

Write Linear Equation by Graph

In earlier lessons, we learned how to graph a line given its equation. Today, we will learn how to write a line's equation given its graph.

[Example 1] Find the equation of the line in the graph.

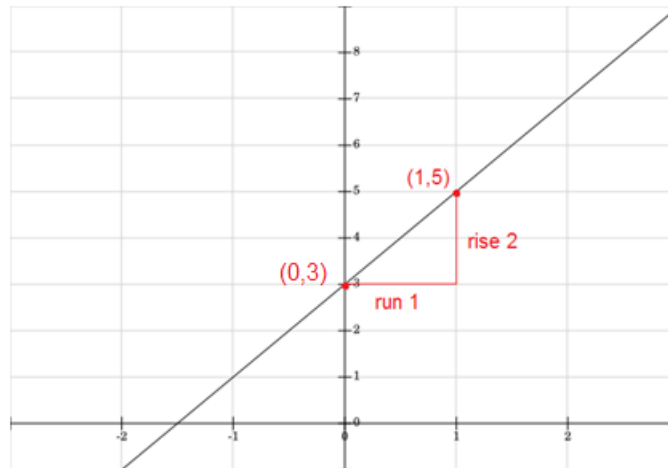


Figure 1: Graph of a line passing (0,3) and (1,5)

[Solution] Let's write the line's equation in slope-intercept form, $y = Mx + B$.

In the graph, it's easy to see the y-intercept is (0, 3), so we have $y = Mx + 3$.

Next, we pick two points on the line and draw a slope triangle, and we can see $slope = \frac{rise}{run} = \frac{2}{1} = 2$.

Solution: The line's equation is $y = 2x + 3$.

The next example involves fractional slope.

[Example 2] Find the equation of the line in the graph.

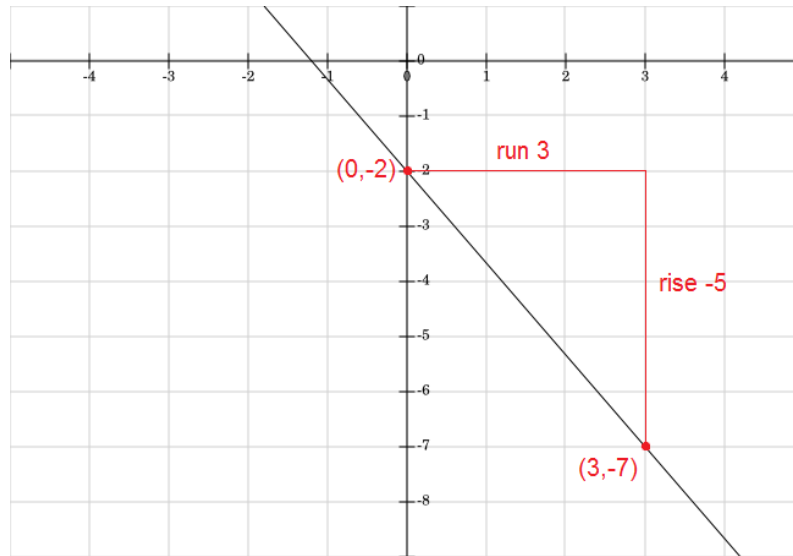


Figure 2: Graph of a line passing (0,-2) and (3,-7)

[Solution] It's easy to see this line's y-intercept: (0, -2). The equation must be $y = Mx - 2$.

Next, we need to find two points and draw a slope triangle. Note that the only two points with integer coordinates are (0, -2) and (3, -7). Picking any other point would end up with decimal or fractional values. It's always wise to pick points with integer coordinates.

Now we can see $slope = \frac{rise}{run} = \frac{-5}{3} = -\frac{5}{3}$. Note that when the value of x increases, the value of y decreases. In other words, the line goes "down". This implies the slope is negative.

Solution: The line's equation is $y = -\frac{5}{3}x - 2$.

Finally, we will learn how to write equations of two types of special lines.

[Example 3] Find the equation of these two lines.

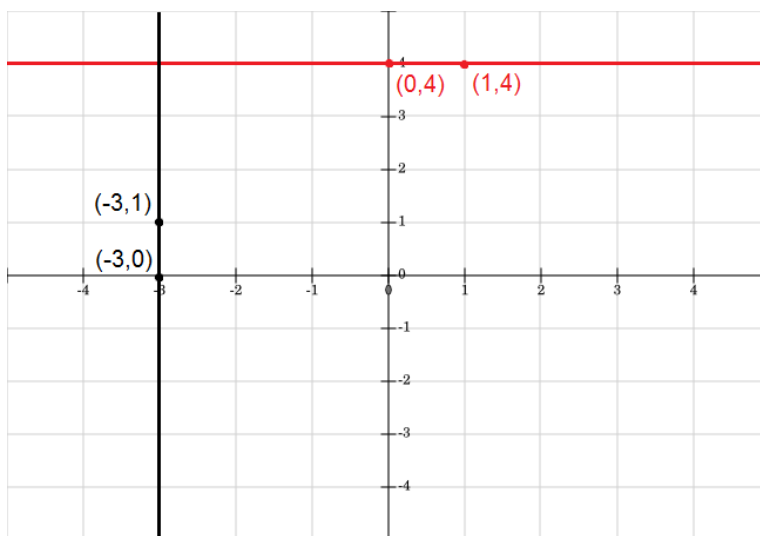


Figure 3: Graphs of two lines, a horizontal line passing (0, 4) and a vertical line passing (-3, 0)

[Solution] If a line is horizontal, its equation looks like $y = b$.

If a line is vertical, its equation looks like $x = a$.

Instead of trying to memorize the above rules, think this way. Pick two points on the horizontal line randomly. In the graph, we picked (0, 4) and (1, 4). We can see the y-value of any point on the horizontal line is always 4. That's why the horizontal line's equation is $y = 4$.

Similarly, pick two points on the vertical line: (-3, 1) and (-3, 0). We can see the x-value of any point on the vertical line is -3. That's why the vertical line's equation is $x = -3$.

When the y-intercept of a line is not given in a graph, or if the y-intercept is not an integer, it would be very difficult to write a line's equation by graph. We will learn how to find such equations in later lessons.