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# Exponents

Obj: Simplify exponential expressions

Apply properties of exponents to applications (word problem)

Essential question: ~~Describe several si~~

How are exponents directly related to real life?

## Properties of Exponents:

Product Rule

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

Power Rule

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

Quotient Rule

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

Neg.  $\rightarrow$  Pos

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

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### Power Rule

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

$$\left(\frac{a}{b}\right)^{-m} = \frac{a^{-m}}{b^{-m}} = \frac{\frac{1}{a^m}}{\frac{1}{b^m}} = \frac{b^m}{a^m}$$

### Zero Exponent

$a^0 = 1$ , anything to zero power is one

Ex) Use properties of exponents to simplify

a)  $5^6 \cdot 5^3 = 5^9$

b)  $(-5)(-5)^6 = (-5)^7 \Rightarrow (-5)(-5)(-5)(-5)(-5)(-5)$

c)  $x^4 \cdot x^3 = x^7$  Keep the base, add the exponents.

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Ex) Use properties of exponents to simplify

d)  $(2^5)^3 = 2^{15}$  Keep the base, multiply the exponents.

e)  $[(y+2)^6]^2 = (y+2)^{12}$

f)  $[(n+8)^2]^9 = (n+8)^{18}$

g)  $(n+8)^{-18} = \frac{1}{(n+8)^{18}}$

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# ~~Review~~ Practice

Exponents — Simplify; ensure all exponents are positive

1)  $(-3n)^2$

2)  $(9m^3n)^4$

3)  $5 \cdot (5x^2)^4$

4)  $(-10x^6)^2 \cdot x^2$

5)  $[(b-2)^2]^6$

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HW for Wed, 11/4/15

Simplify

①  $[-5]^3]^4$

③  $-(5x)^2$

⑤  $(cd^2 \cdot (2d^5)^4$

②  $a^4 \cdot a^3 \cdot a^{10}$

④  $(-8m^4)^2 \cdot m^3$

# Practice and Problem Solving

Simplify

$$1) \frac{(-4)^7}{(-4)^4} =$$

$$4) \frac{2s^3t^3}{st^2} \cdot \frac{(3st)^3}{s^2t}$$

$$2) \frac{10^5 \cdot 10^5}{10^4} =$$

$$5) \frac{4x^{-2}y^4}{8xy^6}$$

$$3) \left( \frac{3x^5}{7y^2} \right)^3$$

$$\textcircled{1} \frac{(-4)^7}{(-4)^4} = (-4)^3 = (-4)(-4)(-4) = -64$$

$$\frac{\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}}{\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}\cancel{(-4)}}$$

$$\textcircled{2} \frac{10^5 \cdot 10^5}{10^4} = \frac{10^{10}}{10^4} = 10^6 = 1,000,000$$

$$\textcircled{3} \left( \frac{3x^5}{7y^2} \right)^3 = \frac{3^3 x^{15}}{7^3 y^6} = \frac{27x^{15}}{343y^6}$$

$$\textcircled{4} \frac{2s^3t^3}{st^2} \cdot \frac{(3st)^3}{s^2t} = \frac{2^3s^3t^3}{st^2} \cdot \frac{3^3s^3t^3}{s^2t}$$

$$= 2s^2t \cdot 27st^2$$

$$= (2 \cdot 27)(s^2 \cdot s)(t \cdot t^2) = \boxed{54s^3t^3}$$



$$\textcircled{5} \frac{4x^{-2}y^4}{8xy^6} = \frac{1}{2} x^{-3} y^{-2}$$

$$= \frac{1}{2} \cdot \frac{1}{x^3} \cdot \frac{1}{y^2}$$

$$= \frac{1}{2x^3y^2}$$

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# Practice and Problem Solving - Simplify

①  $(2xy^{-5})^3$

HW, due 11/6/15

②  $\frac{(2x)^{-2}y^5}{-4x^2y^2}$

③  $(-20x^3)^2(-x^7)$

④  $\left(\frac{2m^5n}{4m^2}\right) \cdot \left(\frac{mn^4}{5n}\right)^2$

⑤  $5m^{-3}n^{-4}$