Lesson 16: Graphing Quadratic Equations from the Vertex Form, $y = a(x - h)^2 + k$

Classwork

Opening Exercise

Graph the equations $y = x^2$, $y = (x - 2)^2$, and $y = (x + 2)^2$ on the interval $-3 \leq x \leq 3$.

Exercises 1–2

1. Without graphing, state the vertex for each of the following quadratic equations.
   a. $y = (x - 5)^2 + 3$

   b. $y = x^2 - 2.5$

   c. $y = (x + 4)^2$

2. Write a quadratic equation whose graph will have the given vertex.
   a. $(1.9, -4)$

   b. $(0, 100)$

   c. $\left(-2, \frac{3}{2}\right)$

Exploratory Challenge

Caitlin has 60 feet of material that can be used to make a fence. Using this material, she wants to create a rectangular pen for her dogs to play in. What dimensions will maximize the area of the pen?

a. Let w be the width of the rectangular pen in feet. Write an expression that represents the length when the width is w feet.

b. Define a function $A(w)$ that describes the area, A, in terms of the width, w.

c. Rewrite $A(w)$ in vertex form.

d. What are the coordinates of the vertex? Interpret the vertex in terms of the problem.

e. What dimensions maximize the area of the pen? Do you think this is a surprising answer?

Lesson Summary

When graphing a quadratic equation in vertex form, $y = a(x-h)^2 + k$, (h, k) are the coordinates of the vertex.

Problem Set

1. Find the vertex of the graphs of the following quadratic equations.
   a. $y = 2(x-5)^2 + 3.5$
   b. $y = -(x+1)^2 - 8$

2. Write a quadratic equation to represent a function with the following vertex. Use a leading coefficient other than 1.
   a. $(100, 200)$
   b. $\left(-\frac{3}{4}, -6\right)$

3. Use vocabulary from this lesson (i.e., stretch, shrink, opens up, opens down, etc.) to compare and contrast the graphs of the quadratic equations $y = x^2 + 1$ and $y = -2x^2 + 1$.