Exponents Properties

By **BrushMyQuant**

YouTube Video Link to this Post is Here

Following is covered in the video

- **Simplifying** $(-1)^n$
- **Simplifying** $(-k)^n$
- **Simplifying** 0^n
- **Simplifying** 1^n
- **Simplifying** $(xy)^a$
- **Simplifying** $a^x * a^y$
- **Simplifying** a^x / a^y
- **Simplifying** $x^a * y^a$
- **Simplifying** (xa)^b
- **Simplifying** $a^{(-x)}$
- **Simplifying** $a^{(x/y)}$
- **Adding exponents with same base and power**
- x^n – y^n **is ALWAYS divisible by x-y**
- x^n – y^n **is divisible by x+y when n is even**
- x^n + y^n **is divisible by x+y when n is odd**
- x^n + y^n **is NEVER divisible by x-y**

Simplifying $(-1)^n$

$(-1)^n$

= - 1 (for all odd values on n)
= + 1 (for all even values of n)

Simplifying $(-k)^n$

$(-k)^n$

= 1 if n is 0
= +ve if n is even (except n = 0)
= -ve if n is odd
= 0 if k=0 and n≠0
= not defined if k=0 and n=0

Simplifying 0^n

$0^n = 0$, for all $n \neq 0$

Simplifying 1^n

$1^n = 1$ (Always)

Simplifying $(xy)^a$

$(xy)^a = x^a * y^a$

Simplifying $a^x * a^y$

If the base of two exponents is same and if we are multiplying the exponents, then we can keep the same base and add the powers.

$a^x * a^y = a^{(x+y)}$

Simplifying a^x / a^y

If the base of two exponents is same and if we are dividing the exponents, then we can keep the same base and subtract the powers.

$a^x / a^y = a^{(x-y)}$

Simplifying $x^a * y^a$

If the power of two exponents is same and if we are multiplying the exponents, then we can multiply the bases and keep the same power

$x^a * y^a = (xy)^a$

Simplifying $(x^a)^b$

$(x^a)^b = (x^b)^a = x^{(ab)}$

Simplifying $a^{(-x)}$

$a^{(-x)} = 1/ (a^x)$

Simplifying $a^{(x/y)}$

$a^{(x/y)} = \sqrt[y]{(a^x)} = (\sqrt[y]{a})^x$

Adding exponents with same base and power

If we are adding two or more exponents with the same power, then we can add them like normal variables

$x^a + x^a + x^a = 3 * x^a$

$x^n - y^n$ **is ALWAYS divisible by x-y**

Ex: If we take n = 2 then we have, $x^n - y^n = x^2 - y^2$ = (x - y) * (x + y) = divisible by x - y

$x^n - y^n$ **is divisible by x+y when n is EVEN**

Ex: If we take n = 1 then we have, $x^n - y^n = x^1 - y^1$ = (x - y) => NOT divisible by x + y
Ex: If we take n = 2 then we have, $x^n - y^n = x^2 - y^2 = (x-y) * (x+y)$ => divisible by x + y

$x^n + y^n$ **is divisible by x+y when n is ODD**

Ex: If we take n = 2 then we have, $x^n + y^n = x^2 + y^2$ => there is NO way in which we can express this as (x+y) * some other integer => NOT divisible by x + y
Ex: If we take n = 3 then we have, $x^n + y^n = x^3 + y^3$ = (x + y) * ($x^2 - xy + y^2$) => divisible by x + y

$x^n + y^n$ **is NEVER divisible by x-y**

Ex: If we take n = 2 then we have, $x^n + y^n = x^2 + y^2$ => there is NO way in which we can express this as (x-y) * some other integer => NOT divisible by x - y
Ex: If we take n = 3 then we have, $x^n + y^n = x^3 + y^3$ = (x + y) * ($x^2 - xy + y^2$) => there is NO way in which we can express this as (x-y) * some other integer => NOT divisible by x - y