Multiplication of Real Numbers

When we add the same positive integer to itself many times, we can use multiplication to shorten the notation for integers. 5 + 5 + 5 + 5 = 20, we added 5 to itself 4 times, so we have 5 times 4 = 5 * 4 = 20.

Whole Numbers

When we add the same Whole Number to itself many times, we can use multiplication to shorten the notation. 5 + 5 + 5 + 5 = 20, we added 5 to itself 4 times, so we have 5 times 4 = 5 * 4 = 20.

Integers

We treat the numbers as positive to perform the multiplication then apply the following rules for the sign.

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

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

Tips:

+number * +number = +number
-number * -number = +number
+number * -number = -number

Examples:

6 * 7 = 42
-6 * -7 = 42
6 * -7 = -42

Decimals

1) Multiply the decimals as though they were whole numbers.
2) The decimal point in the product is placed so the number of decimal places in the product is equal to the *sum* of the number of decimal places in the factors.

Shortcuts with Powers of 10

(10, 100, 1000, …) Move the decimal point to the *right* the same number of places as there are *zeros* in the power of 10.

(.1, .01, .001, …) Move the decimal point to the *left* the same number of places as there are *decimal places* in the power of 10.

Examples:

3.1415	2.36	156
* 5	* 100	* .001
15.7075	236.00	0.156

Fractions

Let a, b, c, d be nonzero integers.

Multiply the numerators and also multiply the denominators: $\frac{a}{b} \bullet \frac{c}{d} = \frac{ac}{bd}$

Example:

$$\frac{3}{5} * \frac{2}{7} = \frac{6}{35}$$

Properties

Multiplication Property of 0 a * 0 = 0 * a = 0

Any number times 0 is 0. This is because we are adding that number to itself 0 times.

3 * 0 = 0; 0 * 20 = 0

Multiplication Property of 1 (Multiplicative Identity) a * 1 = 1 * a = a

Any number times 1 is itself. This is because we are adding the number to itself 1 time.

4 * 1 = 4; 1 * 2500 = 2500

Commutative Property of Multiplication (ordering) a * b = b * a

We can change the order in which we multiply 2 numbers.

6 * 3 = 18 and 3 * 6 = 18

Associative Property of Multiplication (grouping) (a * b) * c = a * (b * c)

The grouping of numbers can be changed without changing the product.

5 * (2 * 3) → 5 * 6 → 30 and (5 * 2) * 3 → 10 * 3 → 30

Multiplicative Inverse (Reciprocals) $a \bullet \frac{1}{a} = \frac{1}{a} \bullet a = 1$

The product of a number and its multiplicative inverse (reciprocal) is the identity (1).

$$3 * \frac{1}{3} = 1 \text{ and } \frac{1}{7} * 7 = 1$$

Distributive Property

Multiplication distributes over addition. That means that the number outside the parenthesis is given to (distributed to) each of the terms inside the parenthesis, using multiplication.

5(8 + 2) → 5 * 8 + 5 * 2 → 40 + 10 → 50

3(79) → 3(70 + 9) → 3 * 70 + 3 * 9 → 210 + 27 → 237

3*83 → 3(80 + 3) → 3*80 + 3*3 → 240 + 9 → 249