Exponent Properties

1. **Product of like bases:** $\qquad\qquad a^m a^n = a^{m+n}$

    To multiply powers with the same base, add the exponents and keep the common base.

    Example: $\quad (x^3)(x^4) = x^{3+4} = x^7$

2. **Quotient of like bases:** $\quad \dfrac{a^m}{a^n} = a^{m-n}$

    To divide powers with the same base, subtract the exponents and keep the common base.

    Example: $\quad \dfrac{x^{10}}{x^3} = x^{10-3} = x^7$

3. **Power to a power:** $\qquad\qquad (a^m)^n = a^{mn}$

    To raise a power to a power, keep the base and multiply the exponents.

    Example: $\quad (x^3)^4 = x^{3 \cdot 4} = x^{12}$

4. **Product to a power:** $\qquad\qquad (ab)^m = a^m b^m$

    To raise a product to a power, raise each factor to the power.

    Example: $\quad (-2x^4 y^5)^3 = (-2)^3 x^{4 \cdot 3} y^{5 \cdot 3} = -8x^{12} y^{15}$

5. **Quotient to a power** $\qquad\qquad \left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

    To raise a quotient to a power, raise the numerator and the denominator to the power.

    Example: $\quad \left(\dfrac{4x^7}{5y^3}\right)^3 = \dfrac{64x^{21}}{125y^9}$

6. **Zero Exponent:** $\qquad\qquad a^0 = 1$

    Any number raised to the zero power is equal to "1".

    Examples: $\quad (2ab^3)^0 = 1 \qquad\qquad -11x^0 = -11(1) = -11$

7. **Negative exponent:** $\qquad\qquad a^{-n} = \dfrac{1}{a^n}$

    Unhappy (negative) exponents will become happy (positive) by having the base/exponent pair "switch floors". Another way to interpret this: negative exponents mean to write the reciprocal of the original, making the exponent positive.

    Examples: $\quad 3x^{-2} = \dfrac{3}{x^2} \qquad\qquad \dfrac{-5}{x^{-3}} = -5x^3 \qquad\qquad \left(\dfrac{2}{3}\right)^{-2} = \left(\dfrac{3}{2}\right)^2 = \dfrac{9}{4}$