

3. Equations and their Graphs

3.1 Use the Rectangular Coordinate System

3.1 Exercise Set, page 312 (294): 1, 5, 7, 11, 15, 19, 25

3.2 Graph Linear Equations in Two Variables

3.2 Exercise Set, page 346 (328): 1, 3, 21, 25, 27, 33

3.3 Graphs with Intercepts-optional

3.3 Exercise Set, page 373 (355): 10,16

3.4 Understand Slope of a Line-optional

3.4 Exercise Set, page 409 (391): 1, 3, 9, 10, 13, 19, 28

Exam 1		stem & leaf		
65.9375	mean			A-0
13.66001	st.dev			B - 2
71	median	8	14	C - 7
39	min	7	0225599	D -2
84	max	6	13	F - 5
16	count	5	134	
		4	7	
		3	9	

3.3

Memorize

Intercepts of a line

The points where a line crosses the x - axis and the y - axis are called the intercepts of a line.

Memorize

x - intercept and y - intercept of a line

The x - intercept is the point $(a, 0)$ where the line crosses the x - axis.

The y - intercept is the point $(0, b)$ where the line crosses the y - axis.

Memorize

Find the x - and y - intercepts from the equation of a line

Use the equation of the line. To find:

- the x - intercept of the line, let $y = 0$ and solve for x .
- the y - intercept of the line, let $x = 0$ and solve for y .

Memorize

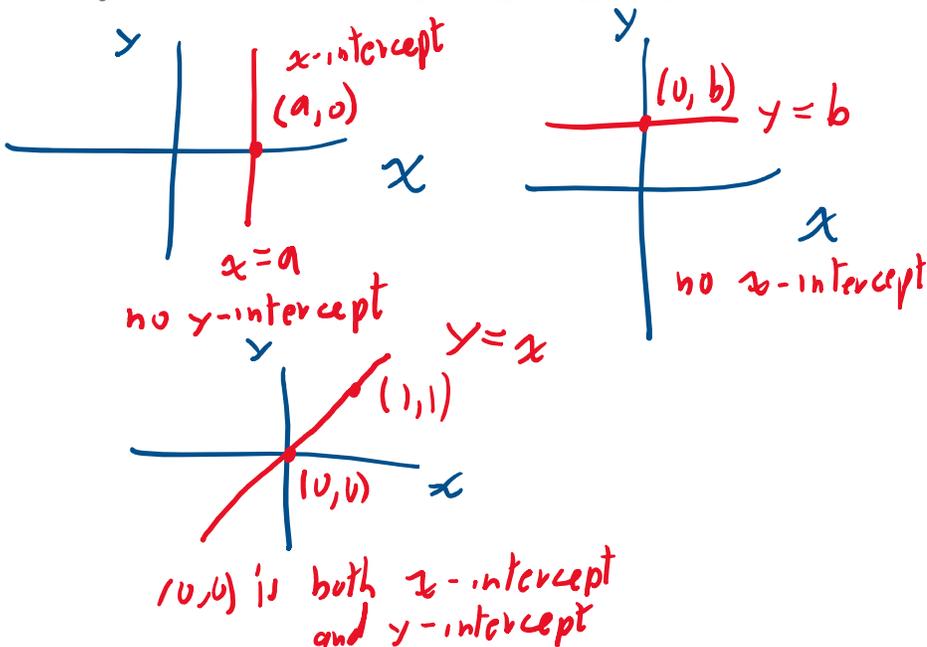
HOW TO: Graph a linear equation using the intercepts

The steps to graph a linear equation using the intercepts are summarized below.

1. Find the x - and y - intercepts of the line.
 - Let $y = 0$ and solve for x
 - Let $x = 0$ and solve for y .
2. Find a third solution to the equation.
3. Plot the three points and check that they line up.
4. Draw the line.

Memorize

- If it only has one variable, it is a vertical or horizontal line.
 - $x = a$ is a vertical line passing through the x - axis at a
 - $y = b$ is a horizontal line passing through the y - axis at b .



Given the line $2x + 3y = 6$
Find and plot the x -intercept
and y -intercept, and graph the
line through them

x -intercept
set $y = 0$, solve for x

$$2x + 3(0) = 6$$

$$2x = 6$$

$$x = 3$$

or the point $(3, 0)$

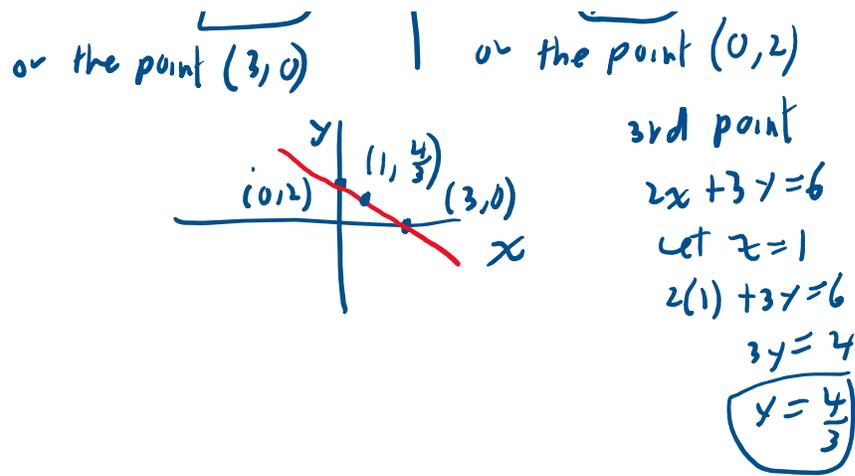
y -intercept
set $x = 0$, solve for y

$$2(0) + 3y = 6$$

$$3y = 6$$

$$y = 2$$

or the point $(0, 2)$



3.4

Memorize

Slope of a line

The slope of a line is $m = \frac{\text{rise}}{\text{run}}$.

The rise measures the vertical change and the run measures the horizontal change between two points on the line.

Memorize

Positive and negative slopes

We 'read' a line from left to right just like we read words in English. As you read from left to right, the line is going up; it has positive slope. The line is going down; it has negative slope.

Memorize

Slope formula

The slope of the line between two points (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{change in } y}{\text{change in } x}$$

This is the slope formula.

The slope is:

y of the second point minus y of the first point
 over
 x of the second point minus x of the first point.

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

$$\begin{aligned} \text{proof } \frac{y_2 - y_1}{x_2 - x_1} &= \frac{(-1)(y_2 - y_1)}{(-1)(x_2 - x_1)} \\ &= \frac{-y_2 + y_1}{-x_2 + x_1} \\ &= \frac{y_1 - y_2}{x_1 - x_2} \end{aligned}$$

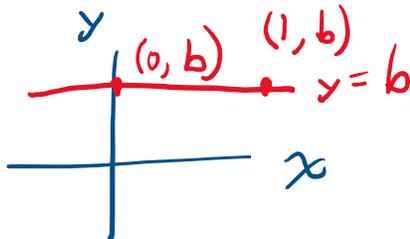
Memorize

- **Slope of a Horizontal Line**

- The slope of a horizontal line, $y = b$, is 0.

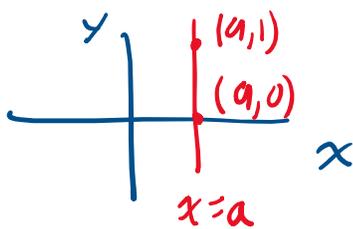
- **Slope of a vertical line**

- The slope of a vertical line, $x = a$, is undefined



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{b - b}{1 - 0} = \frac{0}{1} = 0$$

\therefore slope = 0

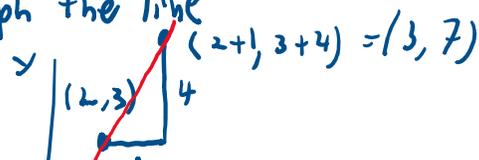


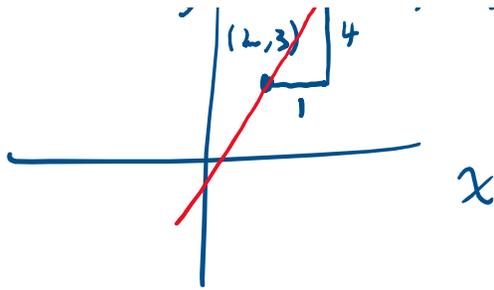
$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 0}{a - a} = \frac{1}{0} \text{ not defined}$$

Given a point $(2, 3) = (x_1, y_1)$

and slope = 4 = $\frac{4}{1}$

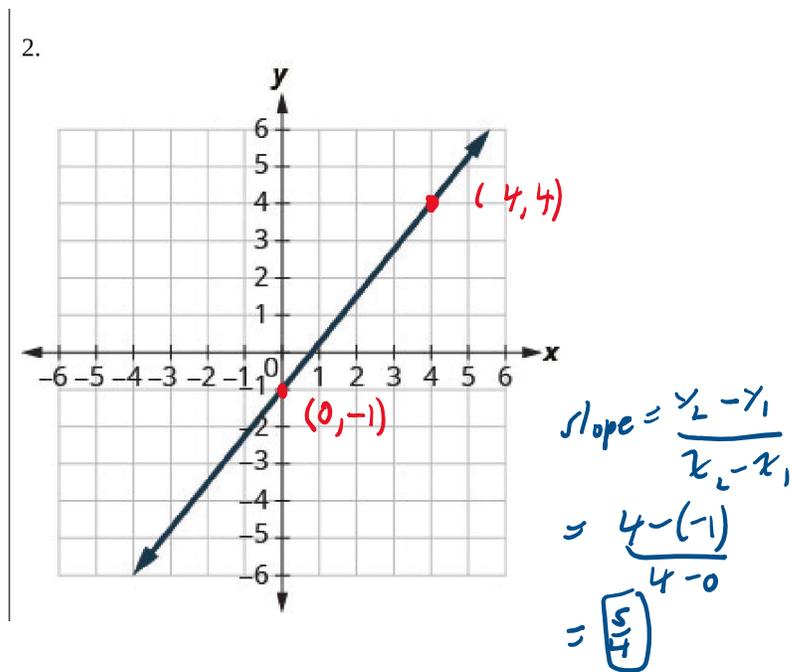
graph the line





3.4 Exercise Set

In the following exercises, find the slope of each line shown.



3.5

Memorize

Slope-intercept form of an equation of a line

The slope-intercept form of an equation of a line with slope m and y -intercept, $(0, b)$ is,

$$y = mx + b$$

EXAMPLE 3

Identify the slope and y -intercept of the line with equation $x + 2y = 6$.

Write the equation in the form $y = mx + b$.
Calculate and plot the x-intercept

$$x + 2y = 6$$

solve for y

$$2y = -x + 6$$

$$y = -\frac{x}{2} + \frac{6}{2}$$

$$y = \left(-\frac{1}{2}\right)x + 3$$

$$m = -\frac{1}{2}$$

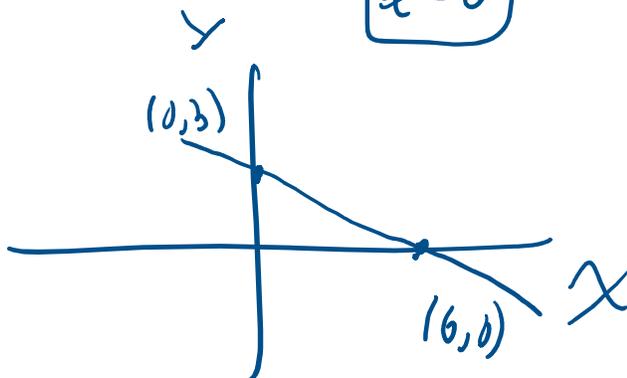
$$b = 3$$

$$x + 2y = 6$$

let $y = 0$, solve for x

$$x + (2)(0) = 6$$

$$x = 6$$



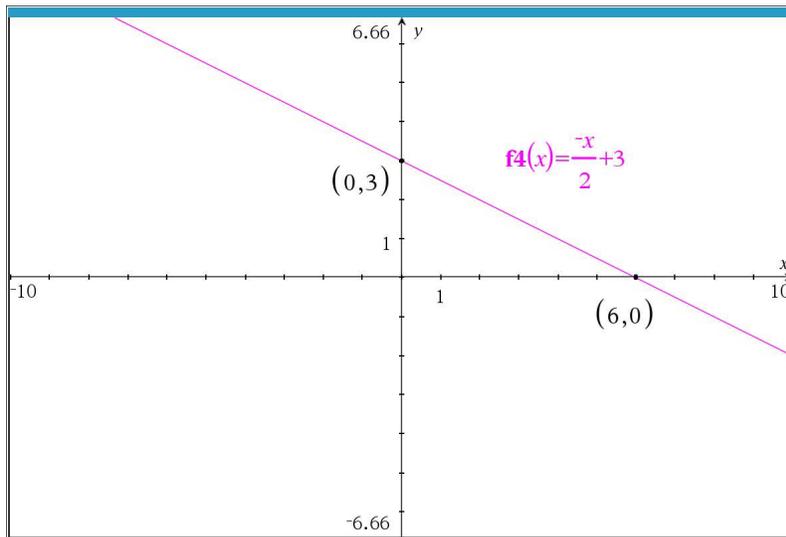
The calculator graph supports my algebra.

bad notation

$$-\frac{1}{2}x$$

good notation

$$\left(-\frac{1}{2}\right)x = -\frac{x}{2}$$



Quiz 2

Let $3x + 4y = 12$

Find the x-intercept and y-intercept and use these to graph the line.

Find the slope of the line.

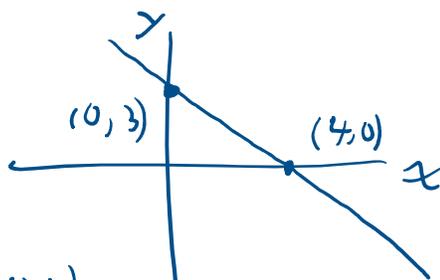
x-intercept
set $y = 0$, solve for x

$$3x + 4(0) = 12$$

$$3x = 12$$

$$x = 4$$

or the point $(4, 0)$



from graph,
slope = $\frac{\Delta y}{\Delta x} = -\frac{3}{4}$

y-intercept
set $x = 0$, solve for y

$$3(0) + 4y = 12$$

$$4y = 12$$

$$y = 3$$

or the point $(0, 3)$

another way to find slope

$$3x + 4y = 12$$

solve for y

$$4y = -3x + 12$$

$$y = \left(-\frac{3}{4}\right)x + \frac{12}{4}$$

$$y = \left(-\frac{3}{4}\right)x + 3$$

$$\text{slope} = -\frac{3}{4}$$