Exponents and Exponent Rules

Learning Goal:

By the end of today, I will be able to recognize the parts of a POWER.

In today's class, I will be performing standard operations with terms that have exponents on variables (powers).

We will develop both long and short solution techniques.

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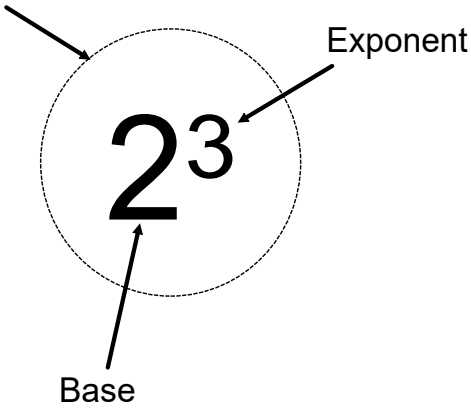
Terminology

Power (the whole package)



Exponents represent repetitive multiplication.

$2 \times 2 \times 2$

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The first two exponent rules

$$a^m \times a^n = a^{m+n}$$

Note, the bases must be the same (letters or numbers)

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

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Power of a Power

$(2^3)^5$

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Shortcut for Power of a Power

$$\left(a^{m}\right)^{n} = a^{m \times n}$$

Note, the bases must be the same (letters or numbers)

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Simplify

$$\left(g^{2}\right)^{5} =$$

$$\left(3^{4}\right)^{2} =$$

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Mixing Exponents and Bracketed Terms

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

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Mixing Exponents and Bracketed Terms

$$(2a)^5 = (2a)(2a)(2a)(2a)(2a)$$

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Mixing Exponents and Bracketed Terms

$$(3a^2)^4 = (3a^2)(3a^2)(3a^2)(3a^2)$$

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The first three exponent rules

$$a^m \times a^n = a^{m+n}$$

Note, the bases must be the same (letters or numbers)

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

$$(a^m)^n = a^{m \times n}$$

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Mixing Exponents and Bracketed Terms

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

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Not rules, but important concepts to watch for:

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \qquad (ab)^n = a^n b^n$$

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Simplify

$$(3a)^2(4a^2)$$

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Simplify

$$\frac{(2a)^3(3a^4)}{6a^2}$$

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The Final Two Rules

$\frac{25}{25}$ = or $\frac{5^2}{5^2}$ =

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The Final Two Rules

$\frac{a^3}{a^3}$ = or $\frac{a \times a \times a}{a \times a \times a}$ =

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Shortcut for the Exponent being Zero

$$a^0 = 1$$

Example

$1000^0 =$

$(a+3b)^0 =$

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Simplify

$32^0 =$

$10{,}043^0 =$

$(34a - 1.9090435343)^0 =$

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Proof By patterning....

2^4 =

2^3 =

2^2 =

2^1 =

2^0 =

2^{-1} =

2^{-2} =

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The Final Two Rules

Number	Exponent Rule	Expanded Form
$\frac{9}{27}$ =	$\frac{3^2}{3^3}$ =	$\frac{3 \times 3}{3 \times 3 \times 3}$

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Shortcut for the Exponent being Zero

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

Example

$5^{-2} =$ $m^{-4} =$

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Simplify

$2^{-1} =$

$3^{-2} =$

$3^{-4} =$

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Exponent Rules Review

$a^m \times a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

$(a^m)^n = a^{m \times n}$

$(ab)^n = a^n b^n$

$a^0 = 1$

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

$a^{-m} = \frac{1}{a^m}$

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Consolidation Questions

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