

EXPONENTS

base: number or variable being multiplied repeatedly; any base (except 0) raised to a power of 0 equals 1 **Example 1:** 3^2 has a base of 3 **Example 2:** $16^0 = 1$

exponent: number of times the base is multiplied repeatedly by itself

Example 1: $2x^5$ has an exponent of 5 **Example 2:** $8b^3 = 8 \times b \times b \times b$

addition/subtraction: add/subtract like terms **Example:** $3x^2 + 4x^2 + x = 7x^2 + x$

multiplication/division with same base: add or subtract exponents

Example 1: $(x^a)(x^b) = x^{a+b}$
 $(a^2)(a^3) = a^{2+3} = a^5$

Example 2: $\frac{x^a}{x^b} = x^{(a-b)}$ $\frac{a^5}{a^2} = a^{(5-3)} = a^2$

negative exponent: equal to reciprocal of term with positive exponent

Example 1:

$$x^{-a} = \frac{1}{x^a} \quad x^{-3} = \frac{1}{x^3}$$

Example 2:

$$\frac{1}{x^{-b}} = x^b \quad \frac{1}{n^{-5}} = n^5$$

raise to a power: raise both variable and constant (coefficient); multiply any exponents

Example 1:

$$(x^a)^b = x^{ab}$$

$$(g^2)^3 = g^{(2 \times 3)} = g^6$$

Example 2:

$$(xy)^b = x^b y^b$$

$$(3a^2)^3 = 3^3 a^{(2 \times 3)} = 27a^6$$

Example 3:

$$\sqrt{x} = x^{\frac{1}{2}}$$

$$\sqrt{16a^6} = 4a^{(6 \times \frac{1}{2})} = 4a^3$$

order of operations: parentheses, exponents, multiply/divide, add/subtract

Example: $(3x^2 + 4x^2)(2x^4)^3$

$$(7x^2)(2x^4)^3$$

add like terms inside parentheses

$$(7x^2)(8x^{12})$$

raise second term to power of 3 (multiply exponents)

$$56x^{14}$$

multiply terms (add exponents)

INVERSE VARIATION AND EXPONENTIAL GROWTH AND DECAY

inverse variation: y varies inversely with x in $y = \frac{k}{x}$ where k is a constant

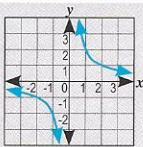
Example: y varies inversely with x in $y = \frac{k}{x}$

If y = 10 when x = 2, find y when x = 5

$$10 = \frac{k}{2} \quad \text{then } k = 10(2) = 20 \quad \text{At } x = 5, y = \frac{20}{5} = 4$$

Example:

$$y = \frac{2}{x}$$



exponential function: $y = a^x$ where a is a constant; for $0 < a < 1$, the graph decreases (**exponential decay**); for $a > 1$, the graph increases (**exponential growth**)

Note: $2^{-x} = (\frac{1}{2})^x$ therefore $y = 2^{-x}$ is equivalent to $y = (\frac{1}{2})^x$

Examples: $y = 3^x$ and $y = (\frac{1}{3})^x$

