Get your homework out and then do the following as a warmup:

What is Vertex Form and what does it tell you?

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

Instantly gives us:

- Vertex: (h, k)
- Axis of symmetry: x = h

What is Standard Form and what does it tell you?

$$f(x) = ax^2 + bx + c$$

Instantly gives us:

- Axis of symmetry: $x = -\frac{b}{2a}$
- Vertex: $(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right))$
- Y-intercept: c

Today you will:

- Graph quadratic functions using x-intercepts
- Practice using English to describe math processes and equations

Core Vocabulary:

- Intercept form of a quadratic equation

  $f(x) = a(x - p)(x - q)$, where $a \neq 0$

Properties of the graph of $f(x) = a(x - p)(x - q)$

- ***p*** and ***q*** are the *x*-intercepts of the graph

  Why? Because $f(p) = 0$ and $f(q) = 0$

- Axis of symmetry is $x = \frac{p+q}{2}$

  Why? Because it lies halfway between $(p, 0)$ and $(q, 0)$

- The parabola opens up when $a > 0$

  and opens down when $a < 0$

COMMON ERROR

Remember that the x-intercepts of the graph of $f(x) = a(x - p)(x - q)$ are p and q, not $-p$ and $-q$.

Graph $f(x) = -2(x + 3)(x - 1)$. Label the x-intercepts, vertex, and axis of symmetry.

SOLUTION

Step 1 Identify the x-intercepts.

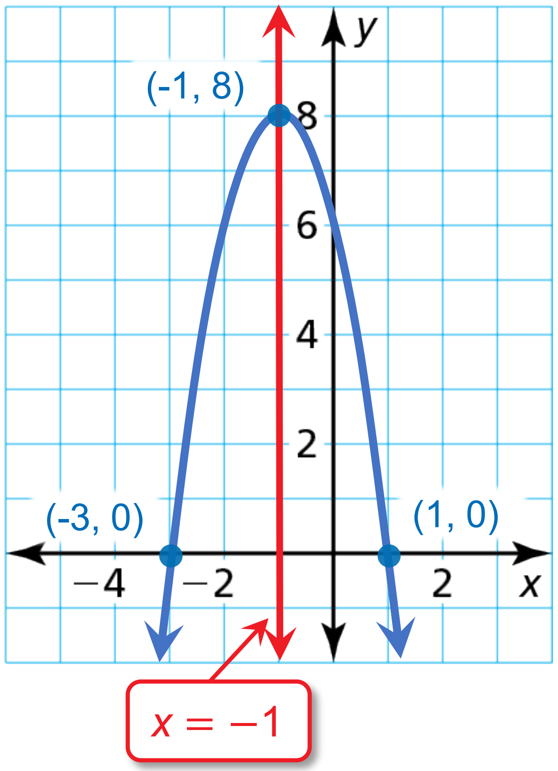
Step 2 Find the coordinates of the vertex.

$$x = \frac{p+q}{2} = \frac{-3+1}{2} = -1$$

$$f(-1) = -2(-1 + 3)(-1 - 1) = 8$$

So, the axis of symmetry is $x = -1$ and the vertex is $(-1, 8)$.

Step 3 Draw a parabola through the vertex and the points where the x-intercepts occur.



Check You can check your answer by generating a table of values for *f* on a graphing calculator.

X	Y1	
−4	−10	
−3	0	
−2	6	
−1	8	
0	6	
1	0	
2	−10	

X=−1

x-intercept → −3

x-intercept → 1

The values show symmetry about $x = -1$. So, the vertex is $(-1, 8)$.

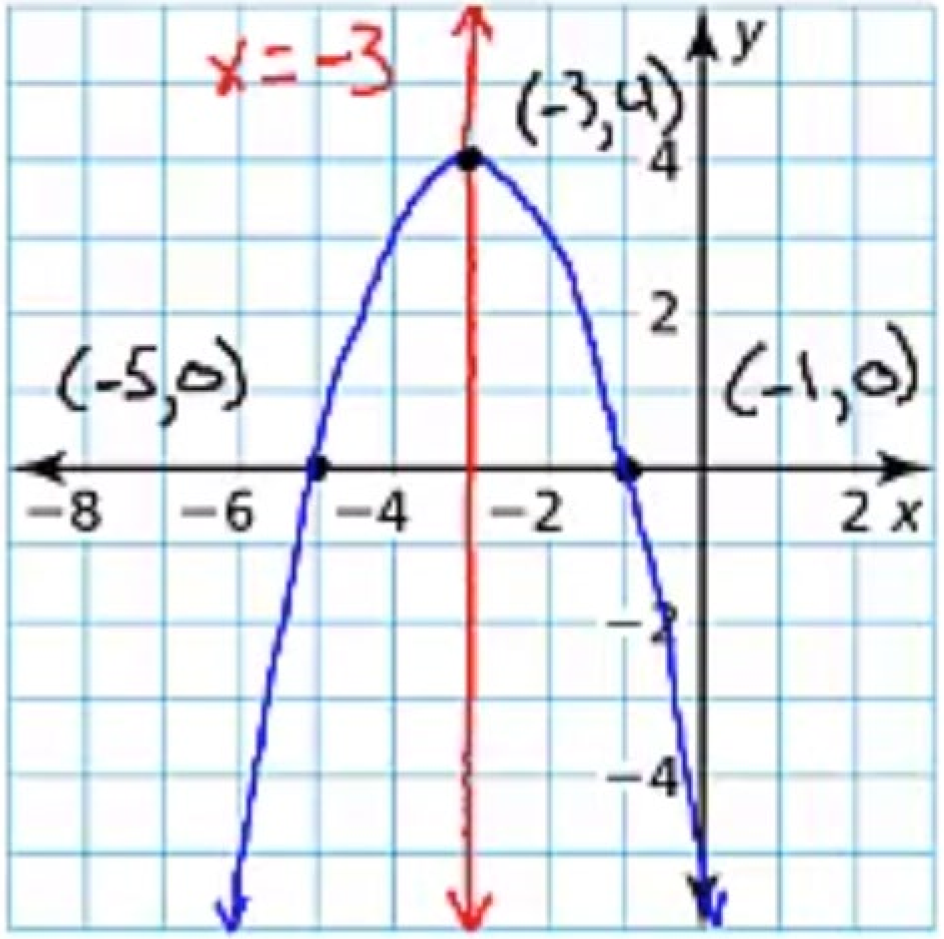
Graph the function $f(x) = -(x+1)(x+5)$. Label the x-intercepts, vertex, and axis of symmetry.

a = -1
p = -1
q = -5

- *-1 and -5 (p* and *q)* are the *x*-intercepts of the graph so: $(-1,0)$ *and* $(-5,0)$
- $a < 0$ so the parabola opens down
- Axis of symmetry is $x = \frac{p+q}{2} = \frac{(-1)+(-5)}{2} = \frac{-6}{2} = -3$
- Vertex is $(-3, f(-3))$

$$and\ f(-3) = -((-3)+1)((-3)+5)$$
$$= -(-2)(2) = 4$$

$vertex\ (-3,4)$



Graph the function $f(x) = \frac{1}{4}(x-6)(x-2)$. Label the x-intercepts, vertex, and axis of symmetry.

a = $\frac{1}{4}$
p = 6
q = 2

- *6 and 2 (p* and *q)* are the *x*-intercepts of the graph so: $(6,0)$ *and* $(2,0)$

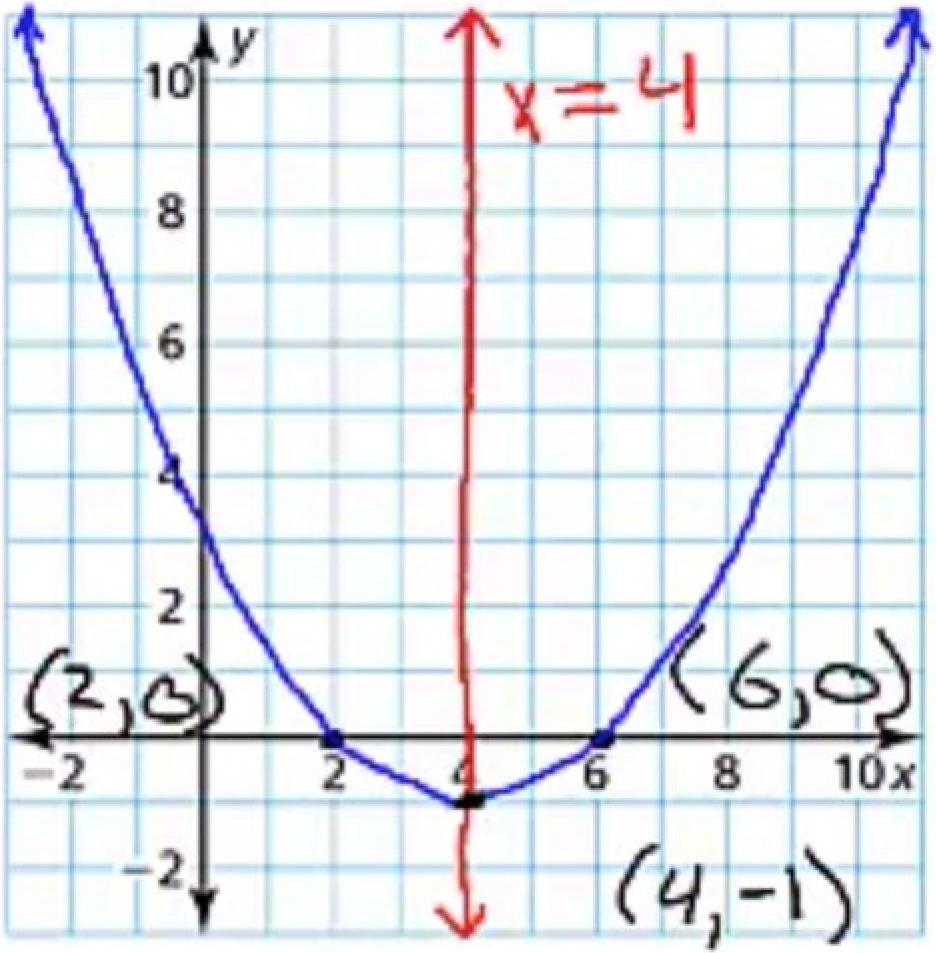
- $a > 0$ so the parabola opens up

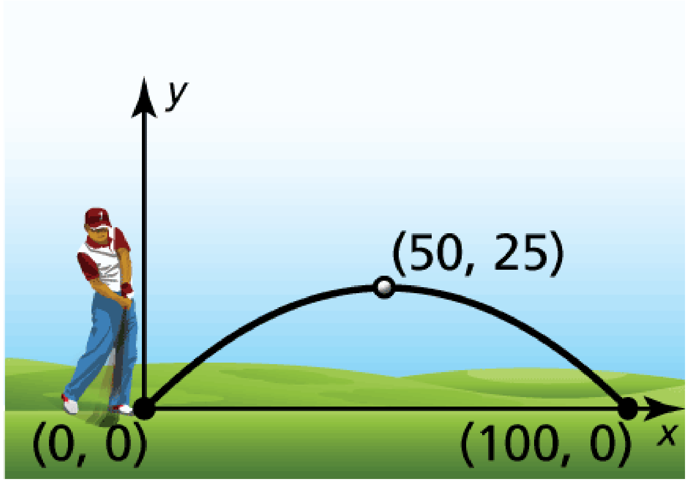
- Axis of symmetry is $x = \frac{p+q}{2} = \frac{6+2}{2} = \frac{8}{2} = 4$

- Vertex is $(4, f(4))$

$$and\ f(4) = \frac{1}{4}\ (4-6)(4-2)$$
$$= \frac{1}{4}(-2)(2) = \frac{1}{4}(-4) = -1$$

$vertex\ (4, -1)$





The parabola shows the path of your first golf shot, where *x* is the horizontal distance (in yards) and *y* is the corresponding height (in yards). The path of your second shot can be modeled by the function $f(x) = -0.02x(x - 80)$. Which shot travels farther before hitting the ground? Which travels higher?

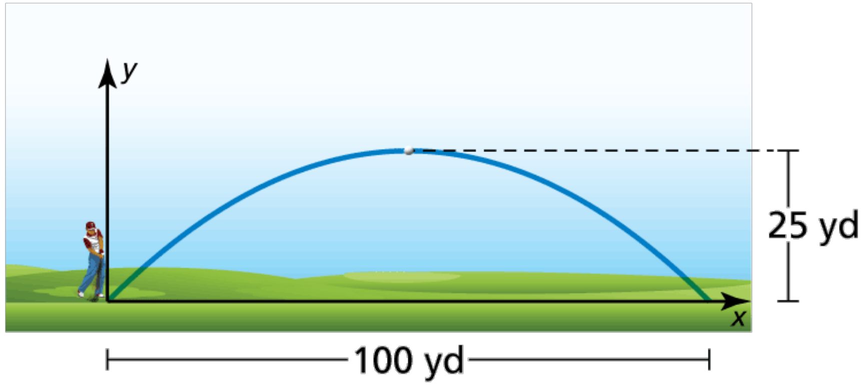
SOLUTION

1. Understand the Problem You are given a graph and a function that represent the paths of two golf shots. You are asked to determine which shot travels farther before hitting the ground and which shot travels higher.

2. Make a Plan Determine how far each shot travels by interpreting the *x*-intercepts. Determine how high each shot travels by finding the maximum value of each function. Then compare the values.

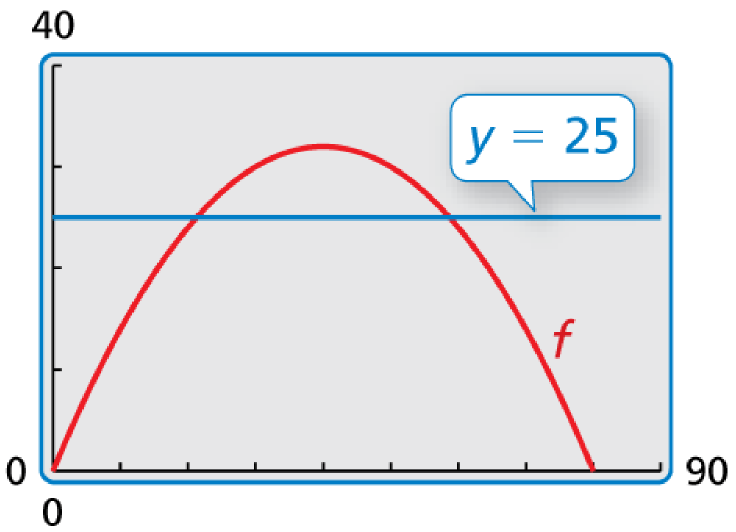
3. Solve the Problem

First shot: The graph shows that the x-intercepts are 0 and 100. So, the ball travels 100 yards before hitting the ground.



Because the axis of symmetry is halfway between (0, 0) and (100, 0), the axis of symmetry is $x = \frac{0 + 100}{2} = 50$. So, the vertex is (50, 25) and the maximum height is 25 yards.

Second shot: By rewriting the function in intercept form as $f(x) = -0.02(x - 0)(x - 80)$, you can see that $p = 0$ and $q = 80$. So, the ball travels 80 yards before hitting the ground.



▶ Because 100 yards > 80 yards, the first shot travels farther. Because 32 yards > 25 yards, the second shot travels higher.

4. Look Back To check that the second shot travels higher, graph the function representing the path of the second shot and the line $y = 25$, which represents the maximum height of the first shot.

The graph rises above $y = 25$, so the second shot travels higher. ✓

Homework:

- Pg 63, #53-79