Quick Review of Exponent Rules

Review: Think about the following: a^3 What does it mean? In the **exponential** expression a^3 (read "a to the third power"), **a** is called the **base** and **3** is called the **exponent.**

Definition: If *a* is a nonzero real number and *n* is a positive integer, then $a^n = a \cdot a \cdot a \cdot \ldots \cdot a$

$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$$

TRY: 4^3

Be careful: Expressions of the form $(-2)^4$ and -2^4

These expressions are not always equal.

$(-2)^4 = (-2)\cdot(-2)\cdot(-2)\cdot(-2) = 16$ $\qquad -2^4 = -2\cdot 2\cdot 2\cdot 2 = -16$

The placement of the ( ) makes a difference.

TRY: $(-3)^2$ and -3^2

Product Property for Exponents

If *m* and *n* are integers and *a* ≠ 0, then, $a^m \cdot a^n = a^{m+n}$

i.e. When multiplying expressions with **like bases**, add the exponents to get the exponent of the common base. If the base is a number, remember NOT to multiply the base.

$3^4 \bullet 3^2 = 3^{4+2} = 3^6 = 729$ $\qquad -2^2 y^2 \bullet 5y^4 = -20y^6$

Since the bases are different in $x^4 \cdot y^2 = x^4 y^2$, the factors cannot be combined.

TRY: $2^3 \bullet 2^4$ $\qquad x^5 \bullet 5x^7$ $\qquad 4x^3 \bullet 5x$

Power Property of Exponents

If *m* and *n* are any integers and *a* ≠ 0, then $(a^m)^n = a^{m\bullet n}$

i.e. A power to a power is found by multiplying the exponents.

$(2^3)^2 = 2^{3\bullet 2} = 2^6 = 64$ $\qquad (2x^2)^4 = 2^{1\cdot 4} x^{2\cdot 4} = 2^4 x^8 = 16x^8$ $\qquad \dfrac{(3a^2)^3}{(6a^3)^2} = \dfrac{3^3 a^6}{6^2 a^6} = \dfrac{3^3}{6^2} = \dfrac{27}{36} = \dfrac{3}{4}$

CAREFUL – do not reduce until after the power rule is applied!!

TRY: $(a^2b^2)^2$ $\qquad (2x^4y^2)^3$ $\qquad (2x^4)^3(y^2)^4$

Power of a Product Property of Exponents

If a and b are nonzero real numbers and n is any integer, then $(ab)^n = a^n b^n$

i.e. When a group of factors is raised to a power, raise each of the **factors** in the group to this power.

WARNING:

$(xy)^5 = x^5y^5$ and $(2ab)^4 = 2^4a^4b^4$ but $(2+3)^3 \neq 2^3 + 3^3$ because 2 and 3 are terms, NOT factors!

$(2+3)^3 = (5)^3$

$(-2x)^2 = (-2)^2(x)^2 = 4x^2$ This is different than $-2^2x^2 = -4x^2$

TRY: $(3y)^3$ $(-3y)^3$ $-(3y)^3$

$4(3y)^3$ $-2(-3y)^3$ $-(2xy)^3$

Quotient Properties of Exponents

If m and n are any integers with $m > n$ and $b \neq 0$, then $\frac{b^m}{b^n} = b^{m-n}$ and $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

To divide expressions with like bases, subtract the exponent of the denominator from the exponent of the numerator to get the exponent of the common base in the quotient.

$\frac{a^5}{a^2} = a^{5-2} = a^3$ $\left(\frac{x}{y^4}\right)^3 = \frac{x^3}{y^{12}}$

TRY: $\frac{3^6}{3^4}$ $\frac{a^7}{a^4}$ $\left(\frac{6}{7}\right)^2$

TRY: A Quick Review

1) 6^2 ________	16) $(-1)^5$ ________
2) 7^2 ________	17) 10^3 ________
3) 3^2 ________	18) $(-3)^2$ ________
4) 5^2 ________	19) -1^6 ________
5) 9^2 ________	20) 12^2 ________
6) 2^3 ________	21) 2^4 ________
7) -3^2 ________	22) 8^0 ________
8) 8^2 ________	23) $(-4)^2$ ________
9) 6^0 ________	24) 11^2 ________
10) 10^2 ________	25) -7^2 ________
11) 1^5 ________	26) $(-2)^3$ ________
12) -5^2 ________	27) 4^2 ________
13) 3^3 ________	28) -3^2 ________
14) $(-2)^2$ ________	29) 12^0 ________
15) 2^3 ________	30) -6^2 ________