Extension

Graph Quadratic Functions in Intercept Form

GOAL Graph quadratic functions in intercept form.

Key Vocabulary
- **intercept form**

You have graphed quadratic functions written in standard form. Quadratic functions can also be written in **intercept form**, $y = a(x - p)(x - q)$ where $a \neq 0$. In this form, the x-intercepts of the graph can easily be determined.

COMMON CORE

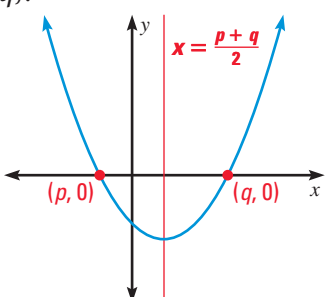
CC.9-12.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.*

KEY CONCEPT *For Your Notebook*

Graph of Intercept Form $y = a(x - p)(x - q)$

Characteristics of the graph of $y = a(x - p)(x - q)$:

- The x-intercepts are p and q.
- The axis of symmetry is halfway between $(p, 0)$ and $(q, 0)$. So, the axis of symmetry is $x = \frac{p + q}{2}$.
- The parabola opens up if $a > 0$ and opens down if $a < 0$.



EXAMPLE 1 Graph a quadratic function in intercept form

Graph $y = -(x + 1)(x - 5)$.

Solution

FIND ZEROS OF A FUNCTION
Notice that the x-intercepts of the graph are also the zeros of the function:
$0 = -(x + 1)(x - 5)$
$x + 1 = 0$ *or* $x - 5 = 0$
$x = -1$ *or* $x = 5$

STEP 1 **Identify** and plot the x-intercepts. Because $p = -1$ and $q = 5$, the x-intercepts occur at the points $(-1, 0)$ and $(5, 0)$.

STEP 2 **Find** and draw the axis of symmetry.

$$x = \frac{p + q}{2} = \frac{-1 + 5}{2} = 2$$

STEP 3 **Find** and plot the vertex.

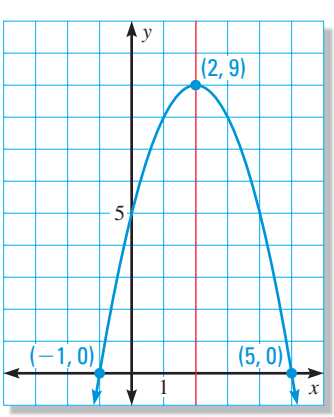
The x-coordinate of the vertex is 2.

To find the y-coordinate of the vertex, substitute **2** for x and simplify.

$$y = -(\mathbf{2} + 1)(\mathbf{2} - 5) = 9$$

So, the vertex is $(2, 9)$.

STEP 4 **Draw** a parabola through the vertex and the points where the x-intercepts occur.



EXAMPLE 2 Graph a quadratic function

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

Solution

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

$y = 2x^2 - 8$ **Write original function.**

$= 2(x^2 - 4)$ **Factor out common factor.**

$= 2(x + 2)(x - 2)$ **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.

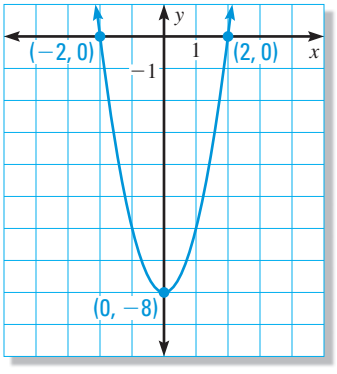
The x-coordinate of the vertex is 0.

The y-coordinate of the vertex is:

$y = 2(0)^2 - 8 = -8$

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

EXAMPLE 1 Exs. 1–9

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

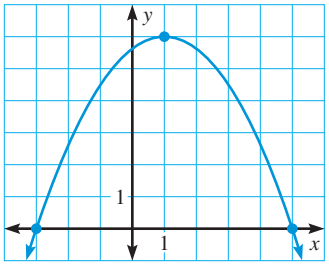
7. $y = -\frac{1}{2}(x + 4)(x - 2)$ **8.** $y = (x - 7)(2x - 3)$ **9.** $y = 2(x + 10)(x - 3)$

EXAMPLE 2 Exs. 10–12

10. $y = -x^2 + 8x - 16$ **11.** $y = -x^2 - 9x - 18$ **12.** $y = 12x^2 - 48$

13. Use factoring to determine how many x-intercepts the graph of the function $y = 3x^2 - 12x + 12$ has.

14. 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.