

Lines in the Coordinate Plane

Lesson Objective INBAT find and use slopes of lines to determine if lines are $\parallel$ or $\perp$; graph lines.

Algebra 1 Review

In Algebra 1, you learned how to find the slope of a line in the coordinate plane.

Slope: The slope of a line is a number that describes the steepness of the line.

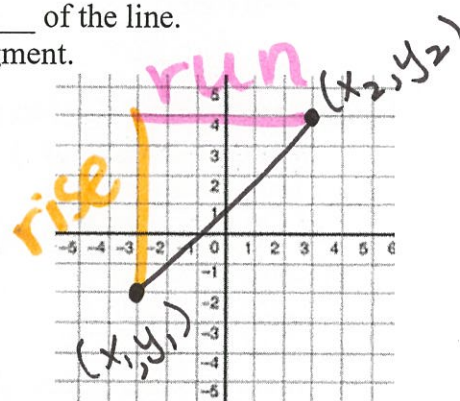
→ ANY two points can be used to determine the slope of a line or line segment.

The rise is the difference in the y-values $y_2 - y_1$

The run is the difference in the x-values $x_2 - x_1$

The slope is the ratio of the rise to the run.

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



Examples:

- Use the slope formula to determine the slope of $\overline{GH}$ if $G(2, 3)$ and $H(7, 5)$.

$$m = \frac{5 - 3}{7 - 2} = \frac{2}{5}$$

Summary: Slope of a Line

Positive Slope	Negative Slope	Zero Slope	Undefined Slope
		 * $y_2 - y_1 = 0$	 * $x_2 - x_1 = 0$

More Algebra 1 Review

In Algebra 1, you learned how to graph lines in the coordinate plane using these formulas:

#1	Slope-Intercept Form	$y = mx + b$	m is the slope b is the y-intercept
#2	Point-Slope Form	$y - y_1 = m(x - x_1)$	m is the slope (x_1, y_1) is a point is on the line

Graphing #1: Slope-Intercept Form

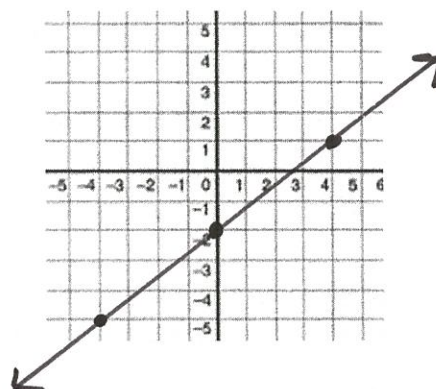
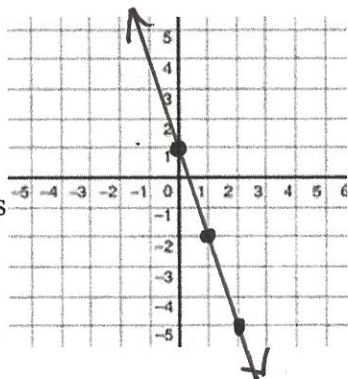
$$y = mx + b$$

$$2. y = -3x + 1$$

$$m = -3 = \frac{-3 \text{ rise}}{1 \text{ run}}$$

$$3. y = \frac{3}{4}x - 2$$

- (1) Graph the y-int (b)
- (2) From the y-int, plot new points using the slope (m) "rise/run"
- (3) Make at least 3 points
- (4) Connect the points with a straightedge



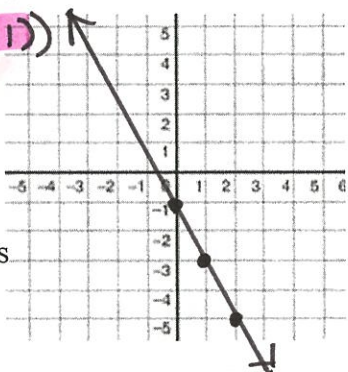
Graphing #2: Point-Slope Form

$$y - y_1 = m(x - x_1)$$

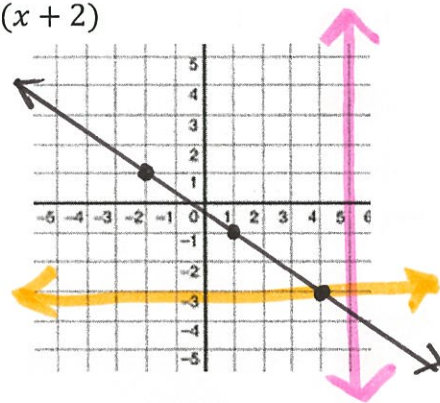
$$4. y + 3 = -2(x - 1)$$

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

- (1) Graph the point (x_1, y_1)
- (2) From this point, plot new points using the slope (m) "rise/run"
- (3) Make at least 3 points
- (4) Connect the points with a straightedge



$$5. y - 1 = -\frac{2}{3}(x + 2)$$



Vertical Lines	The equation of a vertical line is $x = h$, where h is the x -intercept.	Example: $x = 5$
Horizontal Lines	The equation of a horizontal line is $y = k$, where k is the y -intercept.	Example: $y = -3$

Connecting it to Geometry

Parallel Lines Theorem ($\parallel$ Lines Thm)	In a coordinate plane, two distinct non-vertical lines are parallel if and only if they have the <u>same</u> slope. Also, any two vertical lines are parallel.
Perpendicular Lines Theorem ($\perp$ Lines Thm)	In a coordinate plane, two distinct non-vertical lines are perpendicular if and only if the <u>product</u> of their slopes is <u>-1</u> . Also, horizontal lines are perpendicular to vertical lines.

Example:

6. Determine which of the lines are parallel and which of the lines are perpendicular.

$$m_a = \frac{3 - 2}{0 - (-3)} = \frac{1}{3}$$

$$m_d = \frac{2 - 0}{-3 - (-2)} = \frac{2}{-1} = -2$$

$$m_b = \frac{0 - (-1)}{2 - 0} = \frac{1}{2}$$

b // c : same slopes!

$$m_c = \frac{-4 - (-5)}{1 - (-1)} = \frac{1}{2}$$

b $\perp$ d and c $\perp$ d : $(\frac{1}{2})(-2) = -1$

