## Lesson 9: Equations of Lines

* Let’s investigate equations of lines.

### 9.1: Remembering Slope



The slope of the line in the image is . Explain how you know this is true.

### 9.2: Building an Equation for a Line

1. The image shows a line.

* 
  1. Write an equation that says the slope between the points and is 2.
  2. Look at this equation:   
     How does it relate to the equation you wrote?

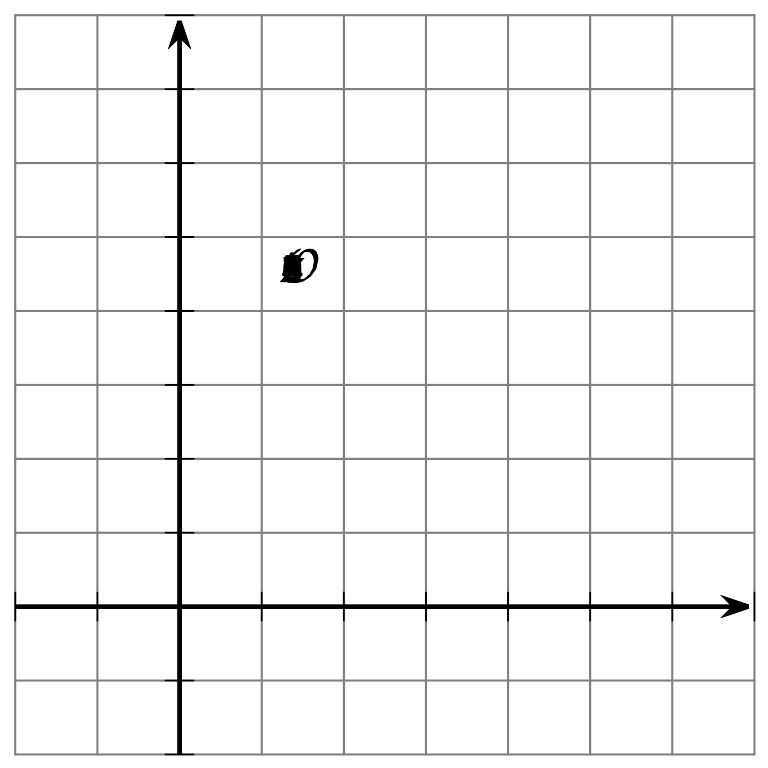
1. Here is an equation for another line:
   1. What point do you know this line passes through?
   2. What is the slope of this line?
2. Next, let’s write a general equation that we can use for any line. Suppose we know a line passes through a particular point .
   1. Write an equation that says the slope between point and is .
   2. Look at this equation: . How does it relate to the equation you wrote?

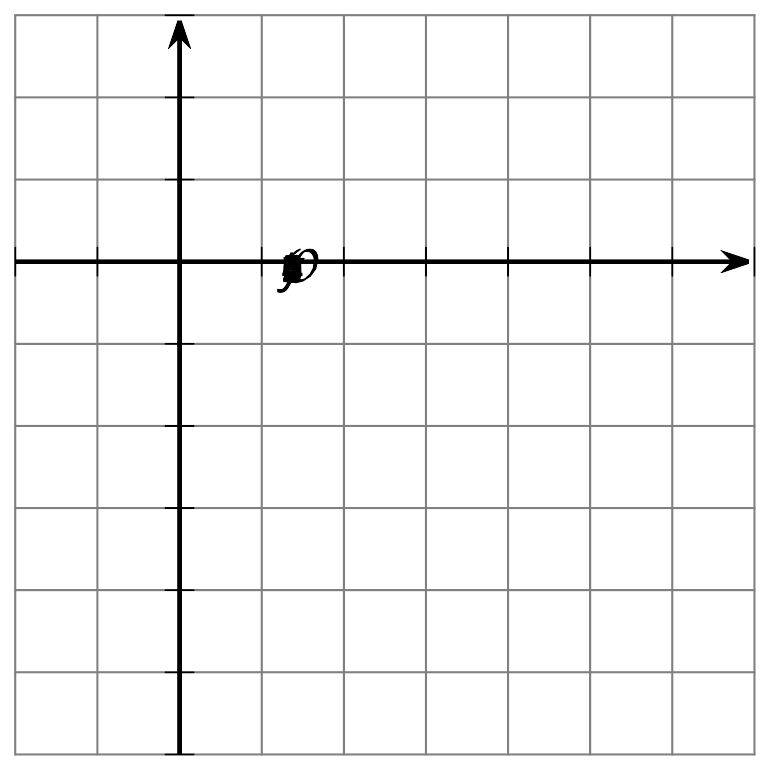
### 9.3: Using Point-Slope Form

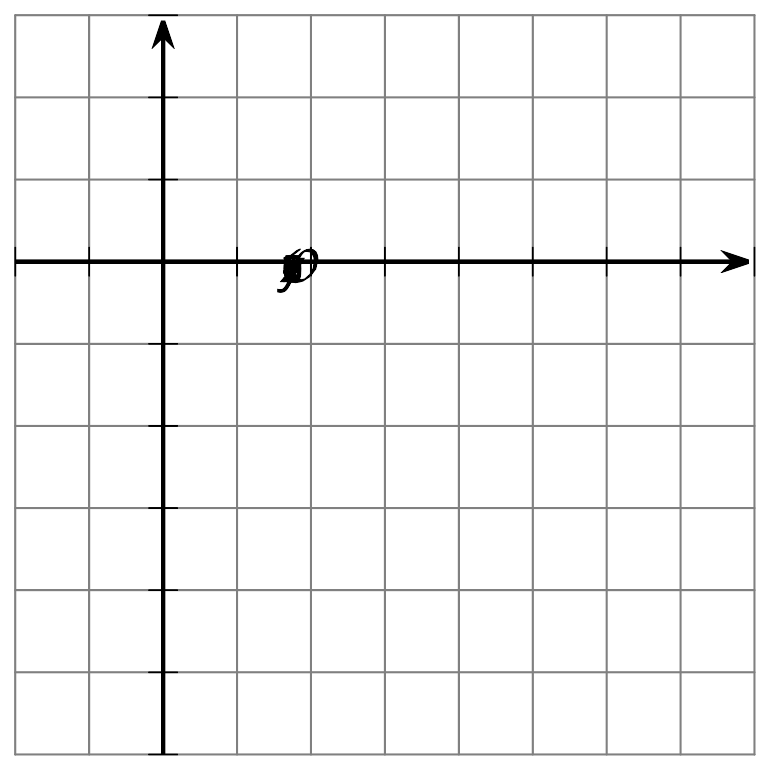
1. Write an equation that describes each line.
   1. the line passing through point with slope
   2. the line passing through point with slope
   3. the line passing through point with slope -1
   4. the line in the image
   * 
2. Using the structure of the equation, what point do you know each line passes through? What’s the line’s slope?

#### Are you ready for more?

Another way to describe a line, or other graphs, is to think about the coordinates as changing over time. This is especially helpful if we’re thinking tracing an object’s movement. This example describes the - and -coordinates separately, each in terms of time, .







1. On the first grid, create a graph of for with on the vertical axis and on the horizontal axis.
2. On the second grid, create a graph of for with on the vertical axis and on the horizontal axis.
3. On the third grid, create a graph of the set of points for on the -plane.

### Lesson 9 Summary

The line in the image can be defined as the set of points that have a slope of 2 with the point . An equation that says point has slope 2 with is . This equation can be rearranged to look like .



The equation is now in **point-slope form**, or , where:

* is any point on the line
* is a particular point on the line that we choose to substitute into the equation
* is the slope of the line

Other ways to write the equation of a line include slope-intercept form, , and standard form, .

To write the equation of a line passing through and , start by finding the slope of the line. The slope is because . Substitute this value for to get . Now we can choose any point on the line to substitute for . If we choose , we can write the equation of the line as .

We could also use as the point, giving . We can rearrange the equation to see how point-slope and slope-intercept forms relate, getting . Notice is the -intercept of the line. The graphs of all 3 of these equations look the same.



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