$$a^n = a \times a \times a \times \ldots$$

Power/exponent

Base

$$4^3 = 4 \times 4 \times 4 = 64$$

Exponents

When expressed as a^n , n stands for the number of times a is multiplied, where a is called the base and n the power or exponent. For example, 4^3 is equal to 4 x 4 x 4 = 64

Some important facts about exponents:

$a^0 = 1$ – Any non-zero number to the power zero is equal to 1.

$$3^0 = 1$$
$$3^1 = 3$$

$a^1 = a$ – Any number to the power 1 is equal to the number itself.

$0^n = 0$ – When $n > 0$, means when n is positive. When $n < 0$, 0^n becomes undefined.

$$0^4 = 0 \qquad 0^{-4} = \text{undefi}$$

$1^n = 1$ – One multiplied by itself will always result in 1.

$$1^5 = 1$$

$a^{-1} = \frac{1}{a}$ and $a^{-n} = \frac{1}{a^n}$

$$3^{-1} = \frac{1}{3} \qquad 3^{-2} = \frac{1}{3^2}$$

$x^a \times x^b = x^{a+b}$ – When bases are same, the powers are added in case of multiplication.

$$5^2 \times 5^4 = 5^6$$

$\frac{x^a}{x^b} = x^{a-b}$ – When the bases are same, the powers are subtracted in case of division.

$$\frac{5^4}{5^2} = 5^2$$

$x^a \times y^a = (xy)^a$ - When the powers are same, the bases multiply in case of multiplication.

$$5^3 \times 4^3 = (20)^3$$

$\frac{x^a}{y^a} = \left(\frac{x}{y}\right)^a$ – When the powers are same, the bases divide in case of division.

$$\frac{5^3}{4^3} = \left(\frac{5}{4}\right)^3$$

$(x^a)^b = x^{ab}$ - Successive powers get multiplied.

$$(2^3)^2 = 2^6 \longrightarrow 2^3 \times 2^3 = 2^6$$

$\sqrt[a]{x} = x^{\frac{1}{a}}$ and $\sqrt[b]{x^a} = x^{\frac{a}{b}}$

$$\sqrt[3]{2} = 2^{1/3} ; \quad \sqrt[4]{2^3} = 2^{3/4} ; \quad \sqrt{5} = 5^{1/2}$$

$\sqrt{x^2} = |x|$

$$\pm x$$

$x^a - y^a$ is divisible by $x + y$, if a is even and not divisible if a is odd

$$\frac{x^2 - y^2}{x + y} = x - y \qquad \frac{x^3 - y^3}{x + y} = \text{Not divisible}$$

$x^a + y^a$ is divisible by $x + y$, if a is odd, and not divisible if a is even

$$\frac{x^2+y^2}{x+y} \quad \text{No divi} \qquad \frac{x^3+y^3}{x+y} = x^2 - xy + y^2$$

Solving Exponents:

$$\frac{5x^2 = 180}{5}$$

$$x^2 = 36$$

$$x = \pm 6$$

$$\frac{6x^3 = 162}{6}$$

$$x^3 = 27$$

$$x = 3$$

$$\frac{(x^3 \times x^2) + x^5}{x^2 + x^2}$$

$$\frac{x^5 + x^5}{2x^2} = \frac{2x^5}{2x^2}$$

$$= x^3$$