

Laws of Exponents

$$x^1 = x$$

$$x^m x^n = x^{m+n}$$

$$x^0 = 1$$

$$\frac{x^m}{x^n} = x^{m-n}$$

$$x^{-n} = \frac{1}{x^n}$$

$$(xy)^m = x^m y^m$$

$$(x^m)^n = x^{mn}$$

$$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$$

$$2^1 = 2$$

$$2^2 = 2 \times 2 = 4$$

$$2^3 = 2 \times 2 \times 2 = 4 \times 2 = 8$$

$$\underbrace{2 \times 2 \times 2}_{\text{3 of them}} = 2^3 = 8$$

$$2 \times 2 = 2^2 = 4$$

$$2 \times 2 \times 2 = 2^3 = 8$$

$$2 \times 2 \times 2 \times 2 = 2^4 = 16$$

$$2 \times 2 \times 2 \times 2 \times 2 = 2^5 = 32$$

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6 = 64$$

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^7 = 128$$

$$3^0 = 1$$

$$6^0 = 1$$

$$429^0 = 1$$

Any number to the zero power is 1!

We could memorize the Law of Exponents or we can play around with numbers and variables. We are allowed to make mistakes so we can learn. Here are some examples to avoid memorizing these laws.

Example 1

$$x^0 = 1 \qquad 182^0 = 1 \qquad 93^0 = 1 \qquad -43^0 = 1$$

Any number to the power of 0 is 1.

Example 2

$$x \cdot x \cdot x =$$

How many x's do we have? 3

(Note* the x variable and x multiplication symbol mean different things. The x variable means a value or number we do NOT know. The x multiplication symbol means to multiply. Some people get confused so they replace the multiplication symbol with a dot a.k.a. *dot product* which you would learn if you study Physics).

$$x \cdot x \cdot x = x^3$$

Example 3

$$(x^2) \cdot (x^3) = (x \cdot x) \cdot (x \cdot x \cdot x) =$$

How many x's do we have? 5

$$(x^2) \cdot (x^3) = (x \cdot x) \cdot (x \cdot x \cdot x) = x^5$$

Example 4

$$(y^3)^2 = (y^3) \cdot (y^3) = (y \cdot y \cdot y) \cdot (y \cdot y \cdot y) = y^6$$

Example 5

The value of x does NOT change unless we are told it changes.

Let's say $x = 5$. Then what is x ?

$$x = 5$$

$$x + 4 = 9$$

$$x + 1 = 6$$

$$x - 2 = 3$$

Example 6

Any number divided by itself is one.

$$\frac{5}{5} = 5 \div 5 = 1$$

$$\frac{10}{10} = 10 \div 10 = 1$$

$$\frac{382}{382} = 382 \div 382 = 1$$

REMEMBER x has the same value.

Example

$$\frac{x}{x} = 1$$

Let $x = 3$

$$\frac{3}{3} = 1$$

Let $x = 5$

$$\frac{5}{5} = 1$$

Extra

$$x^{-2} = \frac{1}{x^2}$$

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

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

Extra

$$x + x + x = 3x$$

$$x \cdot x \cdot x = x^3$$

$$x + y + y + x = 2x + 2y$$

$$x \cdot y \cdot y \cdot x = x^2 \cdot y^2 = x^2 y^2$$

$$y + y^2 + z + 2z + x = y^2 + y + 3z + x$$

$$y \cdot y^2 \cdot z \cdot 2z \cdot x = 2y^3 z^2 x$$