

Lesson 3: Graphing Lines

CC attribute: *Beginning and Intermediate Algebra* by T. Wallace.



Objective: Graph a linear equation by creating a table of values for x . Identify the slope of a linear equation both graphically and algebraically.

Students will be able to:

- Create and populate a table of points for a given equation or graph.
- Calculate the slope of a line when given two points.

Prerequisite Knowledge:

- Plotting points on a coordinate plane.
- Identifying x - and y -coordinates.
- Conceptually understanding of slope.

Lesson:

Given a linear equation, such as $y = 2x - 3$, one may be interested in what solution(s) are possible for a given x or y . We can visualize the set of solutions by making a graph of all possible x and y combinations, or *coordinate pairs*, that satisfy this equation. Our corresponding graph will be a line, and any point on this line will make the equation $y = 2x - 3$ true. We will do this using a table of values.

Additionally, the slope of a line will be extremely useful for drawing conclusions about a linear equation and/or its graph.

Given two points (x_1, y_1) and (x_2, y_2) , the slope of the line through these points is defined as follows.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Whenever we calculate a slope, as we subtract the corresponding y and x coordinates from one another, it is important that we subtract them in the correct order.

I - Motivating Example(s):

Example:

Graph $y = 2x - 3$. Make a table of values. Any test values may be used.

x	y
-1	-5
0	-3
1	-1

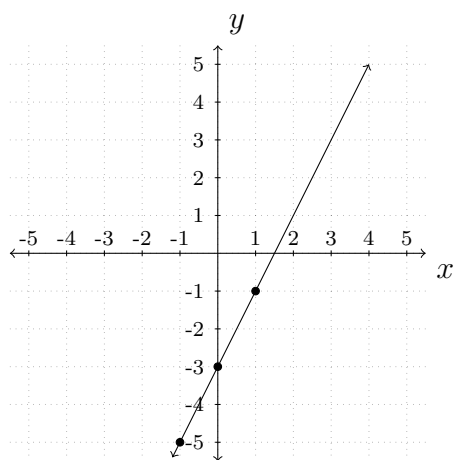
Evaluate each test value by replacing x with the given value.

$$x = -1 \quad y = 2(-1) - 3 = -2 - 3 = -5$$

$$x = 0 \quad y = 2(0) - 3 = 0 - 3 = -3$$

$$x = 1 \quad y = 2(1) - 3 = 2 - 3 = -1$$

$(-1, -5), (0, -3), (1, -1)$ These become our points to graph for our equation.



$(-1, -5), (0, -3),$ and $(1, -1)$

These become the points from our equation which we will plot on our graph.

Once the points are on the graph, connect the dots to make a line.

The graph is our solution.

Notice the graph also goes through the point $(2, 1)$. This means that the pair $(x, y) = (2, 1)$ will also satisfy the equation $y = 2x - 3$, which one can easily check.

Notice also that the slope of the line above is $m = 2$ or $\frac{2}{1}$. We can check this by using any two points from our table. We will use $(-1, -5)$ and $(0, -3)$.

$$m = \frac{-5 - (-3)}{-1 - 0} = \frac{-5 + 3}{-1} = \frac{-2}{-1} = 2 \checkmark$$

Example: Find the slope of the line through the given points.

$(-4, 3)$ and $(2, -9)$. Identify $x_1, y_1, x_2,$ and y_2 .

(x_1, y_1) and (x_2, y_2) Use the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$.

$$m = \frac{-9 - 3}{2 - (-4)}$$

Simplify.

$$m = \frac{-12}{6}$$

Reduce.

$$m = -2$$

Our solution.

II - Demo/Discussion Problems:

1. Make a table of points and use it to graph the linear equation $2x - 3y = 6$.
2. Find the slope of the line through the points $(-4, -1)$ and $(-4, -5)$.
3. Find the slope of the line through the points $(3, 1)$ and $(-2, 1)$.

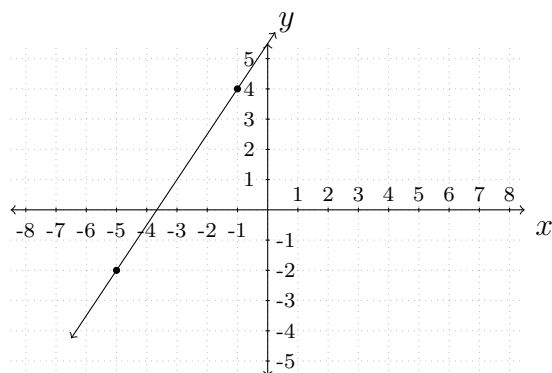
III - Practice Problems:

For each linear equation below, make a table of points and use it to graph the equation.

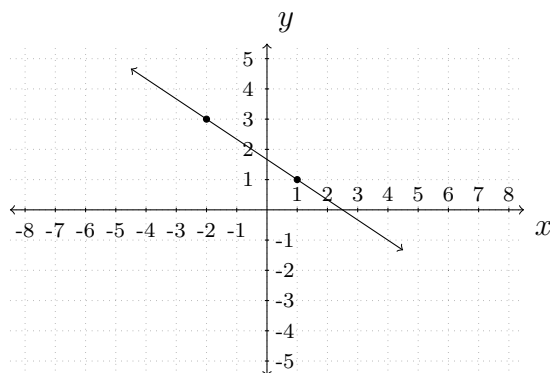
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|----------------------------|----------------------------|--------------------|---------------------|
| 1. $y = -\frac{1}{4}x - 3$ | 6. $y = \frac{5}{3}x + 4$ | 11. $x + 5y = -15$ | 16. $7x + 3y = -12$ |
| 2. $y = x - 1$ | 7. $y = \frac{3}{2}x - 5$ | 12. $8x - y = 5$ | 17. $x + y = -1$ |
| 3. $y = -\frac{5}{4}x - 4$ | 8. $y = -x - 2$ | 13. $4x + y = 5$ | 18. $3x + 4y = 8$ |
| 4. $y = -\frac{3}{5}x + 1$ | 9. $y = -\frac{4}{5}x - 3$ | 14. $3x + 4y = 16$ | 19. $x - y = -3$ |
| 5. $y = -4x + 2$ | 10. $y = \frac{1}{2}x$ | 15. $2x - y = 2$ | 20. $9x - y = -4$ |

Find the slope of each of the following lines.

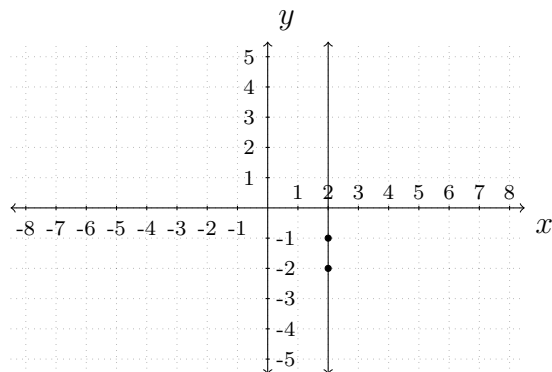
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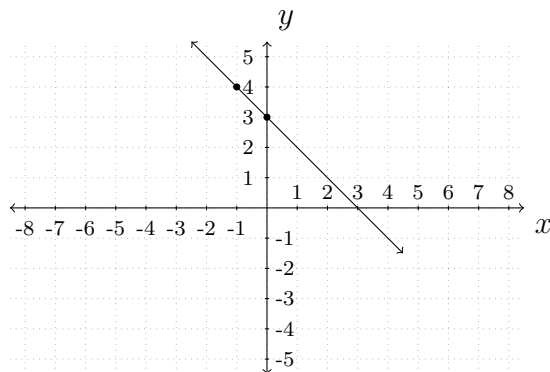
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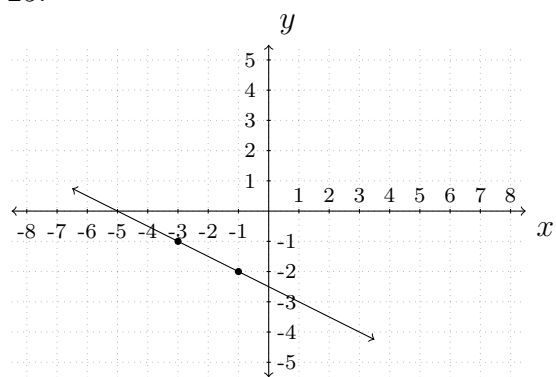
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