

Write each equation in vertex form. Then identify the vertex, axis of symmetry, and direction of opening.

1. $y = -6x^2 - 24x - 25$

$y = -6(x+2)^2 - 1$
 $V(-2, -1); x = -2; \downarrow$

2. $y = 2x^2 + 2$

$y = 2(x+0)^2 + 2$
 $V(0, 2); x = 0; \uparrow$

3. $y = -4x^2 + 8x$

$y = -4(x-1)^2 + 4$
 $V(1, 4); x = 1; \downarrow$

4. $y = x^2 + 10x + 20$

$y = (x+5)^2 - 5$
 $V(-5, -5); x = -5; \uparrow$

5. $y = 2x^2 + 12x + 18$

$y = 2(x+3)^2$
 $V(-3, 0); x = -3; \uparrow$

6. $y = 3x^2 - 6x + 5$

$y = 3(x-1)^2 + 2$
 $V(1, 2); x = 1; \uparrow$

7. $y = -2x^2 - 16x - 32$

$y = -2(x+4)^2$
 $V(-4, 0); x = -4; \downarrow$

8. $y = -3x^2 + 18x - 21$

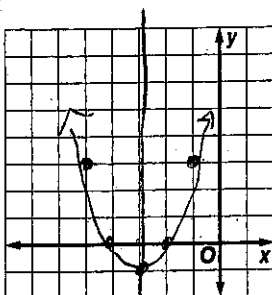
$y = -3(x-3)^2 + 6$
 $V(3, 6); x = 3; \downarrow$

9. $y = 2x^2 + 16x + 29$

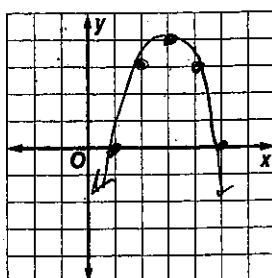
$y = 2(x+4)^2 - 3$
 $V(-4, -3); x = -4; \uparrow$

Graph each function.

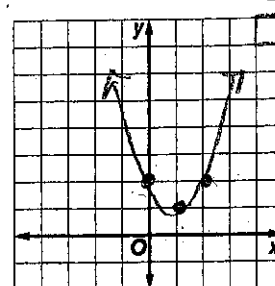
10. $y = (x + 3)^2 - 1$



11. $y = -x^2 + 6x - 5$



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



| | |
|----|---|
| x | y |
| -1 | 5 |

13. Write an equation for a parabola with vertex at (1, 3) that passes through (-2, -15).

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

$$-15 = a(-2-1)^2 + 3$$

$$-18 = 9a$$

$$-2 = a$$

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

14. Write an equation for a parabola with vertex at (-3, 0) that passes through (3, 18).

$$y = a(x+3)^2 + 0$$

$$18 = a(3+3)^2 + 0$$

$$18 = a(36)$$

$$\frac{1}{2} = a$$

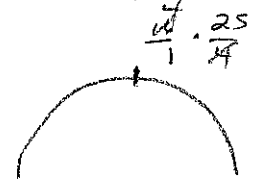
$$y = \frac{1}{2}(x+3)^2$$

15. **BASEBALL** The height h of a baseball t seconds after being hit is given by $h(t) = -16t^2 + 80t + 3$. What is the maximum height that the baseball reaches, and when does this occur?

$$h(t) = -16(t^2 - 5t + \frac{25}{4}) + 3 + 100$$

$$= -16(t - \frac{5}{2})^2 + 103$$

103 ft ; 2.5 sec



16. **SCULPTURE** A modern sculpture in a park contains a parabolic arc that starts at the ground and reaches a maximum height of 10 feet after a horizontal distance of 4 feet. Write a quadratic function in vertex form that describes the shape of the outside of the arc, where y is the height of a point on the arc and x is its horizontal distance from the left-hand starting point of the arc.

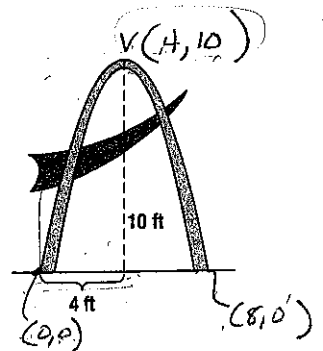
$$y = -\frac{5}{8}(x-4)^2 + 10$$

$$y = a(x-4)^2 + 10$$

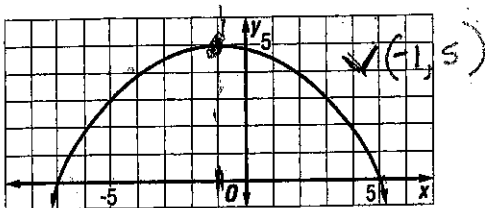
$$0 = a(8-4)^2 + 10$$

$$0 = 16a + 10$$

$$\frac{-10}{16} = -\frac{5}{8} = a$$



ARCHES A parabolic arch is used as a bridge support. The graph of the arch is shown below.



If the equation that corresponds to this graph is written in the form $y = a(x-h)^2 + k$, what are h and k ?

$$h = -1$$

$$k = 5$$

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

$$2 = a(7-4)^2 + 6$$

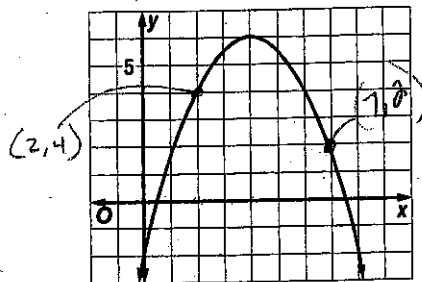
$$2 = 9a + 6$$

$$-4 = 9a$$

$$-\frac{4}{9} = a$$

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

WATER JETS The graph shows the path $V(20, 1600)$; $\rightarrow x = 20$ of a jet of water.



The equation corresponding to this graph is $y = a(x-h)^2 + k$. What are a , h , and k ? $h = 4$ $k = 6$

PROFIT A theater operator predicts that the theater can make $-4x^2 + 160x$ dollars per show if tickets are priced at x dollars.

a. Rewrite the equation $y = -4x^2 + 160x$ in the form $y = a(x-h)^2 + k$.

$$y = -4(x-20)^2 + 1600$$

b. What is the vertex of the parabola and what is its axis of symmetry?

c. Graph the parabola.

