Name: Key Date: _____

BASIC EXPONENT PROPERTIES
COMMON CORE ALGEBRA II

Exponents, at their most basic, represent **repeated multiplication**. The way they combine, or don't combine, is dictated by this simple premise.

***Exercise* #1:** The following four steps are given to find the product of the **monomials** $-2x^5$ and $4x^2$.

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

(1) $-2\cdot(x^5\cdot 4)\cdot x^2$ Associative

(2) $-2\cdot(4\cdot x^5)\cdot x^2$ Commutative

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

(4) $-8x^7$

(a) For steps (1) through (3), write the real number property that justifies each manipulation.

(b) Explain why the final exponent on the variable x is 7.

When multiplying terms with the same base, add the exponents.

Students (and teachers) can forget the basic properties used in simplifying the product of two monomials because we tend to pick up on the pattern of **multiplying the numerical coefficients** and **adding the powers** without thinking about the commutative and associative properties that justify our manipulations.

***Exercise* #2:** Find the product of each of the following monomials.

also $(4x^3)(4x^3)$ → $(4\cdot 4)(x^3\cdot x^3)$

(a) $(5x^2)(3x^6)$ ⇒ $(5\cdot 3)(x^2\cdot x^6)$ ⇒ $15x^8$

(b) $(-2x)(-6x^4)$ ⇒ $(-2\cdot -6)(x\cdot x^4)$ ⇒ $12x^5$

(c) $\left(\frac{3}{2}x^4\right)(6x^{10})$ ⇒ $(\frac{3}{2}\cdot 6)(x^4\cdot x^{10})$ ⇒ $9x^{14}$

(d) $(4x^3)^2$ ⇒ $(4^2)(x^3)^2$ ⇒ $16x^6$

Remember, monomials (or terms) can have more than one variable, just as long as they are all combined using multiplication and division only. Multiplying monomials that contain more than one variable still just involves application of exponent laws and repeated use of the associative and commutative properties.

***Exercise* #3:** Find each of the following products, which involve monomials of multiple variables. Carefully consider what you are doing before applying patterns.

(a) $(4x^3y^2)(5xy^5)$ ⇒ $(4\cdot 5)(x^3\cdot x)(y^2\cdot y^5)$ ⇒ $20x^4y^7$

(b) $(-2x^7y^3)(-4x^2y^6)$ ⇒ $(-2\cdot -4)(x^7\cdot x^2)(y^3\cdot y^6)$ ⇒ $8x^9y^9$

(c) $\left(\frac{1}{2}xy\right)\left(\frac{5}{2}x^2y^5\right)$ ⇒ $(\frac{1}{2}\cdot\frac{5}{2})(x\cdot x^2)(y\cdot y^5)$ ⇒ $\frac{5}{4}x^3y^6$

One of the key skills we will need this year will be factoring expressions, especially factoring out a common factor. To build some skills with this, consider the following problem.

***Exercise* #4:** Fill in the missing blank in each of the following equations involving a product such that the equation is then an identity.

(a) $6x^5 = (2x^2)(\underline{3x^3})$

$(2 \cdot \_) = 6$? coefficient

$(2 + \_) = 5$? exponent

(b) $12x^8 = (4x^3)(\underline{3x^5})$

$(4 \cdot \_) = 12$? coefficient

$(3 + \_) = 8$? exponent

(c) $20x^2y^4 = (-2xy^3)(\underline{-10xy})$

$(-2 \cdot \_) = 20$? Coefficient

$(1 + \_) = 2$? x exponent

$(3 + \_) = 4$? y exponent

The final skill we will review in this lesson is using the **distributive property** of **multiplication (and division)** over **addition (and subtraction).**

***Exercise* #5:** Use the distributive property to multiply the following monomials and polynomials.

(a) $2x(5x+3)$

$10x^2 + 6x$

(b) $5x^3(2x^2 - 3x + 6)$

$10x^5 - 15x^4 + 30x^3$

(c) $-7x^2(x^2 - 2x + 3)$

$-7x^4 + 14x^3 - 21x^2$

(d) $xy^2(x^2 - y^2)$

$x^3y^2 - xy^4$

(e) $3x^2y^4(2x^2y + xy^2 - 4y^3)$

$6x^4y^5 + 3x^3y^6 - 12x^2y^7$

Now, to build our way up to **factoring** in later units, let's make sure we can fill in missing portions of products.

***Exercise* #6:** Similar to Exercise #4, fill in the missing portion of each product so that the equation is an identity.

(a) $8x^2 - 12x = 4x(\underline{2x - 3})$

(b) $7x^4 - 21x^3 - 28x^2 = 7x^2(\underline{x^2 - 3x - 4})$

(c) $10x^3y^2 - 20x^2y^3 + 35xy^5 = 5xy^2(\underline{2x^2 - 4xy + 7y^3})$

(d) $4x^2(x-2) - 9(x-2) = (x-2)(\underline{4x^2 - 9})$