EXAMPLE 2 **Graph a quadratic function**

Graph $y = 2x^2 - 8$.

Solution

STEP 1 **Rewrite** the quadratic function in intercept form.

$$y = 2x^2 - 8 \qquad \text{\textbf{Write original function.}}$$
$$= 2(x^2 - 4) \qquad \text{\textbf{Factor out common factor.}}$$
$$= 2(x + 2)(x - 2) \qquad \text{\textbf{Difference of two squares pattern}}$$

STEP 2 **Identify** and plot the x-intercepts. Because $p = -2$ and $q = 2$, the x-intercepts occur at the points $(-2, 0)$ and $(2, 0)$.

STEP 3 **Find** and draw the axis of symmetry.

$$x = \frac{p + q}{2} = \frac{-2 + 2}{2} = 0$$
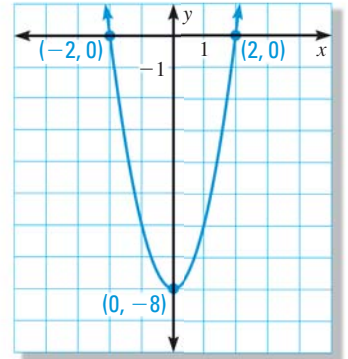
STEP 4 **Find** and plot the vertex.

The x-coordinate of the vertex is 0.

The y-coordinate of the vertex is:

$$y = 2(\mathbf{0})^2 - 8 = -8$$

So, the vertex is $(0, -8)$.

STEP 5 **Draw** a parabola through the vertex and the points where the x-intercepts occur.

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PRACTICE

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

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

2. $y = (x + 5)(x + 2)$

3. $y = (x + 9)^2$

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

5. $y = -5(x + 7)(x + 2)$

6. $y = 3(x - 6)(x - 3)$

7. $y = -\frac{1}{2}(x + 4)(x - 2)$

8. $y = (x - 7)(2x - 3)$

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

10. $y = -x^2 + 8x - 16$

11. $y = -x^2 - 9x - 18$

12. $y = 12x^2 - 48$

13. $y = -6x^2 + 294$

14. $y = 3x^2 - 24x + 36$

15. $y = 20x^2 - 6x - 2$

16. Follow the steps below to write an equation of the parabola shown.

  a. Find the x-intercepts.

  b. Use the values of p and q and the coordinates of the vertex to find the value of a in the equation $y = a(x - p)(x - q)$.

  c. Write a quadratic equation in intercept form.