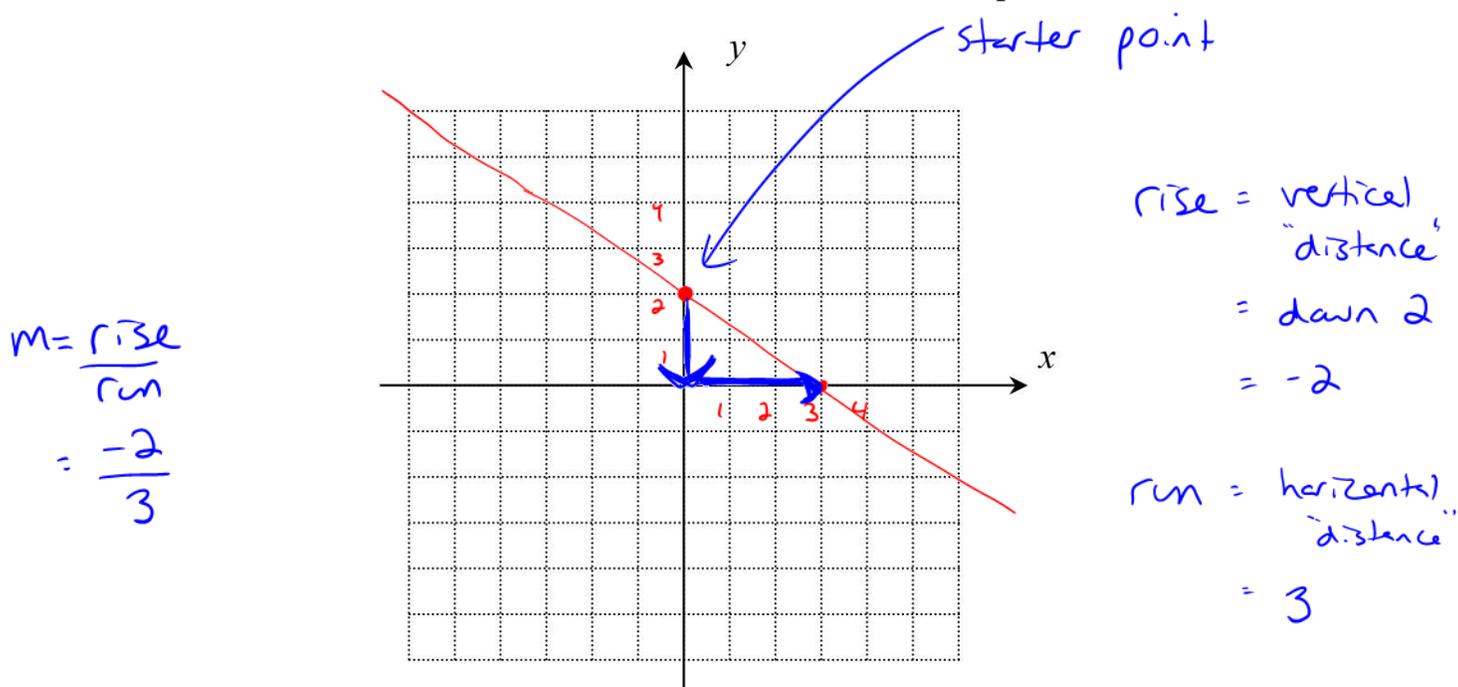


Math 135: Section 5.3: The Slope of a Line

The slope of a straight line is defined to be

$$m = \frac{\text{rise}}{\text{run}}$$

where “rise” is the vertical distance between any two points on the line, and “run” is the horizontal distance between the same two points.



From this definition, we can get a formula for slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

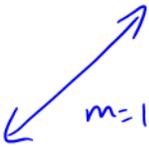
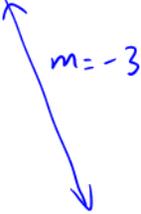
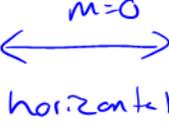
where (x_1, y_1) is one point on the line and (x_2, y_2) is a different point on the line.

Example: Find the slope of the line that passes through (3, 6) and (1, 2).

method #1

<p>① (3, 6) ② (1, 2)</p>	$m = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{2 - 6}{1 - 3}$ $= \frac{-4}{-2}$ $= 2$	<p>① (1, 2) ② (3, 6)</p>	$m = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{6 - 2}{3 - 1}$ $= \frac{4}{2}$ $= 2$
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Different types of slopes give different looking lines:

Positive	Negative	Zero	Undefined
			
		<i>no rise</i>	<i>no run</i>

Slope-Intercept Form of a Linear Equation

When the equation of a line is in slope-intercept form, it looks like

$$y = mx + b$$

where m and b are numbers and x and y are variables.

Examples:

- $y = 2x + 3$

- $y = -\frac{4}{3}x + 7$

← what is the y-intercept? set $x=0$ and find y
 $y = 2 \cdot 0 + 3 = 3$

The numbers m and b are the defining characteristics of the line:

- m is the slope
- $(0, b)$ is the y-intercept

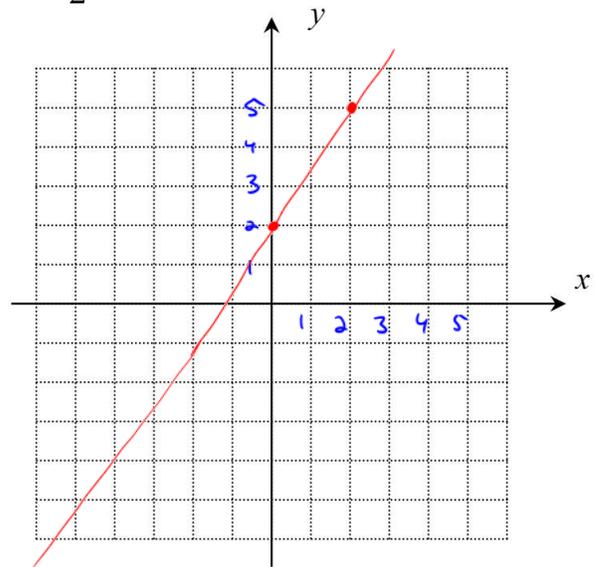
Graphing a Linear Equation using the Slope (Method 3)

To graph linear equations using slope-intercept form:

1. Plot the y-intercept.
2. Count out the slope (up rise, right run) and put a point there.
3. Connect the dots!

Example 5: Graph the line with slope $m = \frac{3}{2}$ and y-intercept $(0, 2)$.

$$m = \frac{\text{rise}}{\text{run}} = \frac{3}{2}$$

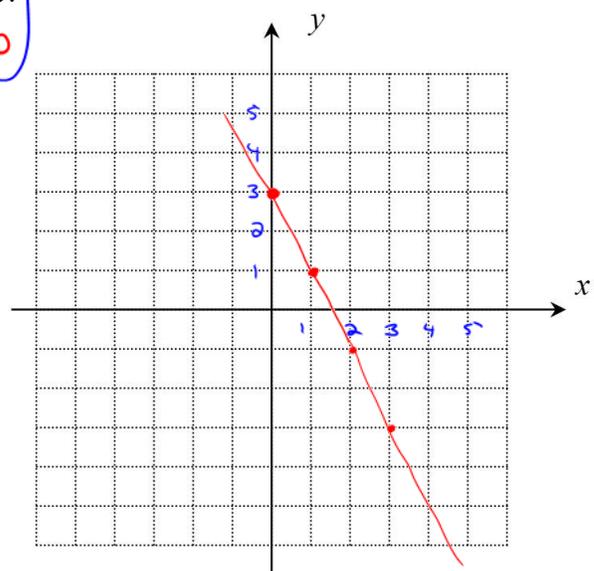


Example 6: Graph the line $y = -2x + 3$.

$$y = mx + b$$

$$m = \frac{-2}{1} = \frac{\text{rise}}{\text{run}}$$

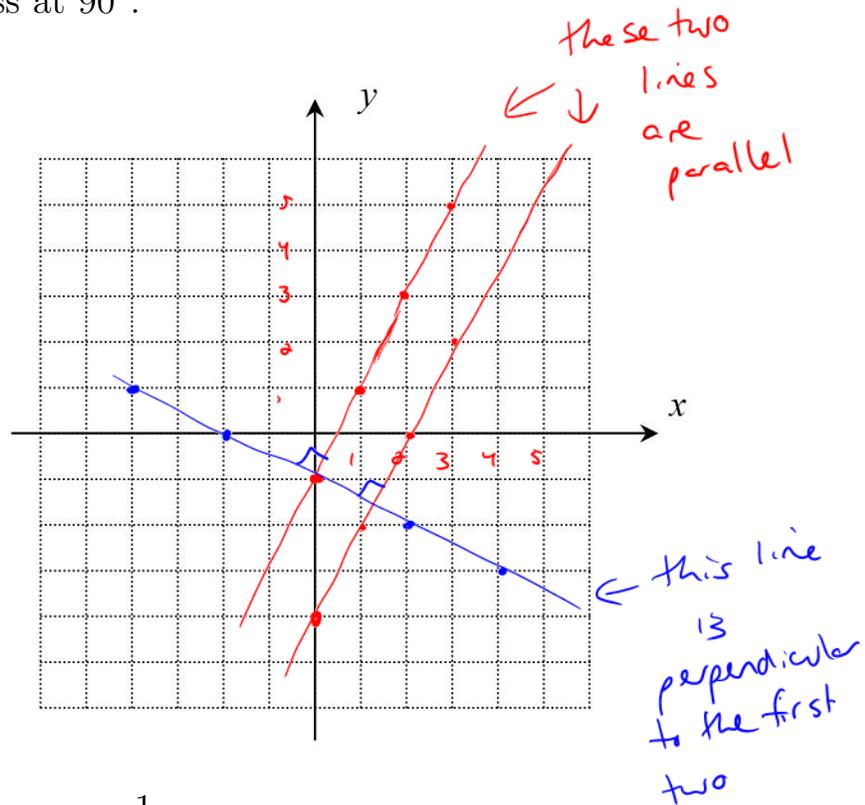
$$\text{y-int is } (0, b) = (0, 3)$$



Parallel and Perpendicular Lines

Two lines are parallel if they have the same slope. Parallel lines never cross.

Two lines are perpendicular if their slopes are negative reciprocals (like $\frac{2}{3}$ and $-\frac{3}{2}$). Perpendicular lines cross at 90° .



Example 6: Suppose a line has a slope of $\frac{1}{2}$.

a) What would be the slope of a parallel line?

same $\frac{1}{2}$

b) What would be the slope of a perpendicular line?

-2 (negative reciprocal)

Example 7: Find the slope of a line that is perpendicular to the line $y = 3x - 4$.

new line = $-\frac{1}{3}$

$y = mx + b$
 $m = 3$