01-28-25 MTH 161

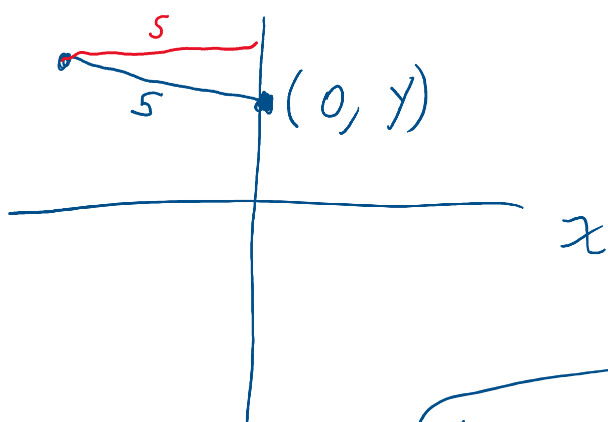
1 Relations and Functions
 1.1 Sets of Real Numbers and the Cartesian Coordinate Plane
 1.1.4 Exercises
 page 14: 1, 3, 5, 11, 17, 23, 31

1.2 Relations
 1.2.2 Exercises
 page 29: 1, 3, 7, 18, 21, 22, 27, 37, 41, 50

Your Name MTH 161-004N quiz 1
Open homework, closed book, closed notes, calculator OK.
1.1: 31

31. Find all of the points on the y-axis which are 5 units from the point $(-5, 3)$.

$(-5,3)$ y $(0,3)$



$$5 = \sqrt{(0-(-5))^2 + (y-3)^2}$$

solve for y

$$25 = 25 + (y-3)^2$$

$$(y-3)^2 = 0$$

$$y - 3 = 0$$

$(\ ,\ )$

$y-3=0$

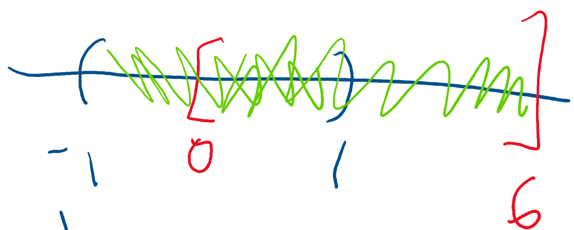
$\boxed{y=3}$

$\boxed{\text{The point is } (0,3)}$

1.1: 3

In Exercises 2 - 7, find the indicated intersection or union and simplify if possible. Express your answers in interval notation.

3. $(-1,1)\cup[0,6]$



graph

$\boxed{(-1,6]}$ interval notation

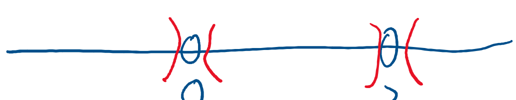
set-builder notation

$\{x \mid -1 < x \le 6\}$

1.1:11

In Exercises 8 - 19, write the set using interval notation.

11. $\{x \,|\, x \neq 0,\, 2\}$



$\boxed{(-\infty,0)\cup(0,2)\cup(2,\infty)}$

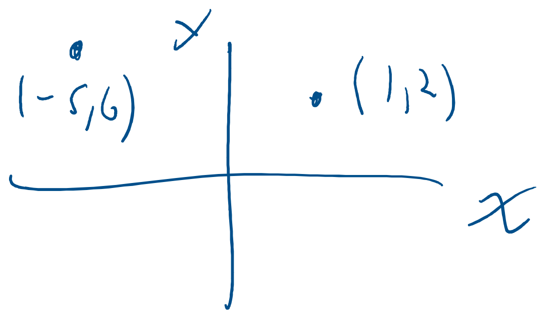
$$\boxed{(-\infty,0)\cup(0,2)\cup(2,\infty)}$$

1.2

Memorize

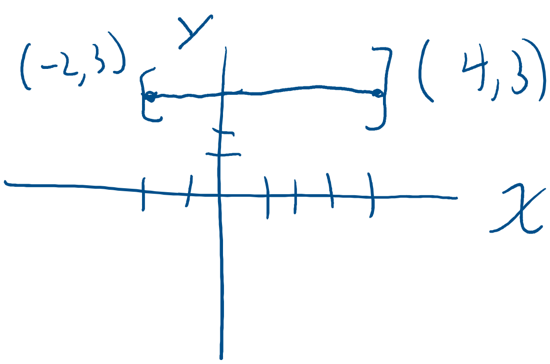
Definition 1.4. A **relation** is a set of points in the plane.

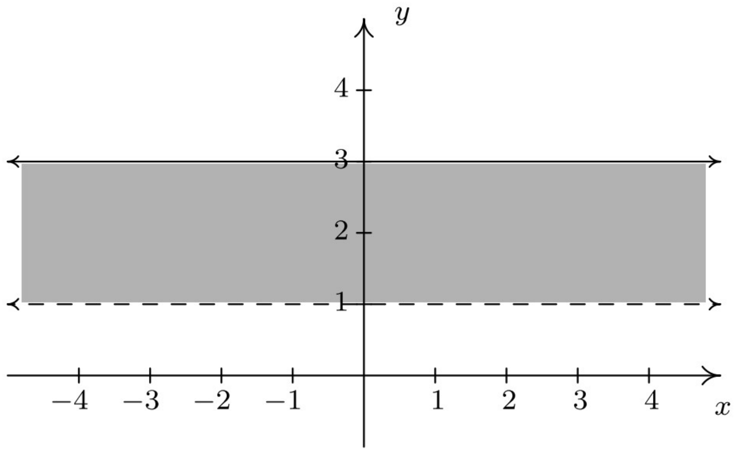
$$R = \{(1,2),(-5,6)\}$$



Example 1.2.1. Graph the following relations.

2. $HLS_1 = \{(x,3) \mid -2 \le x \le 4\}$





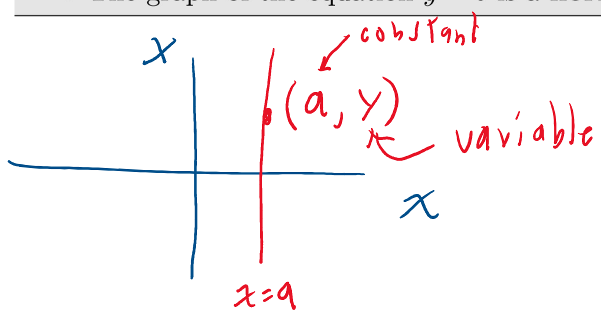
The graph of R

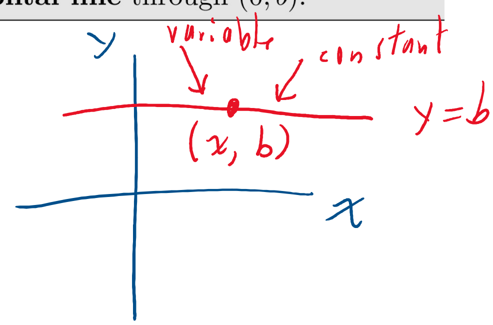
$$R = \{(x, y) \mid 1 < x \le 3\}$$

Memorize

Equations of Vertical and Horizontal Lines

- The graph of the equation $x = a$ is a **vertical line** through $(a, 0)$.
- The graph of the equation $y = b$ is a **horizontal line** through $(0, b)$.





memorize

The Fundamental Graphing Principle

The graph of an equation is the set of points which satisfy the equation. That is, a point (x, y) is on the graph of an equation if and only if x and y satisfy the equation.

$$y = x^3 - 4x^2 + 2$$

Is the point $(0, 10)$ on the graph?

Plug in $x = 0$, $y = 10$

check if the equation is satisfied (true)

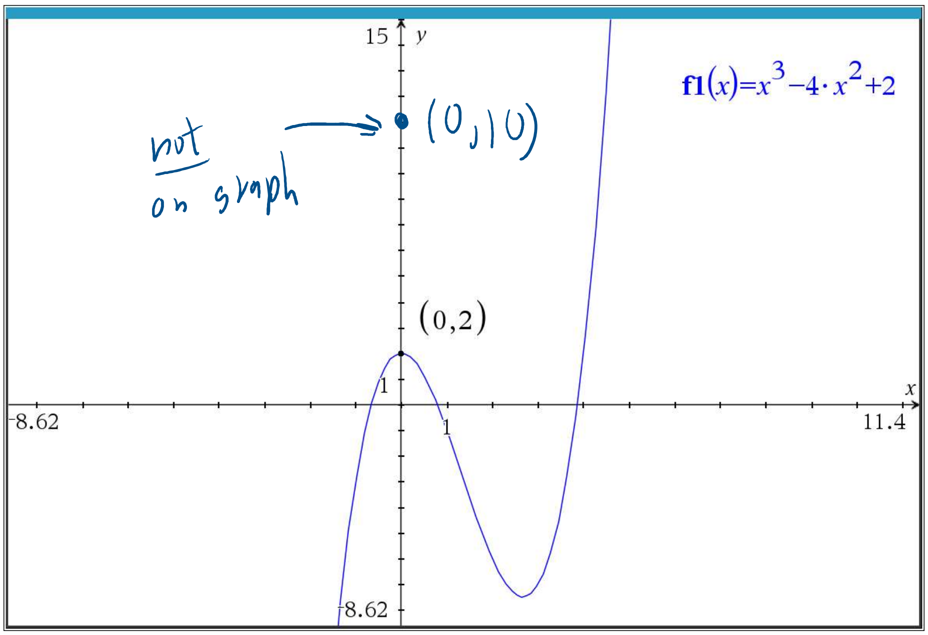
$$10 \stackrel{?}{=} 0^3 - 4(0^2) + 2$$

$10 \stackrel{?}{=} 0^3 - 4(0^2) + 2$

$10 \stackrel{?}{=} 0 - 0 + 2$

$10 \neq 2$

$\therefore$ Therefore $(0,10)$ is not on the graph



Memorize

Definition 1.5. Suppose the graph of an equation is given.

- A point on a graph which is also on the x-axis is called an ***x*-intercept** of the graph.
- A point on a graph which is also on the y-axis is called an ***y*-intercept** of the graph.

Memorize

Finding the Intercepts of the Graph of an Equation

Given an equation involving x and y, we find the intercepts of the graph as follows:

- x-intercepts have the form $(x, 0)$; set $y = 0$ in the equation and solve for x.
- y-intercepts have the form $(0, y)$; set $x = 0$ in the equation and solve for y.

use x-intercept and y-intercept to graph the line given by $2x+3y=6$

$x=0 \Rightarrow 2(0)+3y=6$

implies

$3y=6$

$x = 0 \Rightarrow 2(0) + 3y = 6$

implies

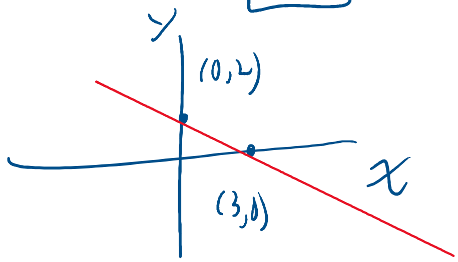
$3y = 6$

$\boxed{y = 2}$ or the point $(0,2)$

$y = 0 \Rightarrow 2x + 3(0) = 6$

$2x = 6$

$\boxed{x = 3}$ or the point $(3,0)$



$2x + 3y = 6$

change to slope-intercept form

$y = mx + b$

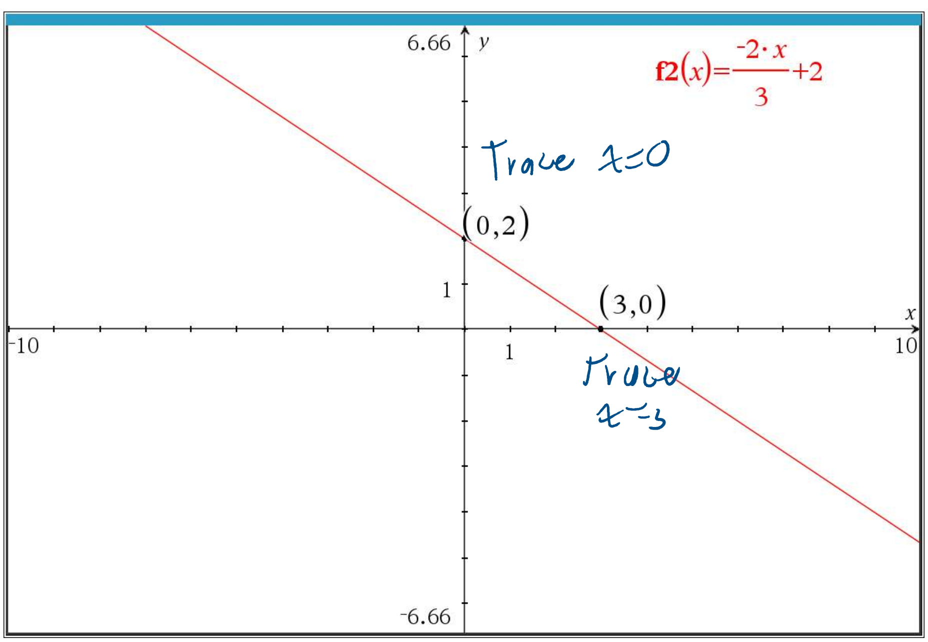
$3y = -2x + 6$

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

Notation

$\left(-\frac{2}{3}\right)x = -\frac{2x}{3}$ (good)

$-2/3\, x$ (bad)



Memorize

Testing the Graph of an Equation for Symmetry

To test the graph of an equation for symmetry

- about the y-axis – substitute $(-x, y)$ into the equation and simplify. If the result is equivalent to the original equation, the graph is symmetric about the y-axis.
- about the x-axis – substitute $(x, -y)$ into the equation and simplify. If the result is equivalent to the original equation, the graph is symmetric about the x-axis.
- about the origin - substitute $(-x, -y)$ into the equation and simplify. If the result is equivalent to the original equation, the graph is symmetric about the origin.