## **Exponent Rules to Remember**

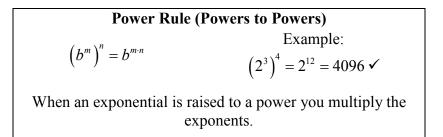
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Product Rule		
$b^m \cdot b^n = b^{m+n}$	Example:	
	$7^3 \cdot 7^4 = 7^7 = 823543$ $\checkmark$	
When multiplying exponential expressions		
with the same base you can add their		
exponents.		

Quotient Ru	le
<b>1</b> m	Example:
$\frac{b^m}{b^n} = b^m \cdot b^{-n} = b^{m-n} \ b \neq 0$	$\frac{3^5}{3^3} = 3^2 = 9 \checkmark$
When dividing exponentia	al expressions
with the same base you can	n subtract their
exponents.	

Zero-Exponent Rule	
	Example:
$b^{0} = 1$	$\left(\sqrt{\pi}\right)^0 = 1$ ✓
Anything raised to the "	zero" power is equal to
1.	

<b>Negative-Exponent Rule</b>		
Example:		
$b^{-x} = \frac{1}{b^{x}}$ or $2^{-3} = \frac{1}{2^{3}} = \frac{1}{8}$ $\frac{1}{b^{-x}} = b^{x}$ $\frac{1}{3^{-2}} = 3^{2} = 9$		
A negative exponent moves it from the		
numerator to the denominator or from		
the denominator to the numerator.		



Products to Powers Example:  $(a \cdot b)^n = a^n \cdot b^n$  Example:  $(2 \cdot 3)^3 = 2^3 \cdot 3^3 = 8 \cdot 27 = 216 \checkmark$ When a product is raised to a power, you can raise each term to that power, and multiply the results.

Quotients to Powers
$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$
Example: $\left(\frac{2}{3}\right)^a = \frac{2^4}{3^4} = \frac{16}{81} \checkmark$ When a quotient is raised to a power,  
you can raise each term to that power,  
and divide the results.

 $\left(x^{4}\right)^{3} = x^{4 \cdot 3} = x^{12}$ 

 $x^3 \cdot x^5 = x^{3+5} = x^8$ 

## Steps for Simplifying Exponential Expressions

1. If necessary, remove parentheses by using the "*products* **Example** *to powers*" rule or "*quotients to powers*" rule.

$$(a \cdot b)^n = a^n \cdot b^n \text{ or } \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$
  $(x \cdot y)^3 = x^3 \cdot y^3$ 

2. If necessary simplify "*powers to powers*".

$$\left(b^{m}\right)^{n}=b^{m\cdot n}$$

3. If necessary, be sure that each base only appears once by using the "*product*" and "*quotient*" rules.

$$b^{m} \cdot b^{n} = b^{m+n}$$
 or  $\frac{b^{m}}{b^{n}} = b^{m} \cdot b^{-n} = b^{m-n}$ 

4. If necessary, rewrite exponential expression with "*zero*" powers as 1. Also, write negative exponents as positive by using the "*negative-exponent*" rule.

$$b^{0} = 1$$
 or  $b^{-x} = \frac{1}{b^{x}}$  or  $\frac{1}{b^{-x}} = b^{x}$   $\frac{x^{5}}{x^{8}} = x^{5-8} = x^{-3} = \frac{1}{x^{3}}$ 

## **Example:** $\frac{-35x^2y^4}{5x^6y^{-8}}$ Solution: $\frac{-35x^2y^4}{5x^6y^{-8}} = \left(\frac{-35}{5}\right)\left(\frac{x^2}{x^6}\right)\left(\frac{y^4}{y^{-8}}\right)$ Group factors with the same bases. When dividing expressions with the same $= (-7)(x^{2-6})(y^{4-(-8)})$ base subtract the exponents. (quotient rule) $-7x^{-4}y^{12}$ = Simplify. Move the base with the negative exponent, $\frac{-7y^{12}}{x^4}$ $x^{-4}$ , to the other side of the fraction bar = and make the negative exponent positive. (negative-exponent rule)