Multiplying Monomials

In order to understand how to multiply monomials, you must understand what an exponent is telling you to do. REMEMBER that an exponent tells you how many times to multiply the base by itself.

x^2 means $x \cdot x$ and x^4 means $x \cdot x \cdot x \cdot x$

If we multiply these together we will have $x^2 \cdot x^4$. This will give us $(x \cdot x) \cdot (x \cdot x \cdot x \cdot x)$ which is x^6.
A shorter way to do this would be to add the exponents together.

$$x^2 \cdot x^4 = x^{2+4} = x^6$$

The Rule for Multiplying Exponential Expressions is as follows:
If m and n (the exponents) are integers, then $x^m \cdot x^n = x^{m+n}$

This means that when you are multiplying two exponential expressions with the same base, you add the exponents and keep the base.

EXAMPLE: Multiply $y^7 \cdot y^3$

The bases are the same so we add the exponents.

$$y^{7+3} = y^{10}$$

To multiply exponential expressions which involve numbers as well as variables, we follow these steps:

1. Use the Commutative and Associative Properties of Multiplication to change the order of the factors so that the numbers are together and the like bases are together.

2. Multiply the numbers.

3. Multiply like bases by adding the exponents.

EXAMPLE: Simplify: $(-4x^3y)(9x^4y^5)$

$(-4 \cdot 9)(x^3 \cdot x^4)(y \cdot y^5)$ Rearrange factors (multiplication commutes)

$-36(x^{3+4})(y^{1+5})$ Remember that the exponent is 1 if there is none written.

$-36x^7y^6$

It is sometimes necessary to simplify powers of monomials. This means that we will have an exponential expression raised to a power.

$$(x^2)^4 \text{ means } x^2 \cdot x^2 \cdot x^2 \cdot x^2$$

We now have the same base being multiplied by itself so we can add the exponents.

$$x^2 \cdot x^2 \cdot x^2 \cdot x^2 = x^{2+2+2+2} = x^8$$

A shorter way to do this is to multiply the exponents.

$$(x^2)^4 = x^{2 \cdot 4} = x^8$$

<u>The Rule for Simplifying Powers of Exponential Expressions</u> is as follows:
If *m* and *n* (the exponents) are integers, then $(x^m)^n = x^{m \cdot n}$

This means that if we are raising a power to a power we multiply the exponents and keep the base.

EXAMPLE: Simplify: $(y^5)^3$

NOTICE that there are parentheses separating the exponents. This tells us that we are raising a power to a power and must multiply the exponents.

$$(y^5)^3 = y^{5 \cdot 3} = y^{15}$$