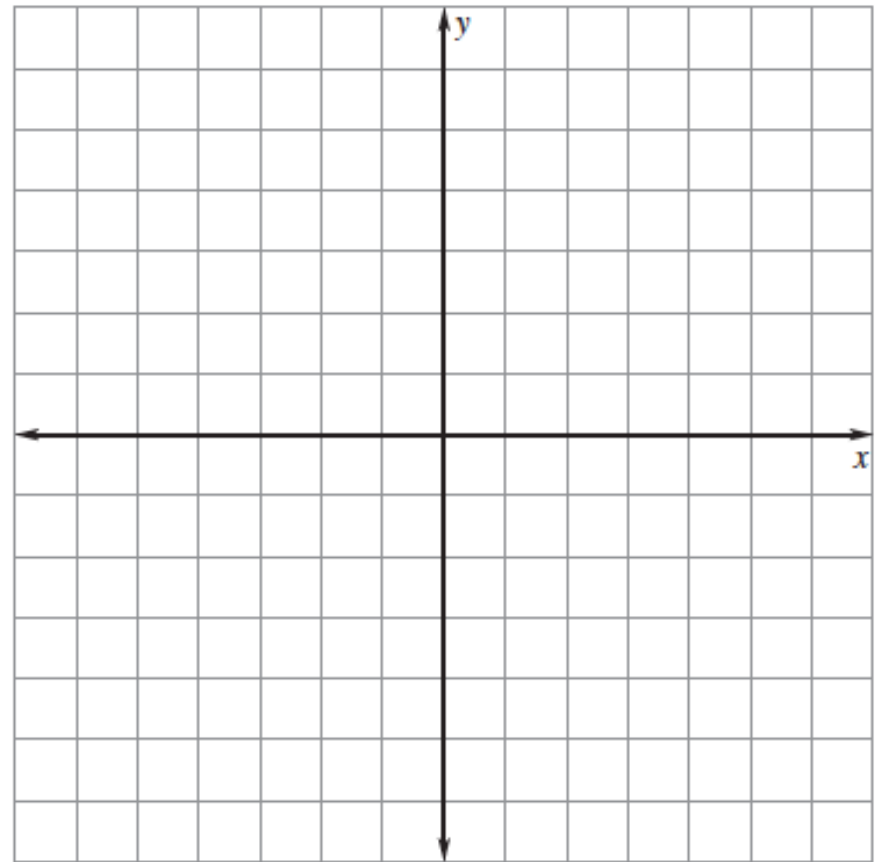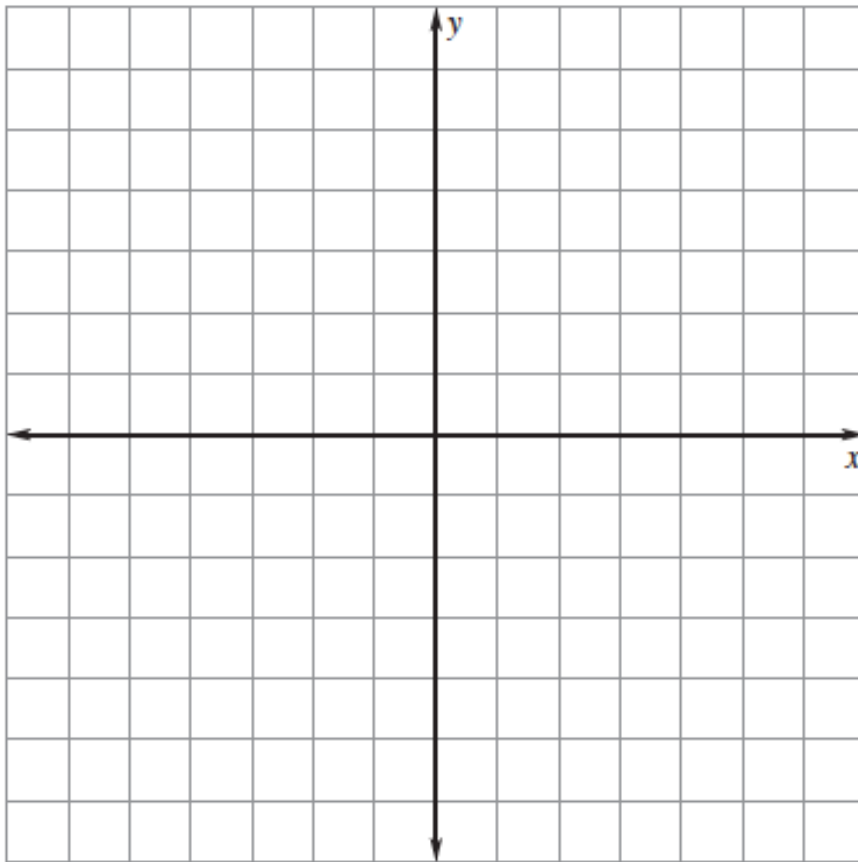
2.3 - Focus of a Parabola

$V : (0,0)$ $F : (-3,0)$

Directrix?   D: x = 3
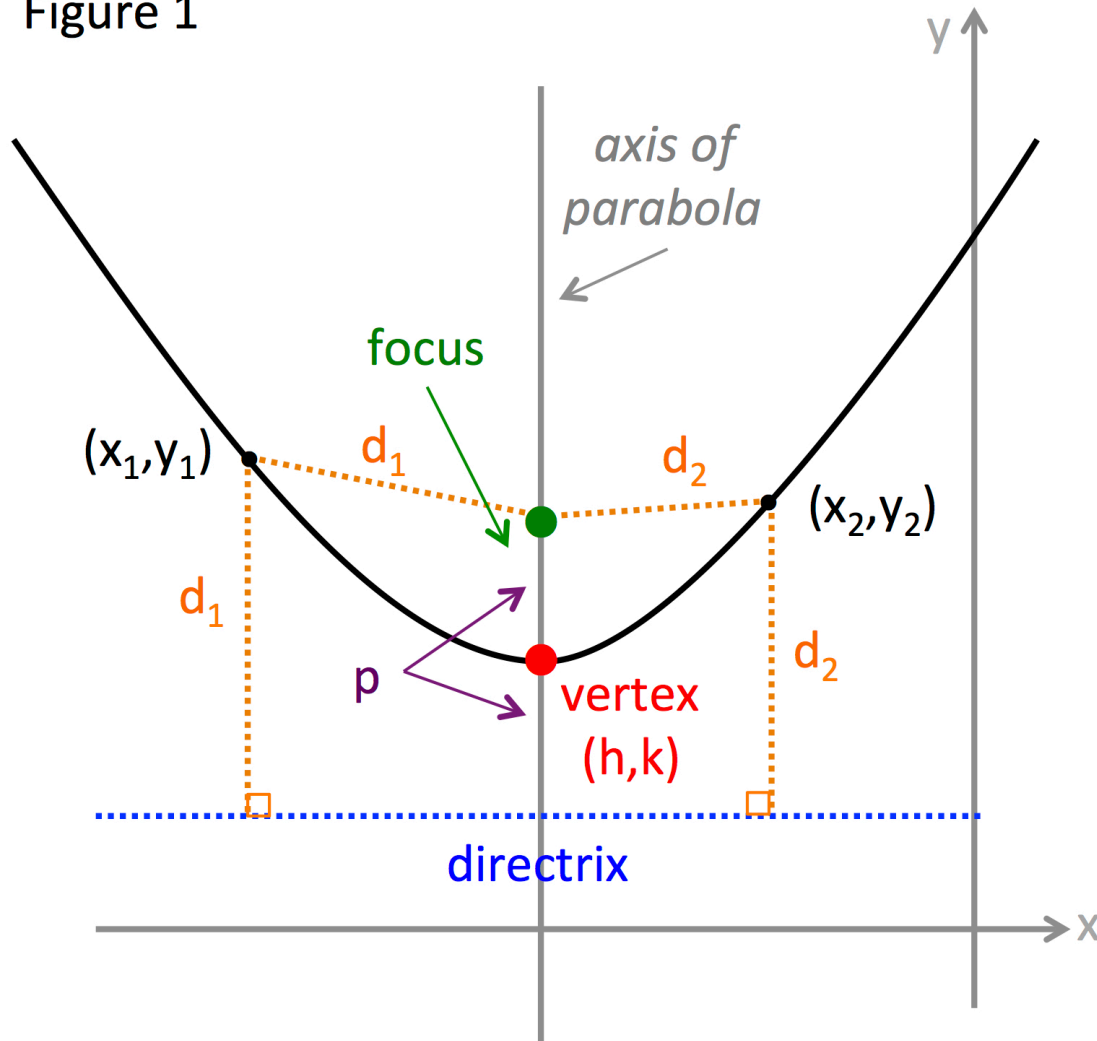
$V : (0,0)$ $D : x = -2$

What is focus?   F: (2, 0)

2.3 - Focus of a Parabola

General equation of a parabola

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

Figure 1

2.3 - Focus of a Parabola

Find equation of the parabola

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

$F : (0,2) \quad D : y = 6$

$$y - 4 = -\frac{1}{4(2)}(x - 0)^2$$

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