

# Integers

The integers consist of the positive numbers, 0, and the negative numbers. Numbers greater than 0 are called positive numbers, they are to the right of 0 on the number line. Numbers less than 0 are called negative numbers, they are to the left of 0 on the number line.



Two numbers that are the same distance from 0 on the number line but are on the opposite sides of 0 are called opposites. Remember that 0 is neither positive nor negative. Therefore, the opposite of 0 is 0.

## Addition

When **adding**, start at the first number then move to the **right**, on the number line, the number of units you are adding to the first number. **UNLESS** it is a negative number, then you have to move to the **left** - remember negative sign change direction. The result is the number that you end on.

In other words:

If the 2 numbers have the same sign, add the numbers & carry over the sign.

If the 2 numbers have different signs, subtract the smaller absolute value from the larger absolute value & carry over the sign from the larger number.



## Subtraction

If  $a$  and  $b$  are numbers, then  $a - b = a + (-b)$ . When **subtracting**, start at the first number then move to the **left**, on the number line, the number of units you are subtracting from the first number. **UNLESS** it is a negative number, then you have to move to the **right** - remember negative sign change direction. The result is the number that you end on. To subtract two numbers, add the first number to the opposite (called additive inverse) of the second number. If you have two minus signs (-) right next to each other, they make a plus sign (+).

I owe you

You owe me...

In other words:

If subtracting a positive number, this is the same as adding a negative number.

If subtracting a negative number, this is the same as adding a positive number.

### Multiplication & Division

If the 2 numbers have the same sign, the result is positive.

If the 2 numbers have different signs, the result is negative.

If  $a$  &  $b$  are real numbers, and  $b \neq 0$ , then  $a \div b = a \times \frac{1}{b}$ , where  $\frac{1}{b}$  is called the reciprocal of  $b$ .

**Addition** (convert subtraction to addition)

$$+\text{number} + +\text{number} = +\text{number}$$

$$-\text{number} + -\text{number} = -\text{number}$$

$$+\text{number} + -\text{smaller number} = +\text{number}$$

$$-\text{number} + +\text{smaller number} = -\text{number}$$

**Multiplication** (Division replace  $\times$  with  $\div$ )

$$+\text{number} \times +\text{number} = +\text{number}$$

$$-\text{number} \times -\text{number} = +\text{number}$$

$$+\text{number} \times -\text{number} = -\text{number}$$

## Properties of the Real Numbers

### Addition

Commutative Property:

$$a + b = b + a$$

Associative Property:

$$(a + b) + c = a + (b + c)$$

Additive Identity:

$$a + 0 = 0 + a = a$$

Additive Inverse (Opposites):

$$a + (-a) = (-a) + a = 0$$

### Multiplication

Commutative Property:

$$a \times b = b \times a$$

Associative Property:

$$(a \times b) \times c = a \times (b \times c)$$

Property of Zero:

$$a \times 0 = 0 \times a = 0$$

Multiplicative Identity:

$$a \times 1 = 1 \times a = a$$

Multiplicative Inverse (Reciprocals):

$$a \cdot \frac{1}{a} = \frac{1}{a} \cdot a = 1$$

**Division:**  $0 \div a = 0$  or  $\frac{0}{a} = 0$        $a \div 0$  is undefined or  $\frac{a}{0} = \text{undefined}$

**Distributive Property** (of multiplication over addition):

$$a(b + c) = ab + ac = ba + ca = (b + c)a$$

## Order of Operations

Please Excuse My Dear Aunt Sally (work from the inside to the outside)

First do what is "inside Parentheses", or other grouping symbol, ( ), [ ], { }, | |, /

Then work with the Exponential parts

Multiplication and Division are worked next from LEFT to RIGHT!

Lastly Addition & Subtraction is performed, again from LEFT to RIGHT!

$$2^2 \rightarrow 2*2 \rightarrow 4$$

$$(2)^2 \rightarrow (2)*(2) \rightarrow 4$$

$$-2^2 \rightarrow -2*2 \rightarrow -4 \text{ (Exponent before Subtraction)}$$

$$(-2)^2 \rightarrow -2*-2 \rightarrow 4 \text{ (Parentheses 1<sup>st</sup>)}$$