

**OBJECTIVE 4: Using the Power Rules for Products & Quotients**

$$\begin{aligned} (xy)^3 &= (xy)(xy)(xy) \\ &= X \cdot X \cdot X \cdot y \cdot y \cdot y \\ &= X^3 y^3 \end{aligned}$$

So...  $(ab)^n = a^n b^n$   
Distribute the exponent to EVERYTHING INSIDE the (!)

**OBJECTIVE 5: Using the Power of a Quotient Rule**

$$\begin{aligned} \frac{X^5}{X^3} &= \frac{X \cdot X \cdot X \cdot X \cdot X}{X \cdot X \cdot X} \\ &= \frac{X \cdot X \cdot X \cdot X \cdot X}{X \cdot X \cdot X} \\ &= X \cdot X \\ &= X^2 \end{aligned}$$

So...  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$   
Distribute the exponent to EVERYTHING INSIDE the (!)

Quotient Rule:

$$\frac{X^5}{X^3} = X^{5-3} = X^2$$

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

Subtract exponents top - bottom, Keep like bases!!

Task: Quotient Rule:

a)  $\frac{4^7}{4^3} = 4^{7-3} = 4^4 = 256$

b)  $\frac{(-3)^5}{(-3)^2} = (-3)^{5-2} = (-3)^3 = -27$

c)  $\left(\frac{s}{t}\right)^2 = \frac{s^2}{t^2}$

d)  $\frac{2x^5 y^2}{xy} = 2x^{5-1} y^{2-1} = 2x^4 y$

TASK 1: Simplify each expression.

a)  $(st)^4$   
 $(s)(s)(s)(s)(t)(t)(t)(t)$   
 $s^4 t^4$

b)  $(2a)^3$   
 $(2a)(2a)(2a)$   
 $8a^3$

c)  $(\frac{1}{3}mn)^2$   
 $\frac{1^2 \cdot 3^2 \cdot m^2 \cdot n^2}{3^2 \cdot m^2 \cdot n^2} = \frac{m^2 n^2}{9}$

d)  $(-5x^2y^3z)^2$   
 $(-5)^2 (x^2)^2 (y^3)^2 (z)^2$   
 $25x^4y^6z^2$

OBJECTIVE 6: Defining the Zero Exponent

$$\frac{x^3}{x^3} = x^{3-3} = x^0$$

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

$$\text{So, } \frac{x^3}{x^3} = x^0 = 1$$

So...  $(a)^0 = 1$

Everything cancels so anything to the 0 power is 1. ALWAYS!

TASK 2: Simplify each expression

a)  $(\frac{m}{n})^7$   
 $\frac{m^7}{n^7}$

b)  $(\frac{x^3}{3y^5})^4$   
 $\frac{(x^3)^4}{(3y^5)^4} = \frac{x^{3 \cdot 4}}{3^4 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot y^{5 \cdot 4}} = \frac{x^{12}}{81y^{20}}$

c)  $(\frac{2a^4}{b^3})^5$   
 $\frac{(2)^5 (a^4)^5}{(b^3)^5} = \frac{32a^{20}}{b^{15}}$

TASK 4: All mixed up practice.

a)  $x^7 \cdot x^4$   
 $x^{7+4} = x^{11}$

b)  $(\frac{n}{2})^4$   
 $\frac{n^4}{2^4} = \frac{n^4}{16}$

c)  $(9y^5)^2$   
 $(9)^2 (y^5)^2 = 81y^{10}$

d)  $4^2 - 4^0$   
 $16 - 1 = 15$

e)  $(\frac{3y^7}{6x^5})^2$   
 $\frac{3^2 (y^7)^2}{6^2 (x^5)^2} = \frac{3 \cdot 3 \cdot y^{14}}{6 \cdot 6 \cdot x^{10}} = \frac{y^{14}}{4x^{10}}$

f)  $(\frac{2a^3b^4}{-8a^9b^2})^3$   
 $\frac{2^3 (a^3)^3 (b^4)^3}{(-8)^3 (a^9)^3 (b^2)^3} = \frac{8a^9b^{12}}{-8a^{27}b^6} = -\frac{a^9b^6}{a^{18}b^6} = -\frac{1}{a^9}$

TASK 3: Use the zero exponent rule to simplify.

a)  $-5^0$   
 $-(1) = -1$

b)  $4x^0$   
 $4(1) = 4$

c)  $(\frac{3}{100})^0$   
 $\frac{3^0}{100^0} = \frac{1}{1}$

TASK 4: All mixed up practice.

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 $x^{7+4} = x^{11}$

b)  $(\frac{n}{2})^4$   
 $\frac{n^4}{2^4} = \frac{n^4}{16}$

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 $(9)^2 (y^5)^2 = 81y^{10}$

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Still need help with: