

## 8-3 Slope of a Line

**Objective:** To find the slope of a line.

### Vocabulary

**Slope** If  $(x_1, y_1)$  and  $(x_2, y_2)$  are any two different points on a line,

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{difference between } y\text{-coordinates}}{\text{difference between } x\text{-coordinates}} = \frac{y_2 - y_1}{x_2 - x_1}$$

**Positive slope** The slope of a line that rises from left to right is positive.

**Negative slope** The slope of a line that falls from left to right is negative.

**Zero slope** A horizontal line has slope 0.

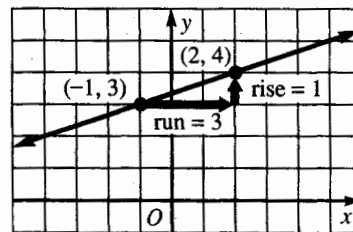
**No slope** A vertical line has no slope.

**Collinear points** Points that lie on the same line.

**Example 1** Find the slope of the line through  $(-1, 3)$  and  $(2, 4)$ .

**Solution** Let  $(x_1, y_1) = (-1, 3)$  and  $(x_2, y_2) = (2, 4)$ .

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 3}{2 - (-1)} = \frac{1}{3}$$



**Example 2** Find the slope of the line through  $(1, -3)$  and  $(4, -3)$ .

**Solution** Slope =  $\frac{-3 - (-3)}{4 - 1} = \frac{0}{3} = 0$  The line has slope 0.

**Example 3** Find the slope of the line through  $(2, -1)$  and  $(2, 5)$ .

**Solution** Slope =  $\frac{5 - (-1)}{2 - 2} = \frac{6}{0}$  (undefined) The line has no slope.

**Find the slope of the line through the given points.**

- |                        |                        |                       |
|------------------------|------------------------|-----------------------|
| 1. $(5, -6), (2, -4)$  | 2. $(-3, 6), (-5, 4)$  | 3. $(0, 1), (2, -2)$  |
| 4. $(1, 2), (4, 6)$    | 5. $(2, 1), (8, -2)$   | 6. $(-1, 5), (0, 0)$  |
| 7. $(4, 3), (2, 7)$    | 8. $(5, 2), (-1, 2)$   | 9. $(-3, -4), (1, 2)$ |
| 10. $(-5, 2), (7, -6)$ | 11. $(1, 4), (-3, 0)$  | 12. $(4, 4), (-4, 6)$ |
| 13. $(8, -1), (6, 0)$  | 14. $(3, -1), (-2, 4)$ | 15. $(7, 4), (7, -4)$ |

**8-3 Slope of a Line** (continued)

**Example 4** Find the slope of the line with the equation  $2x + 3y = 6$ .

**Solution** 1. First find any two points on the line.

$$\begin{array}{ll} \text{If } x = 0: & 2(0) + 3y = 6 \\ & 3y = 6 \\ & y = 2 \end{array} \qquad \begin{array}{ll} \text{If } y = 0: & 2x + 3(0) = 6 \\ & 2x = 6 \\ & x = 3 \end{array}$$

One point:  $(0,2)$                       Another point:  $(3,0)$

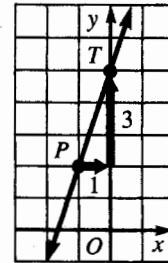
2. Now use the slope formula. Slope =  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 2}{3 - 0} = -\frac{2}{3}$

Find the slope of each line. If the line has no slope, say so.

- |                   |                    |                    |                  |
|-------------------|--------------------|--------------------|------------------|
| 16. $y = 2x - 1$  | 17. $y = 3x + 2$   | 18. $y = 4 - 2x$   | 19. $y = 6 - 3x$ |
| 20. $6x + 2y = 3$ | 21. $2x - 5y = 10$ | 22. $3x + 6y = 12$ | 23. $x - 2y = 4$ |
| 24. $y = 5$       | 25. $y + 2 = 0$    | 26. $x = 1$        | 27. $2x - 3 = 0$ |

**Example 5** Draw a line through the point  $P(-1, 2)$  with a slope of 3.

- Solution**
- Plot point  $P$ .
  - Write the slope as  $\frac{3}{1}$ . Rise = 3. Run = 1.
  - From  $P$ , measure 1 unit to the right and 3 units up to locate a second point,  $T$ .
  - Draw the line through  $P$  and  $T$ .



Through the given point, draw a line with the given slope.

- |                                       |                                       |                                      |
|---------------------------------------|---------------------------------------|--------------------------------------|
| 28. $A(2, 1)$ ; slope 2               | 29. $B(-2, 3)$ ; slope $-3$           | 30. $C(1, -4)$ ; slope 4             |
| 31. $D(-3, -2)$ ; slope $\frac{2}{3}$ | 32. $E(-4, 1)$ ; slope $-\frac{1}{2}$ | 33. $F(3, 0)$ ; slope $-\frac{3}{4}$ |
| 34. $G(-2, -1)$ ; slope $\frac{2}{5}$ | 35. $H(-5, 2)$ ; slope $-2$           | 36. $I(2, -3)$ ; slope $-1$          |

**Mixed Review Exercises**

Solve.

1. $\frac{x+2}{2} + \frac{x}{4} = 0$	2. $-3 = \frac{9b}{4}$	3. $\frac{2+z}{3z} = \frac{4}{z}$	4. $-3(y+2) = 9$
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Evaluate if  $x = -2$ ,  $y = 1$ ,  $a = 3$ , and  $b = -4$ .

5. $\frac{a+2b}{2a-b}$	6. $3(x+3y)$	7. $\frac{1}{2}(3x+4y)$	8. $(2a-3b)+5$
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