Graphing Calculator Investigation

A Follow-Up of Lesson 10-1

Sharp EL-9600c

Families of Quadratic Graphs

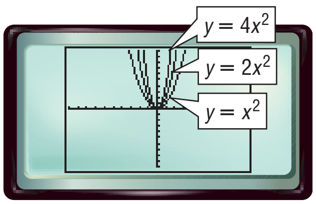
Recall that a *family of graphs* is a group of graphs that have at least one characteristic in common. On page 278, families of linear graphs were introduced. Families of quadratic graphs often fall into two categories—those that have the same vertex and those that have the same shape.

In each of the following families, the parent function is $y = x^2$. Graphing calculators make it easy to study the characteristics of these families of parabolas.

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

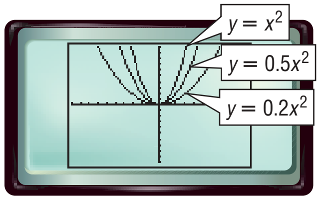
KEYSTROKES: *Review graphing equations on pages 224 and 225.*

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 $y = x^2$.

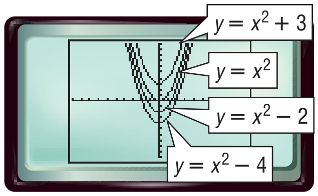
b. $y = x^2, y = 0.5x^2, y = 0.2x^2$



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 $y = x^2$.

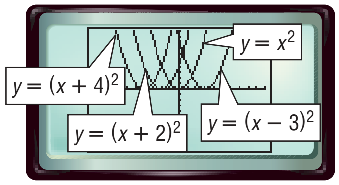
How does the value of a in $y = ax^2$ affect the shape of the graph?

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. *How does the value of the constant affect the position of the graph?*

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

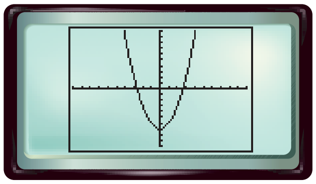
www.algebra1.com/other_calculator_keystrokes

Graphing Calculator Investigation

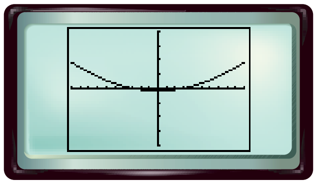
When analyzing or comparing the shapes of various graphs on different screens, it is important to compare the graphs using the same window with the same scale factors. Suppose you graph the same equation using a different window for each. How will the appearance of the graph change?

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

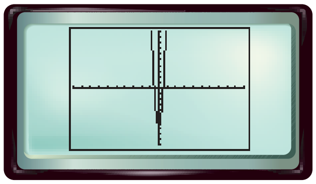


b. [−10, 10] scl: 1 by [−200, 200] scl: 50



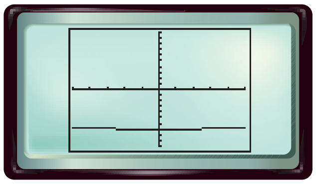
[−10, 10] scl: 1 by [−200, 200] scl: 50

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



[−50, 50] scl: 5 by [−10, 10] scl: 1

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



[−0.5, 0.5] scl: 0.1 by [−10, 10] scl: 1

The window greatly affects the appearance of the parabola. 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. **1–4. See margin.**

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 families of graphs on page 531 and Exercises 1–4 above to predict the appearance of the graph of each equation. Then draw the graph. **5–8. See pp. 581A–581H.**

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. **9–12. See pp. 581A–581H.**

9. $y = ax^2$ **10.** $y = (x + h)^2$ **11.** $y = x^2 + k$ **12.** $y = (x + h)^2 + k$