2. *The Associative Properties for Addition and Multiplication:*

$$(a+b)+c = a+(b+c) \quad (ab)c = a(bc)$$

3. *The Distributive Property of Multiplication over Addition or Subtraction:*

$$a(b+c) = ab+ac \quad a(b-c) = ab-ac$$

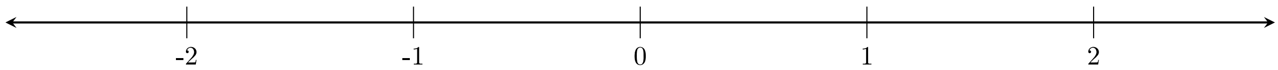
4. *The Double Negative Rule:*

$$-(-a) = a$$

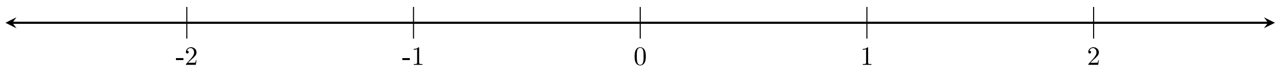
The Distributive Property also applies when more than terms within the parentheses.

Graphing Real Numbers on Number Line

We can graph subsets of real numbers on the number line. The number lines continue forever in both directions. The positive numbers are represented by the points to the right of 0, and the negative numbers are represented by the points to the left of 0.



Example 9. *Graph the following subset of the real numbers:* $\{1, -2, \frac{\pi}{2}, \sqrt{2}, .\overline{12}, -\frac{1}{5}\}$



Each number in the example's set has just one point representing that number.

1.1.3 Inequalities and Intervals

To compare two quantities, we can use an inequality symbol.These is a table of common inequalities that we will use in this class: Note that we can write an inequality with the inequality symbol pointing in the opposite direction:

Symbol	**Words**	**Example**
$<$	less than	$3 < 15$
$>$	greater than	$12 > 5$
$\leq$	less than or equal to	$0 \leq 1$
$\geq$	greater than or equal to	$2 \geq 0$
$\neq$	not equal to	$4 \neq 5$
$\approx$	approximately equal to	$\pi \approx 3.14$

Table 1.1: Basic Inequality symbols

Example 10. *We will see two examples:*

1. $32 < 40$ *is equivalent to* $40 > 32$
2. $2.0 \geq -1.8$ *is equivalent to* $-1.8 \leq 2.0$

Now we will use the number line to graph some inequalities and intervals.

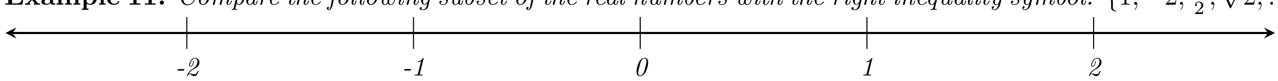
Graphing inequalities on Number Line

Suppose that we have two points on the number line a and b. These are the rules of what the inequality is:

1. If $a > b$, then a lies to the right of b on a number line.
2. If $a < b$, then a lies to the left of b on a number line.

We will use example 9 to demonstrate this idea:

Example 11. *Compare the following subset of the real numbers with the right inequality symbol:* $\{1, -2, \frac{\pi}{2}, \sqrt{2}, .\overline{12}, -\frac{1}{5}\}$

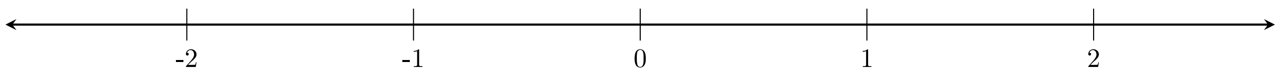


Let's drop the one constant and change it into a variable. Then this is called an inequality. We motivated this idea with an example.

Example 12. *Graph these inequalities:* $x > -1$ *and* $x \leq 1$

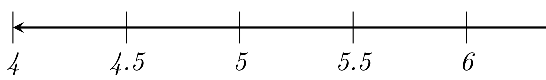
Solution. The first step is to graph the constant value. Then the second step is to see where the arrow of inequality is pointing right or left. Then we ask ourselves, "is it filled in or not?". Meaning that if we see the bar below inequality then we filled in the circle, otherwise we do not fill.

QED



Sometimes, we can combine two inequalities into a compound inequality. Here is one example:

Example 13. $5 < x < 6$ *which means that "x is less than 5 and x is less than 6."*



But other times, we cannot combine inequality.