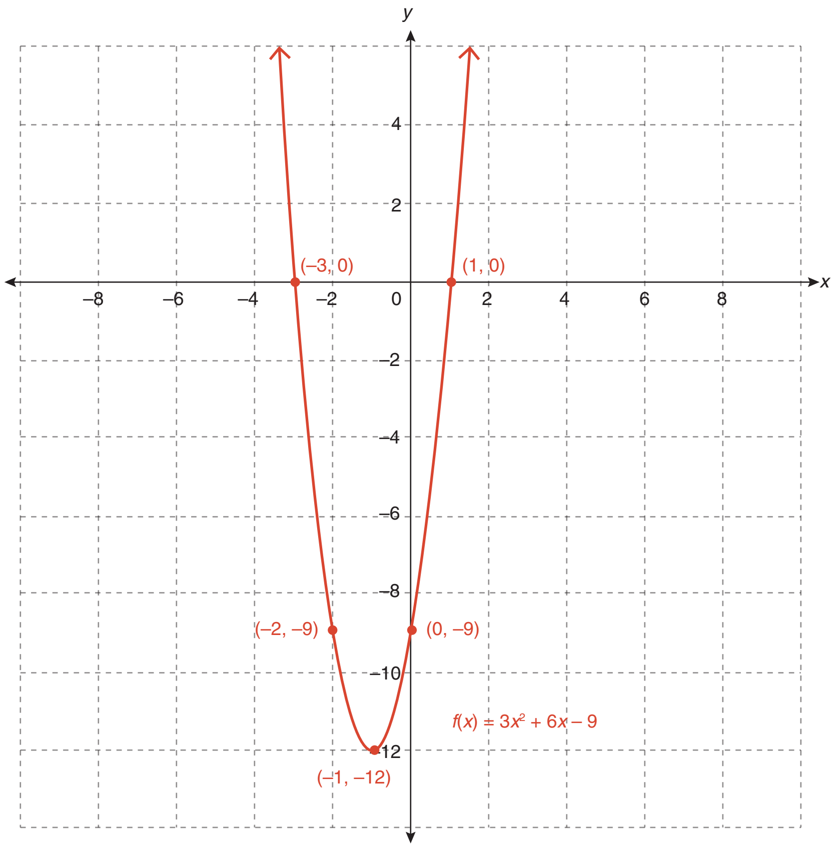
Practice Solutions – V

1. Summarize what information about the graph can be determined from each form of a quadratic function in the table below.

Form	Information that can be determined	How is the information determined?
Vertex Form	Vertex	(p, q)
	Axis of Symmetry	$x = p$
	Direction of opening	If $a > 0$, then opens upward If $a < 0$, then opens downward
	Maximum/minimum	If $a > 0$, then minimum $= q$ If $a < 0$, then maximum $= q$
	Domain and Range	Domain: $\{x \mid x \in R\}$ If $a > 0$, then Range: $\{y \mid y \geq q\}$ If $a < 0$, then Range: $\{y \mid y \leq q\}$
	Number of x-intercepts	If a and q are opposite signs, there are two x-intercepts. If a and q are the same sign, there are zero x-intercepts. If $q = 0$, there is one x-intercept.
Standard Form	y-intercept	c
	x-intercept(s)	If factorable, the values of x that cause the factors to equal zero.
	Direction of opening	If $a > 0$, then opens upward If $a < 0$, then opens downward

2. Sketch the graph of the quadratic function, $y = 3x^2 + 6x - 9$. Be sure to label the axes, provide an appropriate scale, and plot at least five points, including the vertex, zeros, and y-intercept. Show all work.



Factor the functions to find the zeros of the function.

$y = 3x^2 + 6x - 9$

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

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

x-intercept: 1,–3

y-intercept: –9

To find the vertex, domain, and range, convert the function to vertex form.

$y = 3x^2 + 6x - 9$

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

$y = 3(x^2 + 2x + 1 - 1) - 9$

$y = 3(x^2 + 2x + 1) - 9 - 3$

$y = 3(x + 1)^2 - 12$

vertex: $(-1, -12)$

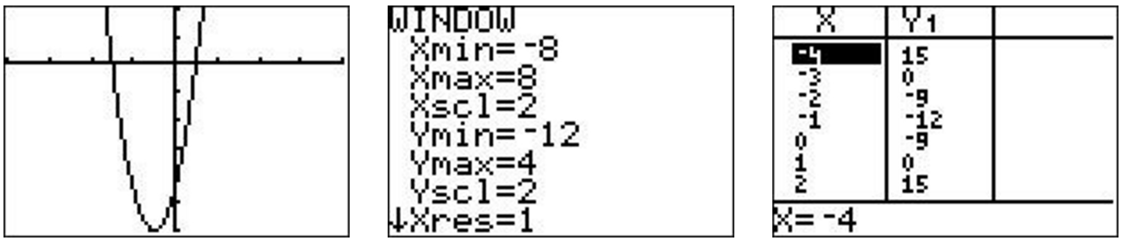
Domain: $\{x \mid x \in \mathrm{R}\}$

Range: $\{y \mid y \geq -12, y \in \mathrm{R}\}$

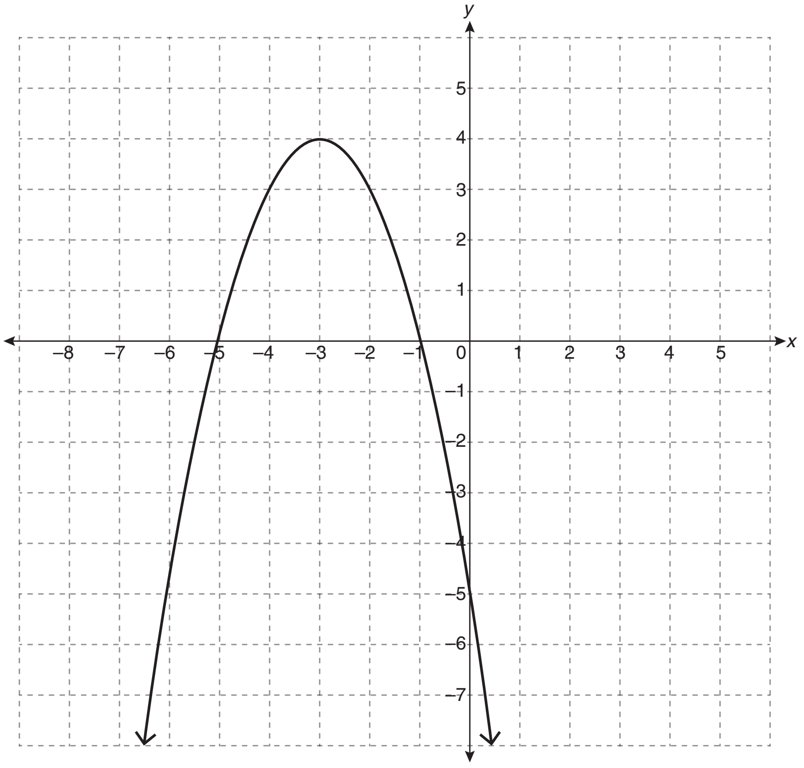
Because no particular graphing method is asked for in this question, you are free to use any method you choose. The graph should look similar to the graph either above or below.

Window	Settings
XMin	–8
XMax	8
XScale	2
YMin	–12
YMax	4
YScale	2

If using a calculator, you would see the following.



3. Write the equation, in standard form, of the quadratic function represented by the graph below.



Write what is known from the graph:

- Vertex: (–3, 4)
    - $p = -3$
    - $q = 4$
- x-intercepts: (–1, 0) and (–5, 0)
- y-intercepts: (0, –5)

Substitute p, q, and one point, (–1, 0), into the vertex form, and solve for a.

$$y = a(x - p)^2 + q$$
$$y = a(x + 3)^2 + 4$$
$$0 = a(-1 + 3)^2 + 4$$
$$-4 = 4a$$
$$-1 = a$$

From the vertex form, expand and simplify. The equation of the function in standard form is

$$y = -(x + 3)^2 + 4$$
$$y = -(x^2 + 6x + 9) + 4$$
$$y = -x^2 - 6x - 9 + 4$$
$$y = -x^2 - 6x - 5$$

4. Determine the equation of a quadratic function with zeros of 5 and 1. The function also passes through the point (2, –9). Write the equation of the function in standard form.

   Write what is given in the question:
   x-intercepts of 5 and 1
   the point, (2, –9) lies on the graph

   Given this information, start with a factored form of the quadratic function.

   $$y = a(x-5)(x-1)$$

   Then, use the third point to solve for a.

   $$\begin{aligned} y &= a(x-5)(x-1) \\ -9 &= a(2-5)(2-1) \\ -9 &= a(-3)(1) \\ 3 &= a \end{aligned}$$

   The function, written in standard form, is

   $$\begin{aligned} y &= 3(x-5)(x-1) \\ y &= 3(x^2 - x - 5x + 5) \\ y &= 3(x^2 - 6x + 5) \\ y &= 3x^2 - 18x + 15 \end{aligned}$$

Please complete *Lesson 2.3 Explore Your Understanding Assignment* located in *Workbook 2B* before proceeding to *Lesson 2.4*.