Exponent Properties

1. Zero Exponent:

Any number raised to the zero power is equal to 1.

$a^0 = 1 \; ; \; a \neq 0$

Example: $4^0 = 1$ and $2500^0 = 1$

2. Negative Exponent:

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

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

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

3. Product of like bases:

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

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

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.

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

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.

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

Example: $(2^2)^3 = 2^{2x3} = 2^6$

6. Product to a power:

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

$$(ab)^m = a^m b^m \; ; \; a \neq 0$$

Example: $(2x3)^2 = 2^2 \times 3^2$

7. Quotient to a power:

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

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

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.

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

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