

Date: Key

8.03 Parabolas - Day 3

Write the standard form of the equation of each parabola. Sketch the graph and fill in the blanks.

1. The vertex is at $(-5, 1)$, and the focus is at $(-1, 1)$.

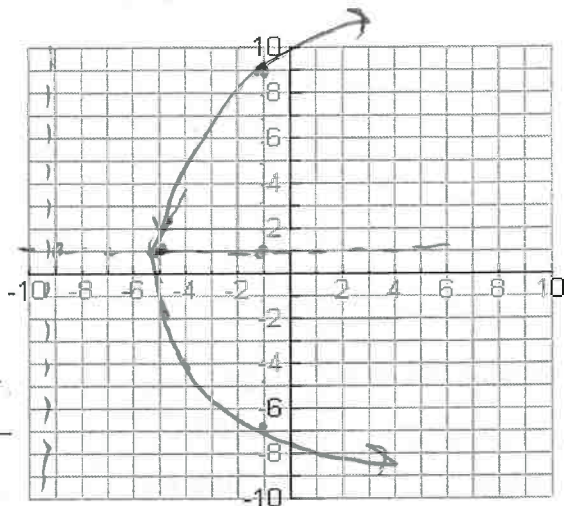
$$(y-k)^2 = 4p(x-h)$$

$$(y-1)^2 = 4(4)(x+5)$$

Equation: $(y-1)^2 = 16(x+5)$

Axis of Symmetry: $y=1$ Directrix: $x=9$

$p=4$ Focal Width: 16



2. The equation of the axis of symmetry is $y=2$, the focus is at $(0, 2)$, and $p=-3$.

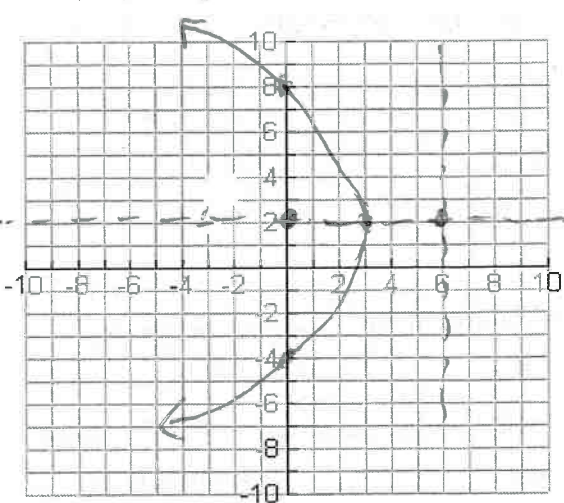
$$(y-k)^2 = 4p(x-h)$$

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

Equation: $(y-2)^2 = -12(x-3)$

Vertex: $(3, 2)$

Directrix: $x=6$ Focal Width: 12



8.03 Practice

1. The parabola passes through the point at $(-3, 1)$, opens to the left and its vertex is at $(-2, -3)$.

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

$$(1+3)^2 = 4p(-3+2)$$

$$4^2 = 4p(-1)$$

$$16 = -4p$$

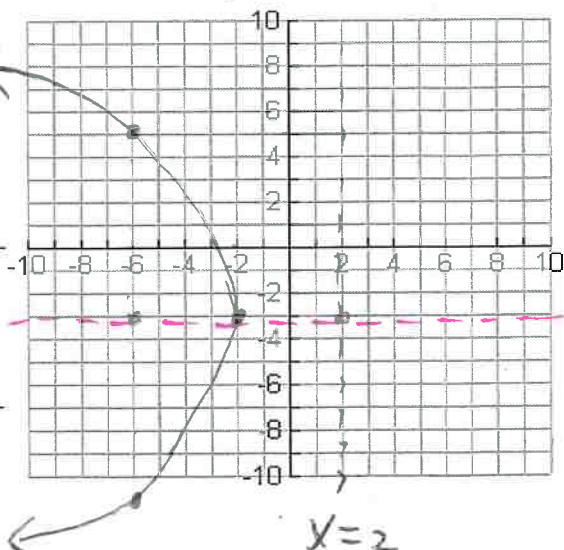
$$\frac{16}{-4} = p$$

$$-4 = p$$

$$\text{Equation: } (y+3)^2 = -16(x+2)$$

Axis of Symmetry: $y=-3$ Directrix: $x=2$

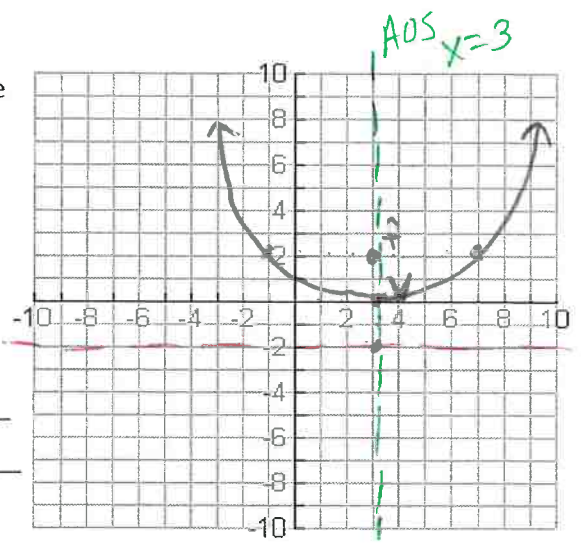
Focus: $(-6, -2)$ $p=-4$ Focal Width: 16



2. The focus is at (3, 2), the distance from the focus to the vertex is 2 units, and the function has a minimum.

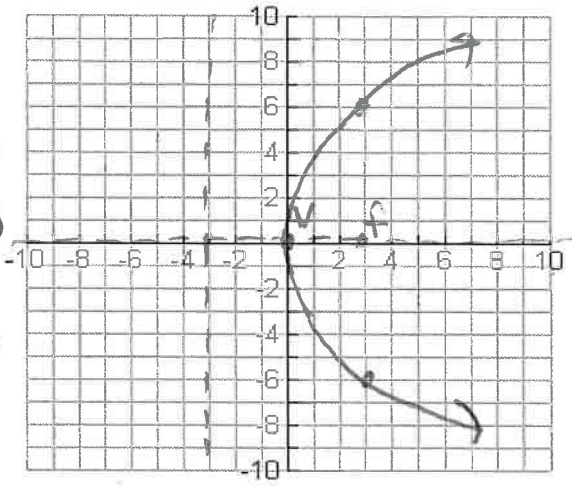
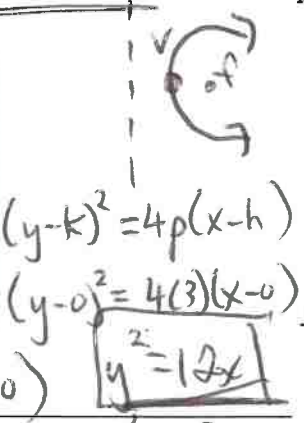
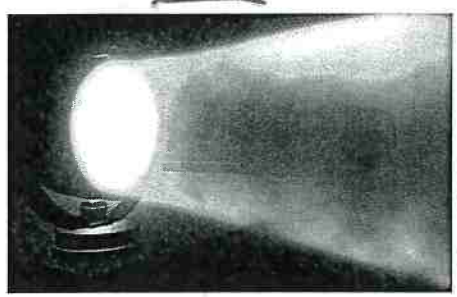
$$(x-h)^2 = 4p(y-k)$$

$$(x-3)^2 = 4(2)(y-0)$$



Equation: $(x-3)^2 = 8(y-0)$
 Axis of Symmetry: Directrix: $y = -2$
 Vertex: $(3, 0)$ $p =$ 2 Focal Width: 8

3. In a searchlight, the bulb is placed at the focus of a parabolic mirror, causing the light rays from the bulb to bounce off the mirror as parallel rays. This provides a concentrated beam of light. Write the equation of the parabola if the focus is 3 feet from the vertex. Assume the vertex is at the origin and the parabola opens to the right.



Equation: $(y-0)^2 = 12(x-0)$ $y^2 = 12x$
 Axis of Symmetry: $y = 0$ Directrix: $x = -3$
 Vertex: $(0, 0)$ Focus: $(3, 0)$
 $p =$ 3 Focal Width: 12

4. The arch in Freedom Park has a parabolic shape. Its height is 25 feet and its base is 30 feet wide. Find an equation, which models this shape, using the x -axis to represent the ground.
 Hint: Use 1 square = 2 feet and put the origin at the lower left corner of the graph.

vertex $(15, 25)$ point $(0, 0)$ $p = -\frac{9}{4} = -2.25$
 h k x y
 $(x-h)^2 = 4p(y-k)$ $225 = 4p(-25)$
 $(0-15)^2 = 4p(0-25)$ $225 = -100p$
 Equation: $(x-15)^2 = -9(y-25)$
 Axis of Symmetry: $x = 15$ Directrix: $y = 27.25$
 Vertex: $(15, 25)$ Focus: $(15, 22.75)$
 $p =$ $-\frac{9}{4}$ Focal Width: 9
 $(x-15)^2 = 4(-\frac{9}{4})(y-25)$

