

# Exponent Properties

## 1. Zero Exponent:

Any number raised to the zero power is equal to 1, except for zero which is not defined.

$$a^0 = 1 ; a \neq 0 \quad \text{where as} \quad 0^0 \text{ is not defined}$$

$$\text{Example: } 4^0 = 1 \text{ and } 2500^0 = 1$$

## 2. Negative Exponent:

Negative exponents indicate reciprocation, with the exponent of the reciprocal becoming positive.

$$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n ; a \neq 0$$

$$\text{Example: } 3^{-2} = \frac{1}{3^2} \quad \text{or} \quad \frac{1}{4^{-3}} = 4^3 \quad \text{or} \quad \frac{1}{n^{-1}} = n$$

## 3. Product of like bases:

To multiply powers with the same base, add the exponents and keep the common base.

$$a^m a^n = a^{m+n} ; a \neq 0$$

$$\text{Example: } 2^3 2^2 = 2^5 = 32$$

## 4. Quotient of like bases:

To divide powers with the same base, subtract the exponents and keep the common base.

$$\frac{a^m}{a^n} = a^{m-n} ; a \neq 0$$

$$\text{Example: } \frac{3^5}{3^3} = 3^{5-3} = 3^2$$



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## 5. Power to a power:

To raise a power to a power, keep the base and multiply the exponents.

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

$$\text{Example: } (2^2)^3 = 2^{2 \times 3} = 2^6$$

## 6. Product to a power:

To raise a product to a power, raise each factor to the power.

$$(ab)^m = a^m b^m ; a \neq 0 \text{ and } b \neq 0$$

$$\text{Example: } (2 \times 3)^2 = 2^2 \times 3^2$$

## 7. Quotient to a power:

To raise a quotient to a power, raise the numerator and the denominator to the power.

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} ; a \neq 0 \text{ and } b \neq 0$$

$$\text{Example: } \left(\frac{2}{3}\right)^2 = \frac{2^2}{3^2}$$

## 8. Rational Exponent:

The denominator of the rational exponent becomes the index of the radical, and the numerator becomes the exponent of the radicand.

$$(a)^{\frac{x}{y}} = {}^y\sqrt{a^x} ; a \neq 0$$

$$\text{Example: } (2)^{\frac{2}{3}} = {}^3\sqrt{2^2}$$

