Number Lines

Big Picture

Real numbers can be visualized using a number line. Number lines are helpful for picturing a number of algebra concepts, including opposite numbers, operations of real numbers, and inequalities.

Key Terms

Number Line: A straight line where every point on the line represents a real number.

Opposite Numbers: Two numbers that are the same distance from zero but on opposite sides of the number line.

Absolute Value: The absolute value of a number is the distance of that number from 0.

Graphing Rational Numbers

All real numbers can be drawn on a **number line**. A number line plots the greatest number to the farthest right, and the least to the farthest left.

- The numbers increase from left to right.

- 2 is further to the right than -5 is, so 2 is greater than -5. 2 > -5

The number -5   The number 2
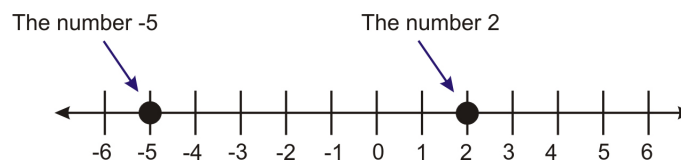
The number line above is divided into intervals of 1, so the numbers on the line increase by +1 from left to right. A number line can be divided into as many sub-intervals as you need. To plot $\frac{2}{3}$ on the number line, you can have sub-intervals of $\frac{1}{3}$.
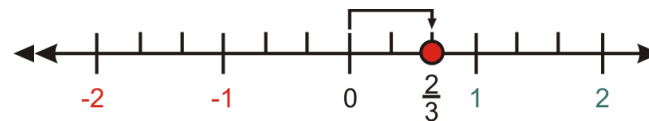

A number line represents all real numbers (that's an infinite amount of numbers)!

- The arrows on both ends of the number line will keep extending in length forever. This means 100 and -25 are a part of the number line above.

- Numbers that are not labeled on the number line are also included. Numbers like 1.111, -4/3, and $\sqrt{2}$ are a part of the number line.

Opposite Numbers

Opposite numbers are on opposite sides of 0 and are the same distance away from zero.

These numbers are opposites
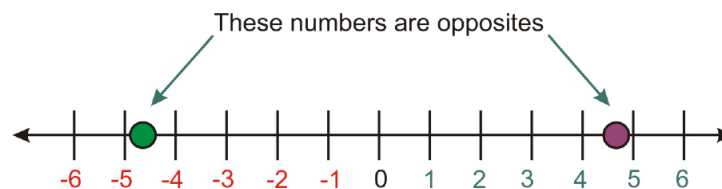
- Every number has an opposite - the opposite number of 0 is 0

- The sum of a number and its opposite is always zero
  - Example: 2 + -2 = 0, -5.7 + 5.7 = 0
  - The opposite of a number is sometimes called the additive inverse

- Multiplying a number by -1 is the same as finding the opposite number
  - The opposite number of an expression can be found by multiplying the *entire* expression by -1
  - Example: opposite of (x - 2) ≠ (x + 2); instead the opposite of (x - 2) = -(x - 2) = (-x + 2) = (2 - x)

NUMBER LINES CONT.

Absolute Value

The **absolute value** of a number is its distance from zero.

- The absolute value of a number or an expression is ALWAYS positive or 0

- The absolute values of opposite numbers are equal

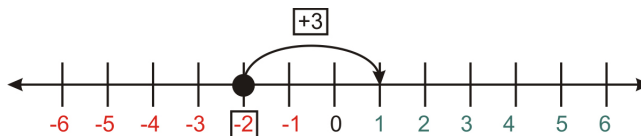- Example: |-4| = |4| = 4 because both -4 and 4 are 4 units away from 0
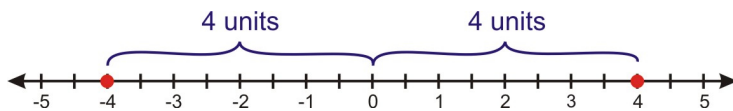
Operations

Add Using a Number Line

To add numbers on a number line, start on the first number in the expression. If you are adding a positive number, then move to the right by the number of units equal to the next number in the expression.

Example: -2 + 3
- Start at -2
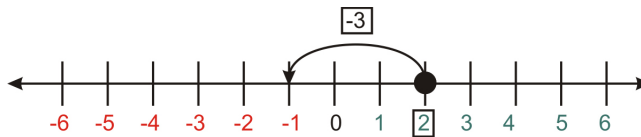- Move to the right by 3 units
- End at 1, so -2 + 3 = 1

Subtracting Using a Number Line

To subtract numbers on a number line, move left instead of right. Subtracting a number is like adding a negative number.

Example: 2 - 3 = 2 + (-3)
- Start at 2
- Move to the left by 3 units
- End at -1, so 2 - 3 = -1

If a number is negative, move left, and if a number is positive, move right.

Inequalities

Inequalities in one variable can be shown on a number line.

Symbols for Inequalities

Symbol	Meaning
<	less than
≤	less than *or* equal to
>	greater than
≥	greater than *or* equal to

If we want to show all the values of x that is greater than some number a, we are looking for all the numbers of x that will make $x > a$ true. The number line would look like:

$$x > a$$

- The open circle at a means that a is not included
- The shaded arrow includes all the numbers to the right of a

If we want to show $x \geq a$, then we would want to include a. If $x=a$, then the inequality would still be true.

$$x \geq a$$

- The filled circle at a means that a is included

Showing less than (<) or less than and equal (≤) is similar, except the arrow would now point to the left.

$$x < a$$

$$x \leq a$$