EXAMPLE 3 Graph a quadratic function in intercept form

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

Solution

AVOID ERRORS
Remember that the x-intercepts for a quadratic function written in the form $y = a(x - p)(x - q)$ are p and q, not $-p$ and $-q$.

STEP 1 **Identify** the x-intercepts. Because $p = -3$ and $q = 1$, the x-intercepts occur at the points $(-3, 0)$ and $(1, 0)$.

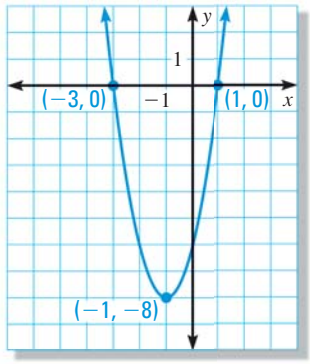
STEP 2 **Find** the coordinates of the vertex.

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

$$y = 2(\mathbf{-1} + 3)(\mathbf{-1} - 1) = -8$$

So, the vertex is $(-1, -8)$.

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



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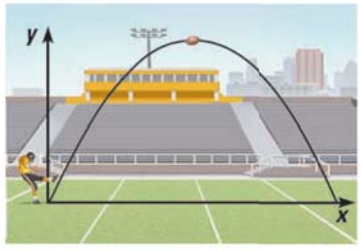
EXAMPLE 4 Use a quadratic function in intercept form

FOOTBALL The path of a placekicked football can be modeled by the function $y = -0.026x(x - 46)$ where x is the horizontal distance (in yards) and y is the corresponding height (in yards).

a. How far is the football kicked?

b. What is the football's maximum height?



Solution

a. Rewrite the function as $y = -0.026(x - 0)(x - 46)$. Because $p = 0$ and $q = 46$, you know the x-intercepts are 0 and 46. So, you can conclude that the football is kicked a distance of 46 yards.

b. To find the football's maximum height, calculate the coordinates of the vertex.

$$x = \frac{p + q}{2} = \frac{0 + 46}{2} = \mathbf{23}$$

$$y = -0.026(\mathbf{23})(\mathbf{23} - 46) \approx 13.8$$

The maximum height is the y-coordinate of the vertex, or about 13.8 yards.

GUIDED PRACTICE for Examples 3 and 4

Graph the function. Label the vertex, axis of symmetry, and x-intercepts.

5. $y = (x - 3)(x - 7)$ **6.** $f(x) = 2(x - 4)(x + 1)$ **7.** $y = -(x + 1)(x - 5)$

8. WHAT IF? In Example 4, what is the maximum height of the football if the football's path can be modeled by the function $y = -0.025x(x - 50)$?