

# Inverses and Parabolas Review

Name: Answer Key

1. Given the function  $f(x) = 2(x + 3)^2 - 2$ , graph and find the following:

A. Vertex:  $(-3, -2)$

B. Axis of Symmetry:  $x = -3$

C.  $p = 1/8$

D. Opens:  $up$

E. Focus:  $(-3, -1.875)$

F. Directrix:  $y = -2.125$

$\frac{1}{4p} = \frac{2}{1}$   
 $8p = 1$   
 $p = 1/8$

2. Given the function  $(x + 3) = \frac{1}{4}(y - 3)^2$ , graph  $x = \frac{1}{4}(y - 3)^2 - 3$  and find the following.

A. Vertex:  $(-3, 3)$

B. Axis of Symmetry:  $y = 3$

C.  $p = 1$

D. Opens:  $right$

E. Focus:  $(-2, 3)$

F. Directrix:  $x = -4$

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

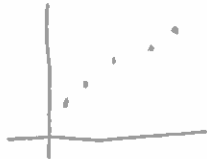
3. Each time Mary rolled a ball down a hallway she recorded its position at five different times.

Time (seconds)	1	2	4	6	8
Position (meters)	9	12	17	21	26

- A. Find the quadratic regression

$y = -.035x^2 + 2.690x + 6.548$

- B. Sketch the data.



- C. Predict the position of the ball after 13 seconds.

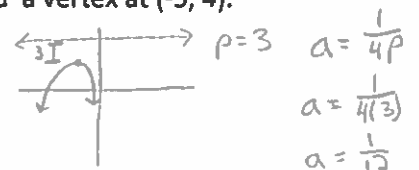
35.615 meters

4. Write the equation for the parabola which goes through Vertex:  $(-1/3, -1/2)$ ; and points  $(-1, 13/6)$ ,  $(2, 193/6)$ .

$y = a(x-h)^2 + k$   
 $y = a(x + 1/3)^2 - 1/2$   
 $13/6 = a(-1 + 1/3)^2 - 1/2$   
 $\frac{8}{3} = \frac{4}{9}a$   
 $6 = a$   
 $y = 6(x + 1/3)^2 - 1/2$

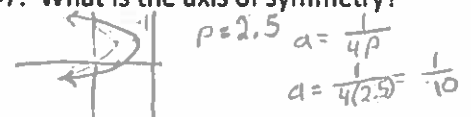
5. Write the equation for the quadratic function that has a directrix at  $y=7$  and a vertex at  $(-3, 4)$ .

$y = -\frac{1}{12}(x + 3)^2 + 4$



6. Write the equation for the parabola that has focus at  $(2, 3)$  and directrix at  $x=7$ . What is the axis of symmetry?

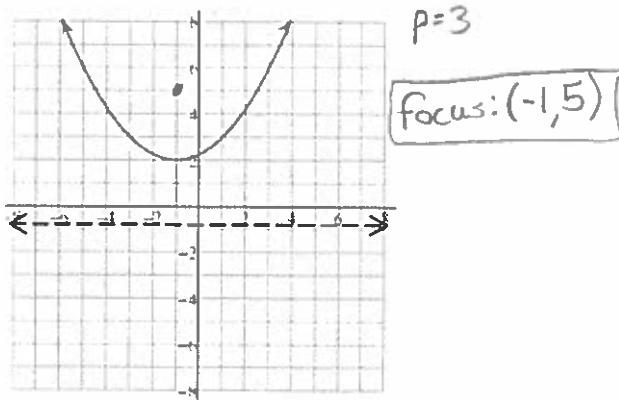
$x = \frac{1}{10}(y - 3)^2 + 4.5$       A.O.S.:  $y = 3$



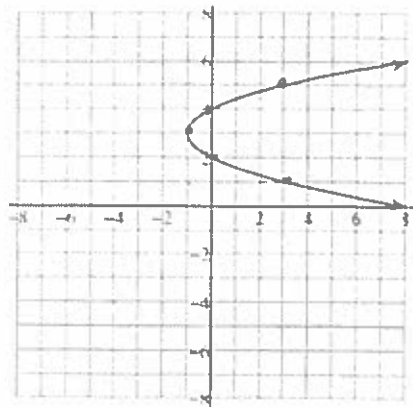
7. A parabola goes through the points  $(3, -3)$ ,  $(5, -3)$ , and the vertex  $(4, -2)$ . What is the axis of symmetry and the "a" value in the equation?

$y = a(x-4)^2 - 2$   
 $-3 = a(5-4)^2 - 2$   
 $-1 = 1a$   
 $y = -1(x-4)^2 - 2$   
 A.O.S.:  $x = 4$        $a = -1$

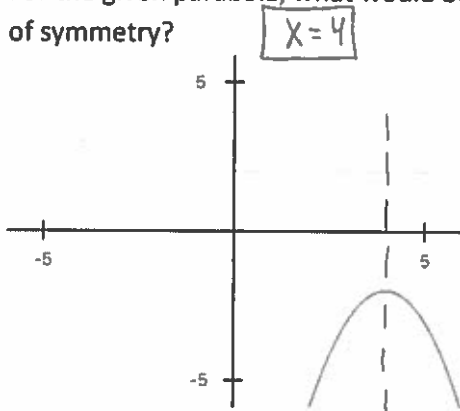
8. Given the following graph, and a directrix of  $y = -1$ , what would be the coordinates of the focus?



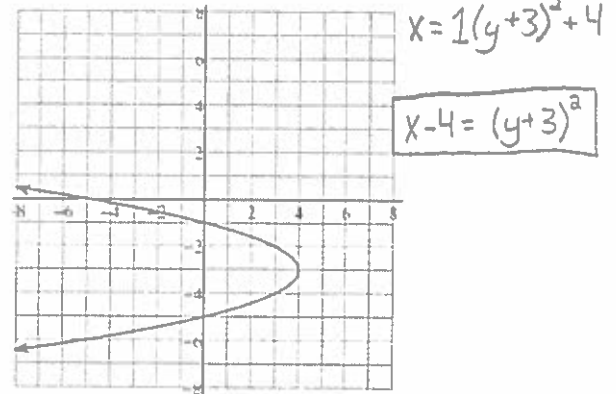
9. Given the following parabola, what is the equation.



10. For the given parabola, what would be the axis of symmetry?



11. Write the standard form equation for the parabola shown, given  $a = 1$ .



- 12) Sunfire is a glass parabola used to collect solar energy. The sun's rays are reflected from the mirrors toward two boilers located at the focus of the parabola. When heated, the boilers produce steam that powers an alternator to produce electricity. Write an equation for Sunfire's cross section. How deep is the dish?

$$y = a(x-0)^2 + 0$$

$$y = \frac{1}{40}x^2$$

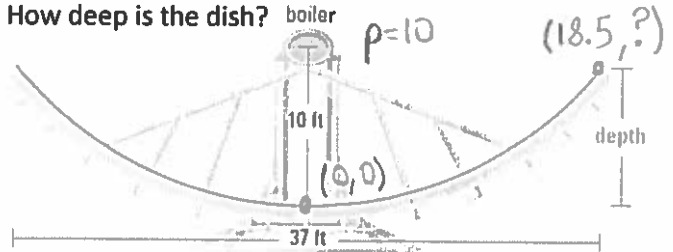
$$y = ax^2$$

$$y = \frac{1}{40}(18.5)^2$$

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

$$y = 8.556 \text{ ft}$$

$$a = \frac{1}{4(10)}$$



- 13) The filament of a lightbulb is a thin wire that glows when electricity passes through it. The filament of a car headlight is at the focus of a parabolic reflector, which sends light out in a straight beam. Given that the filament is 1.5 inches from the vertex, find the equation for the cross section of the reflector. If the reflector is 7 inches wide, how deep is it?

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

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

$$x = \frac{1}{6}y^2$$

$$x = a(y-0)^2 + 0$$

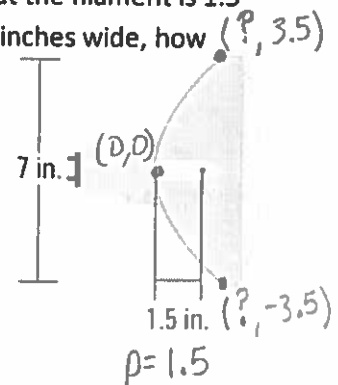
$$a = \frac{1}{4(1.5)}$$

$$x = \frac{1}{6}(3.5)^2$$

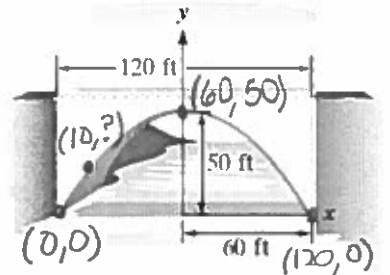
$$x = ay^2$$

$$a = \frac{1}{6}$$

$$x = 2.042 \text{ in}$$



14) A concrete bridge is designed with an arch in the shape of a parabola. The road over the bridge is 120 feet long and the maximum height of the arch is 50 feet. Write an equation for the parabolic arch. How far above the water is the bridge 10 feet from the shore? Assume the origin is at the bottom left of the bridge.



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

$$y = a(x-60)^2 + 50$$

$$0 = a(0-60)^2 + 50$$

$$-50 = 3600a$$

$$-\frac{1}{72} = a$$

$$y = -\frac{1}{72}(x-60)^2 + 50$$

$$y = -\frac{1}{72}(10-60)^2 + 50$$

$$y = 15.2\bar{7} \text{ ft}$$

15. For the function  $f(x) = \frac{1}{2}(x+4) - 5$ :  $\rightarrow f(x) = \frac{1}{2}x + 2 - 5 \rightarrow f(x) = \frac{1}{2}x - 3$

a. Find  $f^{-1}(x)$

$$y = \frac{1}{2}x - 3$$

$$x = \frac{1}{2}y - 3$$

$$x + 3 = \frac{1}{2}y$$

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

$$f^{-1}(x) = 2x + 6$$

b. Show composition for inverse

$$\frac{1}{2}(2x+6) - 3$$

$$x + 3 - 3$$

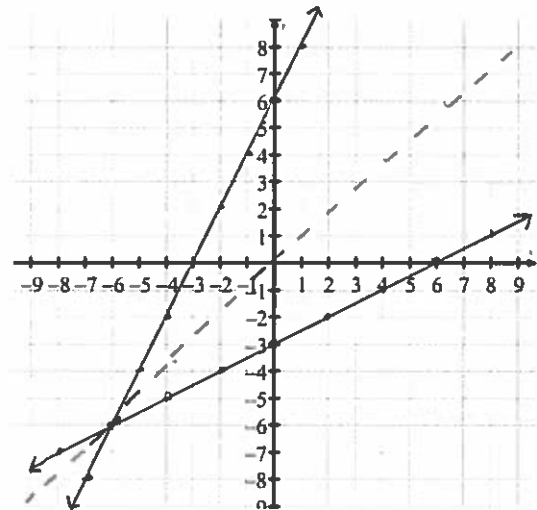
$$x$$

$$2(\frac{1}{2}x - 3) + 6$$

$$x - 6 + 6$$

$$x$$

c. Graph and show the inverse using  $y=x$



16. Find  $g^{-1}(x)$  for  $g(x) = 4(x-5)^2 + 8$

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

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

$$x - 8 = 4(y-5)^2$$

$$\frac{x-8}{4} = (y-5)^2$$

$$\sqrt{\frac{x-8}{4}} = y-5$$

$$\sqrt{\frac{x-8}{4}} + 5 = y$$

$$g^{-1}(x) = \sqrt{\frac{x-8}{4}} + 5$$