

# Key Concepts



## Graphing Technology: Parent and Family Graphs

**Objective** Use a graphing calculator to explore how changing the values of  $m$  and  $b$  affect the graph of  $y = mx + b$ .

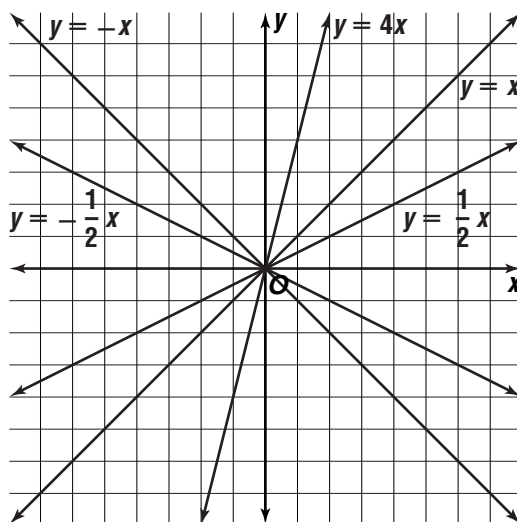
**Note to the Teacher** *In this lesson, students are asked to explore the graphs of linear equations, and how they depend on the slope and the  $y$ -intercept.*

There are several main ideas that this lesson reinforces.

### Key Ideas

- Lines with positive slope have the property that as we move to the right along the line, the line slopes upward.
- Lines with negative slope slope downward.
- Lines with zero slope are horizontal.
- Lines with greater positive slope move upward more steeply. Lines with lesser negative slope move downward more steeply.

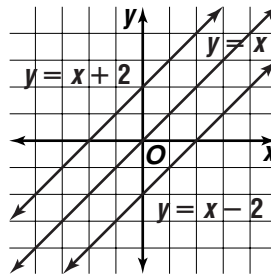
Ask students to explore both positive and negative values of  $m$  by graphing equations of the form  $y = mx$ . Emphasize the key ideas above when discussing the results of the exploration. The collection of lines obtained in this way can be thought of as a **family** of lines. A family of lines is shown below.



Any one of the lines in the family can be thought of as a **parent**, since the other members of the family are obtained by rotating that line. Typically a simple member, such as  $y = x$ , is the parent graph.

<b>Key Idea</b>	<p>In graphing an equation of the form <math>y = mx + b</math>,</p> <ul style="list-style-type: none"> <li>• the line shifts up as the value of <math>b</math> increases, and</li> <li>• the line shifts down as the value of <math>b</math> decreases.</li> </ul>
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Ask students to explore by graphing equations of the form  $y = x + b$  for various values of  $b$ , both positive and negative. Emphasize the key idea above, that the lines are simply a family of parallel lines that move up or down. Again, a simple member, such as  $y = x$ , is the parent graph. A family of graphs is shown below.



Next, have students explore two different families of lines,  $y = 2x + b$  and  $y = -x + b$ , for various values of  $b$ . They will again find families of parallel lines, with slopes 2 and  $-1$ , respectively. Ask the class, “What can you say about lines having the same slope?” **They are parallel.**

**Note to the Teacher** *The relationship between parallelism and slope will be discussed more in Lesson 6-6, but it is good to introduce the idea now, so that students will more readily understand it later.*

Finally, work a little bit with the absolute value function. Have students graph equations of the form  $y = |x|$ ,  $y = |x| + 2$ , and  $y = |x + 2|$ . Ask students how they can get the graphs of the latter two equations from the graph of the first equation. **The graph of  $y = |x| + 2$  is obtained by moving the graph of  $y = |x|$  up two units, and the graph of  $y = |x + 2|$ , by moving the graph of  $y = |x|$  two units to the left.**

