

Exponents and Exponent Rules

Learning Goal:

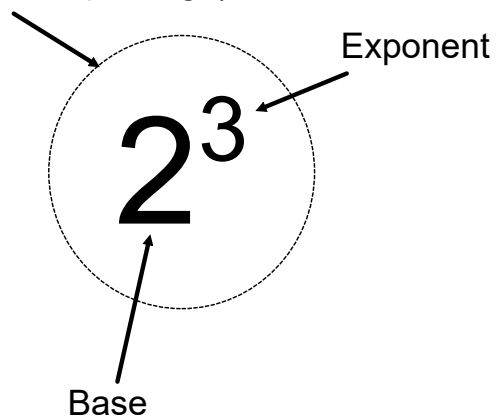
By the end of today, I will be able to recognize the parts of a POWER.

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

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Terminology

Power (the whole package)



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Exponential Form	Expanded Form
2^3	$2 \times 2 \times 2$
5^4	$5 \times 5 \times 5 \times 5$
$(-3)^2$	$(-3) \times (-3)$
$(a+5)^3$	$(a+5) \times (a+5) \times (a+5)$

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Popular Powers to Know

Base	Exponents										
	0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1	1
2	1	2	4	8	16	32	64	128	256	512	1024
3	1	3	9	27	81	243					
4	1	4	16	64	256						
5	1	5	25	125							
6	1	6	36	216							
7	1	7	49								
8	1	8	64								
9	1	9	81								
10	1	10	100								

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Multiplication of Powers

$$9 \times 81 =$$

$$3^2 \times 3^4 = 3 \times 3 \times 3 \quad \times \quad 3 \times 3 \times 3 \times 3$$

=

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Multiplication of Powers

$$a^4 \times a^7 = a \times a \times a \times a \quad \times \quad a \times a \times a \times a \times a \times a \times a$$

=

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There must be a faster way.....

Shortcut for Multiplying Powers

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

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

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Simplify

$$2^3 \times 2^4 =$$

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

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Simplify

$$(-1)^2 =$$

$$(-1)^3 =$$

$$(-1)^4 =$$

$$(-1)^5 =$$

$$(-1)^6 =$$

$$(-1)^7 =$$

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Note the difference between:

$$(-3)^2 \quad \text{and} \quad -3^2$$

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Division of Powers

$$243 \div 9 =$$

$$3^5 \div 3^2 = \frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3}$$

=

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Simplify

$$\frac{a^{10}}{a^6} =$$

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Shortcut for Dividing Powers

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

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

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

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Simplify

$$\frac{m^{12}}{m^8} =$$

$$\frac{2^{10}}{2^7} =$$

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Mixed Term Operations

$$(2^3)(a^5)(2^4)(a^3)$$

Note: c

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Mixed Term Operations

$$(2^2)(3^3)(2^3)(3^3)$$

Note: c

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Simplify

$$\frac{5^4 a^6 b^8}{5^2 a^4 b^7}$$

=

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Power of a Power

$$(a^2)^3 = (\quad)(\quad)(\quad)$$

=

=

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Power of a Power

$$(2^3)^5 = (\quad)(\quad)(\quad)(\quad)(\quad)$$

=

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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

$$(g^2)^5 =$$

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

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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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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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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

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

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Simplify

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

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Summary of Exponent Rules

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

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

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



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

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Consolidation Questions

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