NAME KEY

Multiplying and Dividing Powers

Compute what happens when we multiply the following...

Problem	Factor Out	Standard Notation	Write Answer as a Power
$10^4 \bullet 10^3$	$10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$	10,000,000	10^7
$10^1 \bullet 10^2$	$10 \bullet 10 \bullet 10$	1,000	10^3
$10^2 \bullet 10^5$	$10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$	10,000,000	10^7
$10^4 \bullet 10^2$	$10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$	1,000,000	10^6
$10^{25} \bullet 10^{100}$	Too many factors of 10 to do	Too many 0's	10^{125}

1. What patterns or short cuts do you notice about this process?

   - **A power of base 10 is factors of 10 equal to the number of the exponent. For example, $10^5 = 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$**
   - **A power of base 10 is a 1 followed by the number of zeros in the exponent. For example, 10^5 is 100,000**
   - **When multiplying with similar bases the answer is the sum of the exponents with that same base. For example, $10^1 \bullet 10^2 = 10^{1+2} = 10^3$**

2. What would $10^m \bullet 10^n$ equal?

   - **Using the pattern, $10^m \bullet 10^n = 10^{m+n}$**

This property works for powers of any number, not just powers of ten.

General Rule:

- $\mathbf{b^x \bullet b^y = b^{x+y}}$

Compute what happens when we divide the following...

Problem	Write with a Horizontal Fraction	Factor Out	Reduced	Standard Notation	Write Answer as a Power
$10^4 \div 10^2$	$\frac{10^4}{10^2}$	$\frac{10 \bullet 10 \bullet 10 \bullet 10}{10 \bullet 10}$	$\frac{10 \bullet 10}{1}$	100	10^2
$10^3 \div 10^2$	$\frac{10^3}{10^2}$	$\frac{10 \bullet 10 \bullet 10}{10 \bullet 10}$	$\frac{10}{1}$	10	10^1
$10^5 \div 10^3$	$\frac{10^5}{10^3}$	$\frac{10 \bullet 10 \bullet 10 \bullet 10 \bullet 10}{10 \bullet 10 \bullet 10}$	$\frac{10 \bullet 10}{1}$	100	10^2
$10^2 \div 10^1$	$\frac{10^2}{10^1}$	$\frac{10 \bullet 10}{10}$	$\frac{10}{1}$	10	10^1
$10^{32} \div 10^{20}$	$\frac{10^{32}}{10^{20}}$	Too many factors of 10 to do	Too many factors of 10 to do	Too many 0's	10^{12}

1. What patterns or short cuts do you notice about this process?

   - **A power of base 10 is factors of 10 equal to the number of the exponent. For example, $10^5 = 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$**
   - **A power of base 10 is a 1 followed by the number of zeros in the exponent. For example, 10^5 is 100,000**
   - **When dividing with similar bases the answer is the top exponent MINUS the bottom exponent with that same base. For example, $10^7 \div 10^2 = 10^{7-2} = 10^5$**

2. What would $10^m \div 10^n$ equal?

   - **Using the pattern, $10^m \div 10^n = 10^{m-n}$**

This property works for powers of any number, not just powers of ten.

<u>**General Rule:**</u>

$$b^x \div b^y = b^{x-y}$$