## Lesson 17: The Line Joining Two Distinct Points of the Graph

$y = mx + b$ has Slope $m$ $\frac{\Delta y}{\Delta x}$
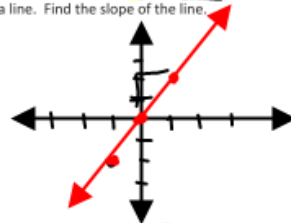
If $y$ is by itself (isolated), the slope is in front of the $x$.

**Classwork**

**Exercises**  $(x, y)$

1.  Find at least three solutions to the equation $y = 2x$, and graph the solutions as points on the coordinate plane. Connect the points to make a line. Find the slope of the line.
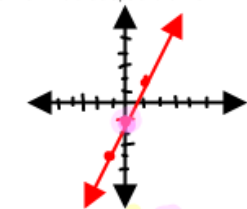
| x | y |
|---|---|
| -1 | -2 |
| 0 | 0 |
| 1 | 2 |



$m = \frac{\Delta y}{\Delta x} = \frac{2}{1}$

$m = 2$

2.  Find at least three solutions to the equation $y = 3x - 1$, and graph the solutions as points on the coordinate plane. Connect the points to make a line. Find the slope of the line.

| x | y |
|---|---|
| -1 | -4 |
| 0 | -1 |
| 1 | 2 |

$3(-1) - 1$
$-3 - 1 = -4$
$3(0) - 1$
$0 - 1 = -1$
$3(1) - 1$
$3 - 1 = 2$

$m = \frac{\Delta y}{\Delta x} = \frac{3}{1} = 3$

3.  Find at least three solutions to the equation $y = 3x + 1$, and graph the solutions as points on the coordinate plane. Connect the points to make a line. Find the slope of the line.
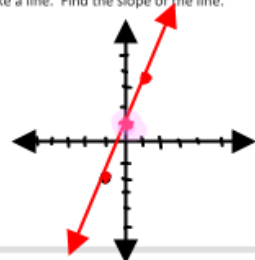
| x | y |
|---|---|
| -1 | -2 |
| 0 | 1 |
| 1 | 4 |

$3(-1) + 1 = -2$

$3(0) + 1 = 1$

$3(1) + 1 = 4$

$m = \frac{\Delta y}{\Delta x} = \frac{3}{1} = 3$

4. The graph of the equation $y = 7x - 3$ has what slope?

$$m = 7 \qquad \frac{\Delta y}{\Delta x} = \frac{up\ 7}{right\ 1}$$

5. The graph of the equation $y = -\frac{3}{4}x - 3$ has what slope?

$$m = -\frac{3}{4} \qquad \frac{\Delta y}{\Delta x} = \frac{down\ 3}{right\ 4}$$

6. You have $20 in savings at the bank. Each week, you add $2 to your savings. Let $y$ represent the total amount of money you have saved at the end of $x$ weeks. Write an equation to represent this situation, and identify the slope of the equation. What does that number represent?

7. A friend is training for a marathon. She can run 4 miles in 28 minutes. Assume she runs at a constant rate. Write an equation to represent the total distance, $y$, your friend can run in $x$ minutes. Identify the slope of the equation. What does that number represent?

8. Four boxes of pencils cost $5. Write an equation that represents the total cost, $y$, for $x$ boxes of pencils. What is the slope of the equation? What does that number represent?

9. Solve the following equation for $y$, and then identify the slope of the line: $9x - 3y = 15$.

$$-9x \quad \Big| \quad -9x$$

$$\frac{-3y}{-3} = \frac{-9x}{-3} + \frac{15}{-3}$$

$$y = 3x - 5$$

$$m = 3 \qquad \frac{\Delta y}{\Delta x} = \frac{up\ 3}{right\ 1}$$

10. Solve the following equation for $y$, and then identify the slope of the line: $5x + 9y = 8$.

$$-5x \quad \Big| \quad -5x$$

$$\frac{9y}{9} = \frac{-5x}{9} + \frac{8}{9}$$

$$m = \frac{-5}{9} \qquad \frac{\Delta y}{\Delta x} = \frac{down\ 5}{right\ 9}$$

$$y = -\frac{5}{9}x + \frac{8}{9}$$

11. Solve the following equation for $y$, and then identify the slope of the line: $ax + by = c$.

**Lesson Summary**

The line joining two distinct points of the graph of the linear equation $y = mx + b$ has slope $m$.

The $m$ of $y = mx + b$ is the number that describes the slope. For example, in the equation $y = -2x + 4$, the slope of the graph of the line is $-2$.

**Problem Set**

1. Solve the following equation for $y$: $-4x + 8y = 24$. Then, answer the questions that follow.

   a. Based on your transformed equation, what is the slope of the linear equation $-4x + 8y = 24$?

   b. Complete the table to find solutions to the linear equation.

   | $x$ | Transformed linear equation: | $y$ |
   |-----|------------------------------|-----|
   |     |                              |     |
   |     |                              |     |
   |     |                              |     |
   |     |                              |     |

   c. Graph the points on the coordinate plane.

   d. Find the slope between any two points.

   e. The slope you found in part (d) should be equal to the slope you noted in part (a). If so, connect the points to make the line that is the graph of an equation of the form $y = mx + b$ that has slope $m$.

   f. Note the location (ordered pair) that describes where the line intersects the $y$-axis.

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2. Solve the following equation for $y$: $9x + 3y = 21$. Then, answer the questions that follow.

a. Based on your transformed equation, what is the slope of the linear equation $9x + 3y = 21$?

b. Complete the table to find solutions to the linear equation.

$-9x \qquad -9x$

$3y = -9x + 21$

$\frac{3y}{3} = \frac{-9x}{3} + \frac{21}{3}$

$y = -3x + 7$

| $x$ | Transformed linear equation: $y = -3x + 7$ | $y$ |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

c. Graph the points on the coordinate plane.

d. Find the slope between any two points.

e. The slope you found in part (d) should be equal to the slope you noted in part (a). If so, connect the points to make the line that is the graph of an equation of the form $y = mx + b$ that has slope $m$.

f. Note the location (ordered pair) that describes where the line intersects the $y$-axis.

3. Solve the following equation for $y$: $2x + 3y = -6$. Then, answer the questions that follow.

a. Based on your transformed equation, what is the slope of the linear equation $2x + 3y = -6$?

b. Complete the table to find solutions to the linear equation.

$-2x \qquad -2x$

$\frac{3y}{3} = \frac{-2x}{3} - \frac{6}{3}$

$y = -\frac{2}{3}x - 2$

| $x$ | Transformed linear equation: $y = -\frac{2}{3}x - 2$ | $y$ |
|---|---|---|
| $-3$ | | |
| $0$ | | |
| $3$ | | |
| $6$ | | |

c. Graph the points on the coordinate plane.

d. Find the slope between any two points.

e. The slope you found in part (d) should be equal to the slope you noted in part (a). If so, connect the points to make the line that is the graph of an equation of the form $y = mx + b$ that has slope $m$.

f. Note the location (ordered pair) that describes where the line intersects the $y$-axis.

4. Solve the following equation for $y$: $5x - y = 4$. Then, answer the questions that follow.

    a. Based on your transformed equation, what is the slope of the linear equation $5x - y = 4$?

    b. Complete the table to find solutions to the linear equation.

| $x$ | Transformed linear equation: | $y$ |
|-----|------------------------------|-----|
|     |                              |     |
|     |                              |     |
|     |                              |     |
|     |                              |     |

    c. Graph the points on the coordinate plane.

    d. Find the slope between any two points.

    e. The slope you found in part (d) should be equal to the slope you noted in part (a). If so, connect the points to make the line that is the graph of an equation of the form $y = mx + b$ that has slope $m$.

    f. Note the location (ordered pair) that describes where the line intersects the $y$-axis.

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