Graphing Quadratic Functions in Vertex Form

Quadratic functions written in the form $y = a(x - h)^2 + k$ are said to be in **vertex form**.

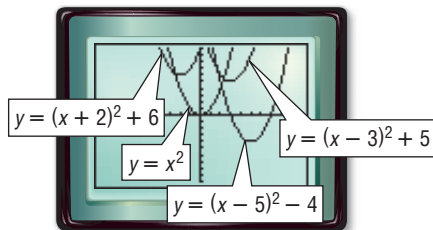**Graph each group of equations on the same screen. Use the standard viewing window. Compare and contrast the graphs.**

a. $y = x^2$
$\quad y = (x - 3)^2 + 5$
$\quad y = (x + 2)^2 + 6$
$\quad y = (x - 5)^2 - 4$

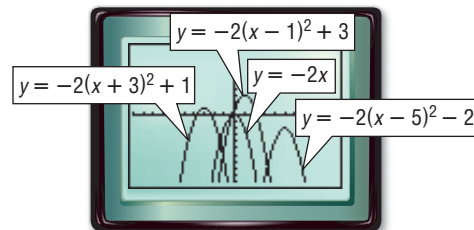Each graph opens upward and has the same shape. However, the vertices are different.

Equation	Vertex
$y = x^2$	$(0, 0)$
$y = (x - 3)^2 + 5$	$(3, 5)$
$y = (x + 2)^2 + 6$	$(-2, 6)$
$y = (x - 5)^2 - 4$	$(5, -4)$

b. $y = -2x^2$
$\quad y = -2(x - 1)^2 + 3$
$\quad y = -2(x + 3)^2 + 1$
$\quad y = -2(x - 5)^2 - 2$

Each graph opens downward and has the same shape. However, the vertices are different.

Equation	Vertex
$y = -2x^2$	$(0, 0)$
$y = -2(x - 1)^2 + 3$	$(1, 3)$
$y = -2(x + 3)^2 + 1$	$(-3, 1)$
$y = -2(x - 5)^2 - 2$	$(5, -2)$

Exercises

1. Study the relationship between the equations in vertex form and their vertices. What is the vertex of the graph of $y = a(x - h)^2 + k$?

2. Completing the square can be used to change a quadratic equation to vertex form. Copy and complete the steps needed to rewrite $y = x^2 - 2x - 3$ in vertex form.
$y = x^2 - 2x - 3$
$y = (x^2 - 2x + \underline{\ ?\ }) - 3 - \underline{\ ?\ }$
$y = (x - \underline{\ ?\ })^2 - \underline{\ ?\ }$

Complete the square to rewrite each quadratic equation in vertex form. Then determine the vertex of the graph of the equation and sketch the graph.

3. $y = x^2 + 2x - 7$ **4.** $y = x^2 - 4x + 8$ **5.** $y = x^2 + 6x - 1$