

## 5.1 Investigate Families of Lines

**QUESTION** How can you use a graphing calculator to find equations of lines using slopes and  $y$ -intercepts?

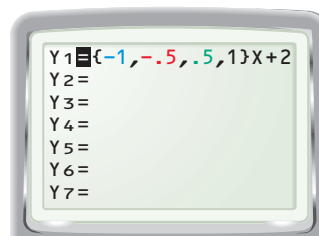
Recall from Chapter 4 that you can create families of lines by varying the value of either  $m$  or  $b$  in  $y = mx + b$ . The constants  $m$  and  $b$  are called *parameters*. Given the value of one parameter, you can determine the value of the other parameter if you also have information that uniquely identifies one member of the family of lines.

**EXAMPLE 1** Find the slope of a line and write an equation

In the same viewing window, display the four lines that have slopes of  $-1$ ,  $-0.5$ ,  $0.5$ , and  $1$  and a  $y$ -intercept of  $2$ . Then use the graphs to determine which line passes through the point  $(12, 8)$ . Write an equation of the line.

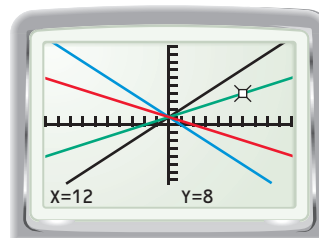
**STEP 1** Enter equations

Press  $\boxed{Y=}$  and enter the four equations. Because the lines all have the same  $y$ -intercept, they constitute a family of lines and can be entered as shown.



**STEP 2** Display graphs

Graph the equations in an appropriate viewing window. Press  $\boxed{\text{TRACE}}$  and use the left and right arrow keys to move along one of the lines until  $x = 12$ . Use the up and down arrow keys to see which line passes through  $(12, 8)$ .



**STEP 3** Find the line

The line that passes through  $(12, 8)$  is the line with a slope of  $0.5$ . So, an equation of the line is  $y = 0.5x + 2$ .

### PRACTICE

Display the lines that have the same  $y$ -intercept but different slopes, as given, in the same viewing window. Determine which line passes through the given point. Write an equation of the line.

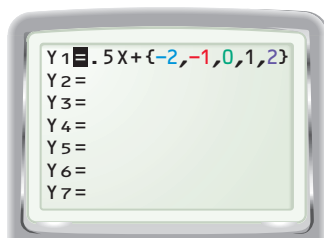
- Slopes:  $-3, -2, 2, 3$ ;  $y$ -intercept:  $5$ ; point:  $(-3, 11)$
- Slopes:  $4, -2.5, 2.5, 4$ ;  $y$ -intercept:  $-1$ ; point:  $(4, -11)$
- Slopes:  $-2, -1, 1, 2$ ;  $y$ -intercept:  $1.5$ ; point:  $(1, 3.5)$

**EXAMPLE 2** Find the  $y$ -intercept of a line and write an equation

In the same viewing window, display the five lines that have a slope of 0.5 and  $y$ -intercepts of  $-2$ ,  $-1$ ,  $0$ ,  $1$ , and  $2$ . Then use the graphs to determine which line passes through the point  $(-2, -2)$ . Write an equation of the line.

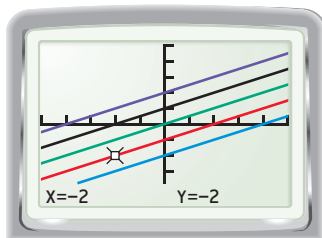
**STEP 1** Enter equations

Press  $\boxed{Y=}$  and enter the five equations. Because the lines all have the same slope, they constitute a family of lines and can be entered as shown below.



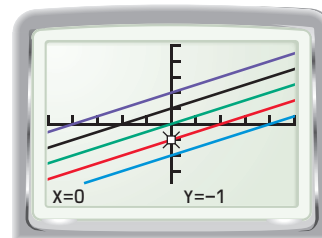
**STEP 2** Display graphs

Graph the equations in an appropriate viewing window. Press  $\boxed{\text{TRACE}}$  and use the left and right arrow keys to move along one of the lines until  $x = -2$ . Use the up and down arrow keys to see which line passes through  $(-2, -2)$ .



**STEP 3** Find the line

The line that passes through  $(-2, -2)$  is the line with a  $y$ -intercept of  $-1$ . So, an equation of the line is  $y = 0.5x - 1$ .



**PRACTICE**

Display the lines that have the same slope but different  $y$ -intercepts, as given, in the same viewing window. Determine which line passes through the given point. Write an equation of the line.

4. Slope:  $-3$ ;  $y$ -intercepts:  $-2, -1, 0, 1, 2$ ; point:  $(4, -13)$
5. Slope:  $1.5$ ;  $y$ -intercepts:  $-2, -1, 0, 1, 2$ ; point:  $(-2, -1)$
6. Slope:  $-0.5$ ;  $y$ -intercepts:  $-3, -1.5, 0, 1.5, 3$ ; point:  $(-4, 3.5)$
7. Slope:  $4$ ;  $y$ -intercepts:  $-3, -1, 0, 1, 3$ ; point:  $(2, 5)$
8. Slope:  $2$ ;  $y$ -intercepts:  $-6, -3, 0, 3, 6$ ; point:  $(-2, -7)$

**DRAW CONCLUSIONS**

9. Of all the lines having equations of the form  $y = 0.5x + b$ , which one passes through the point  $(2, 2)$ ? *Explain* how you found your answer.
10. *Describe* a process you could use to find an equation of a line that has a slope of  $-0.25$  and passes through the point  $(8, -2)$ .