

# Equations of Linear Relations Lesson #1: The Equation of a Line in Slope y-intercept Form $\rightarrow y = mx + b$

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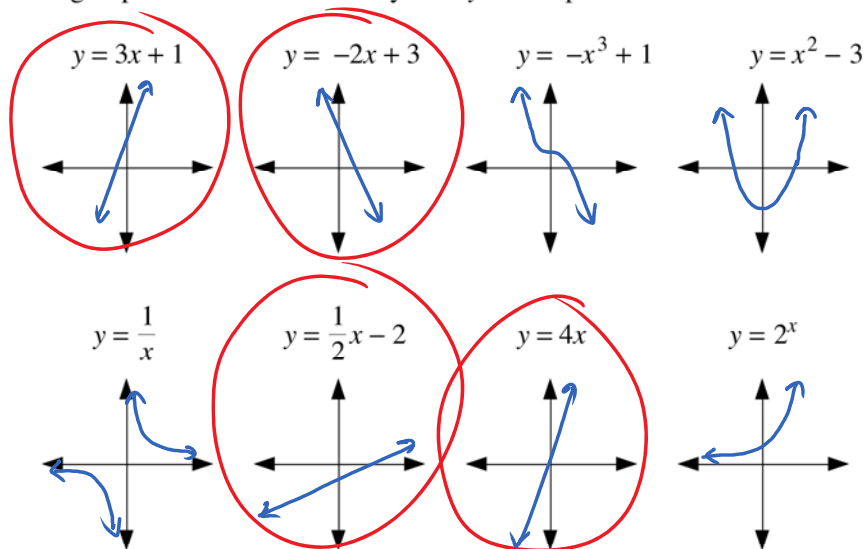
## Overview of Unit

In this unit we express the equation of a linear relation in three different forms: slope y-intercept form, point-slope form, and general form. We relate linear relations expressed in these forms to their graphs.

We also determine the linear relation given: a graph, a table of data points, a point and the slope, two points, a point and the equation of a parallel or perpendicular line.

## Investigating the Graphs of Linear and Non-Linear Relations

- a) The equations of the graphs of some relations are given. In each case, use a graphing calculator to sketch the graph of the relation and make a rough sketch of the graph on the grid provided. Do not list any  $x$ - or  $y$ -intercepts.



- b) List the equations of the graphs as linear or non-linear.

LINEAR:  $y = 3x + 1$   $y = -2x + 3$   $y = \frac{1}{2}x - 2$   $y = 4x$

NON-LINEAR:  $y = -x^3 + 1$   $y = x^2 - 3$   $y = \frac{1}{x}$   $y = 2^x$

- c) Compare the lists. Write a rule from the equation which can be used to determine whether the graph is a straight line or not.

The exponent of  $x$  and  $y$  must be 1

### Linear Equation

A **linear equation** is an equation of the form  $y = mx + b$ , where  $m, b \in \mathbb{R}$ .  
The graph of a linear equation is a straight line.

### Investigating $m$ and $b$ in the equation $y = mx + b$

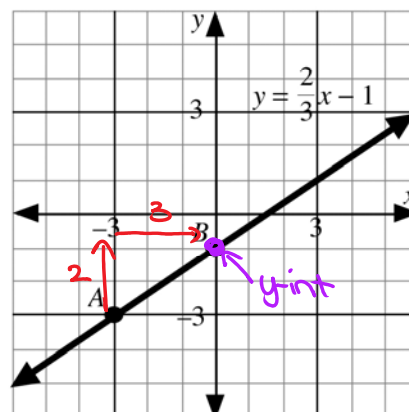
#### Part One

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

Jenine used a graphing calculator to sketch the graph of the linear equation  $y = \frac{2}{3}x - 1$ .  
Her sketch is shown on the grid.

- a) Use the sketch and points A and B to find the slope and y-intercept of the graph of  $y = \frac{2}{3}x - 1$ .

Slope =  $\frac{2}{3}$       y-int = -1

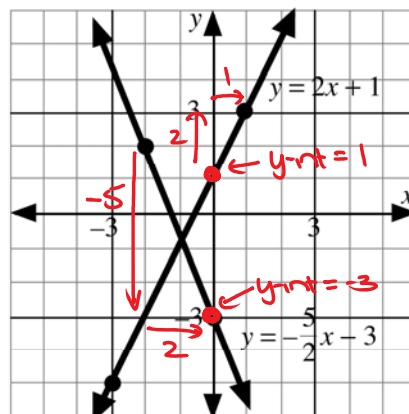


- b) Compare the values found in a) with the coefficient of  $x$  and the constant term in the equation  $y = \frac{2}{3}x - 1$ .

$\frac{2}{3}$  is the slope  
 $-1$  is the y-intercept

- c) Jenine sketched the graphs of two more linear equations. Use the grid to determine the slope and y-intercept of each graph.

equation	slope	y-intercept
$y = 2x + 1$	2	1
$y = -\frac{5}{2}x - 3$	$-\frac{5}{2}$	-3

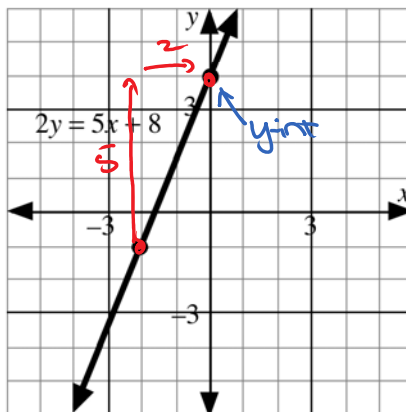


- d) Make a conjecture about the slope and y-intercept of the graph of the linear equation  $y = mx + b$ .

$m$  = slope  
 $b$  = y-int

**Part Two**

Hashib used a graphing calculator to graph the linear equation  $2y = 5x + 8$ . The graph is shown on the grid.



- a) Use the sketch to determine the slope and y-intercept of the graph of  $2y = 5x + 8$ .

slope =  $\frac{5}{2}$       y-int = 4

- b) Explain why, in this case, the slope is not 5 (the coefficient of  $x$ ) and the y-intercept is not 8 (the constant term).

$y$  has a coefficient of 2

$$\begin{aligned} \cancel{2}y &= \cancel{2}(5x + 8) \\ &\downarrow \text{solve for } y \\ y &= \frac{5}{2}x + 4 \end{aligned}$$

**Slope y-intercept Form of the Equation of a Line  $\rightarrow y = mx + b$**

The graph of an equation in the form  $y = mx + b$  (or a function in the form  $f(x) = mx + b$ ) is a straight line with **slope  $m$**  and **y-intercept  $b$** .

The equation  $y = mx + b$  is known as the **slope y-intercept form** of the equation of a line.

The graph of an equation in this form can be drawn without making a table of values.



Determine the slope and y-intercept of the graph of each linear equation listed below:

a)  $y = 3x + 2$

slope = 3  
y-int = 2

b)  $y = 7 - \frac{2}{3}x$

slope =  $-\frac{2}{3}$   
y-int = 7

c)  $\cancel{6}y = \frac{8x+1}{\cancel{6}}$

$y = \frac{4}{3}x + \frac{1}{6}$   
slope =  $\frac{4}{3}$       y-int =  $\frac{1}{6}$

### Graphing an Equation of the Form $y = mx + b$

In this section, we will look at two ways of sketching the graph of a linear equation without using a graphing calculator or a table of values.



Consider the equation  $y = 2x - 5$ .

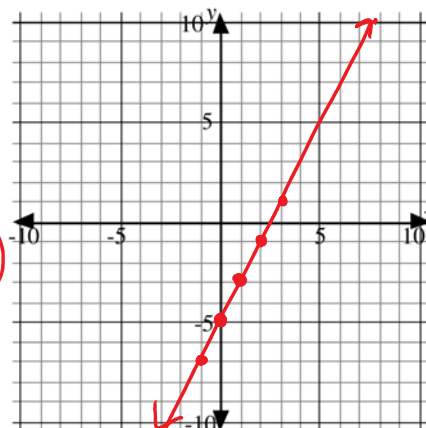
- a) State the slope and y-intercept.

$\text{slope} = 2 \quad \text{y-int} = -5$

- b) Mark the y-intercept on the grid.

- c) Use the y-intercept and the formula  $\text{slope} = \frac{\text{rise}}{\text{run}}$  to mark three other points on the grid. Join the points together, and extend the line.

- d) Verify the graph using a graphing calculator.



Consider the equation  $y = \frac{2}{3}x - 6$ .

- a) State the y-intercept.

$\text{y-int} = -6$

- b) Determine the  $x$ -intercept algebraically.

where  $y=0$

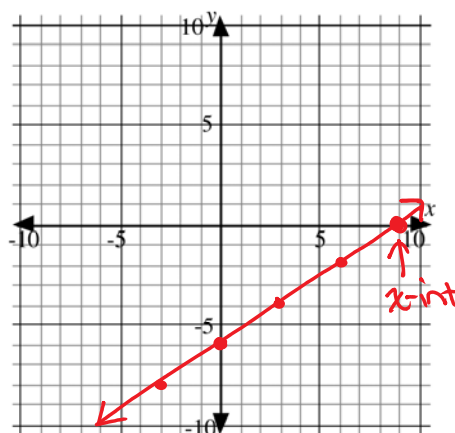
$$0 = \frac{2}{3}x - 6$$

$$6 = \frac{2}{3}x$$

$$18 = 2x \rightarrow x = 9 \text{ (x-int)}$$

- c) Mark the  $x$ - and  $y$ -intercepts on the grid. Join the points together, and extend the line.

- d) Verify the graph and the intercepts using a graphing calculator.



### Complete Assignment Questions #1 - #14