

# LINEAR EQUATIONS

## Formulas for Graphing and Writing Equations of Lines

Slope Formula	Slope-intercept form of a line	Point-slope form of a line
$m = \frac{y_2 - y_1}{x_2 - x_1}$	$y = mx + b$	$y - y_1 = m(x - x_1)$

### Graphing Methods

#### Plotting points

x	y

Choose  $x$ , and then calculate  $y$ . Plot at least two points (three or four is better), and draw the line.

#### Intercepts

x	y
0	
	0

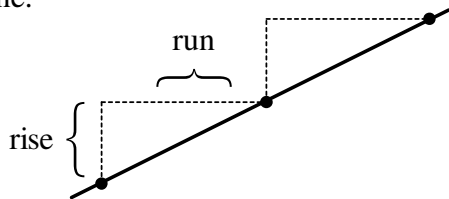
Plug in 0 for each variable (one at a time) to find the  $x$ - and  $y$ -intercepts. Then plot them and draw the line.

Use a different method if intercepts are  $(0,0)$ .

#### Slope and y-intercept

Put the equation into the form  $y = mx + b$ .

Plot the  $y$ -intercept. Then use the slope to find more points and build a staircase. Draw the line.



Remember, if you read from left to right:

- Positive slope goes upstairs.
- Negative slope goes downstairs.

#### Other Facts about Slopes:

- Parallel lines have the same slope.
- Perpendicular lines have slopes where the slope of one line is the negative reciprocal of the slope of the other line.

Example:  $-\frac{5}{8}$  and  $\frac{+8}{5}$

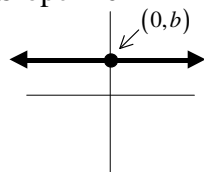
### Horizontal and Vertical lines

Equations have only one variable ( $x$  or  $y$ , but not both). Other formulas do not necessarily apply.

#### Horizontal

Equation:  $y = b$

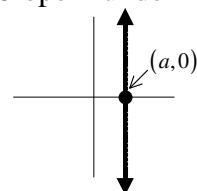
Slope = 0



#### Vertical

Equation:  $x = a$

Slope = undefined



# Using Linear Formulas

**Finding the equation of a line when given 2 points** (NOTE: If you are given the slope and one point, start with Step 2.)

EXAMPLE: Write the equation of the line passing through  $(-2, 6)$  and  $(-4, -5)$ .

**Step 1:** Find the slope of the line using the slope formula. Label the first point  $(x_1, y_1)$  and label the second point  $(x_2, y_2)$ . Substitute  $(x_1, y_1)$  and  $(x_2, y_2)$  into the slope formula. Be careful to subtract in the correct order and watch your signs!

EXAMPLE:

Substitute  $(-2, 6)$  for  $(x_1, y_1)$  and  $(-4, -5)$  for  $(x_2, y_2)$  into the slope formula and simplify.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{(-5) - (6)}{(-4) - (-2)} = \frac{-11}{-2} = \frac{11}{2}$$

**Step 2:** Use point-slope form to write the equation of the line. Substitute the slope you found in step 1 and one of the given points (you can use either point) into the point-slope form and simplify.

EXAMPLE:

Substitute  $(-2, 6)$  for  $(x_1, y_1)$  and  $\frac{11}{2}$  for  $m$  (from step 1) into the point-slope form and simplify.

$$y - y_1 = m(x - x_1) \rightarrow y - 6 = \frac{11}{2}(x - (-2))$$

$$y - 6 = \frac{11}{2}(x + 2) \quad \text{We now have the equation of the line in point-slope form.}$$

**Finally, if you are instructed to write your answer in slope-intercept form, then you need to solve the point-slope equation for  $y$ .**

EXAMPLE:

$$y - 6 = \frac{11}{2}x + 11 \quad \text{distribute the slope}$$

$$y - 6 + 6 = \frac{11}{2}x + 11 + 6 \quad \text{add 6 to both sides}$$

$$y = \frac{11}{2}x + 17 \quad \text{slope - intercept form}$$