

# Graphing Calculator Lab

## The Family of Quadratic Functions

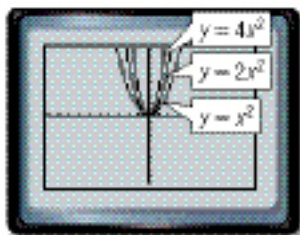
The parent function of the family of quadratic functions is  $y = x^2$ .

### ACTIVITY 1

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

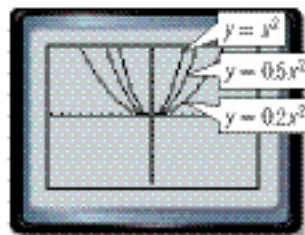
KEYSTROKES: Review graphing equations in your textbook

a.  $y = x^2, y = 2x^2, y = 4x^2$



Each graph opens upward and has its vertex at the origin. The graphs of  $y = 2x^2$  and  $y = 4x^2$  are narrower than the graph of  $y = x^2$ .

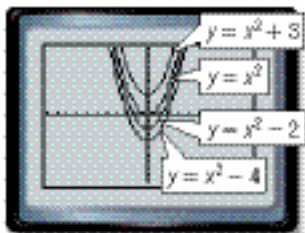
b.  $y = x^2, y = 0.5x^2, y = 0.2x^2$



Each graph opens upward and has its vertex at the origin. The graphs of  $y = 0.5x^2$  and  $y = 0.2x^2$  are wider than the graph of  $y = x^2$ .

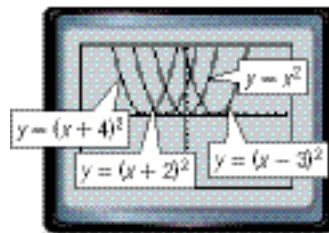
1A. How does the value of  $a$  in  $y = ax^2$  affect the shape of the graph?

c.  $y = x^2, y = x^2 + 3, y = x^2 - 2,$   
 $y = x^2 - 4$



Each graph opens upward and has the same shape as  $y = x^2$ . However, each parabola has a different vertex, located along the  $y$ -axis.

d.  $y = x^2, y = (x - 3)^2, y = (x + 2)^2,$   
 $y = (x + 4)^2$



Each graph opens upward and has the same shape as  $y = x^2$ . However, each parabola has a different vertex located along the  $x$ -axis.

1B. How does the value of the constant affect the position of the graph?

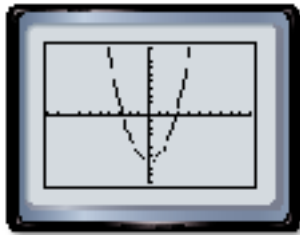
1C. How is the location of the vertex related to the equation of the graph?

Suppose you graph the same equation using different windows. How will the appearance of the graph change?

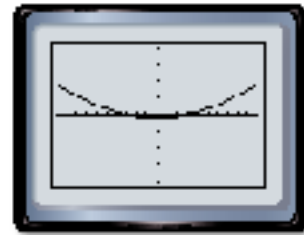
### ACTIVITY 2

Graph  $y = x^2 - 7$  in each viewing window. What conclusions can you draw about the appearance of a graph in the window used?

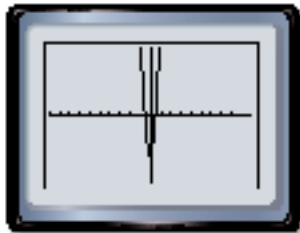
a. standard viewing window



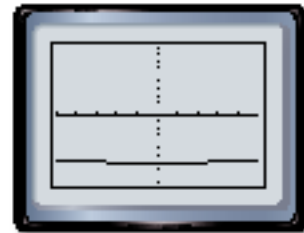
b.  $[-10, 10]$  scl: 1 by  $[-200, 200]$  scl: 50



c.  $[-50, 50]$  scl: 5 by  $[-10, 10]$  scl: 1



d.  $[-0.5, 0.5]$  scl: 0.1 by  $[-10, 10]$  scl: 1



Without knowing the window, graph b might be of the family  $y = ax^2$ , where  $0 < a < 1$ . Graph c looks like a member of  $y = ax^2 - 7$ , where  $a > 1$ . Graph d looks more like a line. However, all are graphs of the same equation.

### EXERCISES

Graph each family of equations on the same screen. Compare and contrast the graphs.

1.  $y = -x^2$   
 $y = -3x^2$   
 $y = -6x^2$

2.  $y = -x^2$   
 $y = -0.6x^2$   
 $y = -0.4x^2$

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

4.  $y = -x^2$   
 $y = -x^2 + 7$   
 $y = -x^2 - 5$

Use the graphs in your textbook and Exercises 1–4 above to predict the appearance of the graph of each equation. Then draw the graph.

5.  $y = -0.1x^2$

6.  $y = (x + 1)^2$

7.  $y = 4x^2$

8.  $y = x^2 - 6$

Describe how each change in  $y = x^2$  would affect the graph of  $y = x^2$ . Be sure to consider all values of  $a$ ,  $h$ , and  $k$ .

9.  $y = ax^2$

10.  $y = (x + h)^2$

11.  $y = x^2 + k$

12.  $y = (x + h)^2 + k$