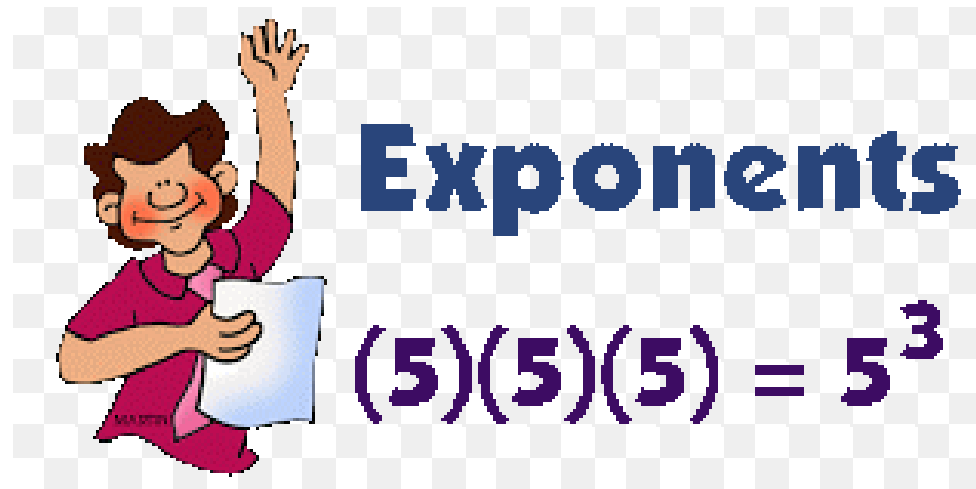


# Exponent Rules



Any quantity raised to the “zero” power is 1!!!

Use the Zero Exponent Rule to simplify:

a.  $7^0 = 1$

b.  $\pi^0 = 1$

c.  $(-5)^0 = 1$

d.  $-5^0 = -1$     *But why???*     $-1 \cdot 5^0 = -1 \cdot 1 = -1$

# Properties of Exponents

- The Product Rule:  $x^a \cdot x^b = x^{a+b}$

$$x^3 \cdot x^5 = x^{3+5} = x^8 \qquad 2^3 \cdot 2^2 = 2^{3+2} = 2^5 = 32$$

- The Quotient Rule:  $\frac{x^a}{x^b} = x^{a-b}$

$$\frac{x^{12}}{x^4} = x^{12-4} = x^8 \qquad \frac{3^9}{3^7} = 3^{9-7} = 3^2 = 9$$

- The Power Rule:  $(x^a)^b = x^{ab}$

$$(x^2)^4 = x^{2 \cdot 4} = x^8 \qquad (3^2)^2 = 3^{2 \cdot 2} = 3^4 = 81$$

Combining more than one rule....

Product to a Power:

$$(2a^2b^2 \cdot a^5)^4 = (2a^2a^5b^2)^4 = (2a^7b^2)^4 = (2)^4 a^{28} b^8 = 16a^{28}b^8$$

Quotient to a Power:

$$\left(\frac{-2a^2b^2}{3a^7b}\right)^2 = \left(\frac{-2b}{3a^5}\right)^2 = \frac{(-2)^2 b^2}{(3)^2 a^{10}} = \frac{4b^2}{9a^{10}}$$

# Practice with Exponents

$$1. (5a^2b^3c^4)(6a^3b^4c^2) \\ 30a^5b^7c^6$$

$$3. (2b^2)^3 \\ 8b^6$$

$$5. (-4a^2b^5c)^2 \\ 16a^4b^{10}c^2$$

$$7. \left(\frac{2a^3b^5}{3}\right)^2 = \frac{4a^6b^{10}}{9}$$

$$2. 8a^0 \\ 8$$

$$4. (-2x^4)^3 \\ -8x^{12}$$

$$6. \frac{x^6y^4z}{x^2y^9z^7} = \frac{x^6}{y^{15}}$$

$$8. \left(\frac{x^5y^2}{x^3y^7}\right)^3 = \frac{x^6}{y^{15}}$$

# The Negative Exponent Rule

- If  $x$  is any real number other than 0 and  $a$  is a natural number,

$$x^{-a} = \frac{1}{x^a}.$$

- Negative exponents are “unhappy.” So move them up or down and they become happy (“positive”). 😊

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

# Using the Negative Exponent Rule

$$1. 8^{-2} = \frac{1}{64}$$

$$2. 4x^{-3} = \frac{4}{x^3}$$

$$3. \frac{2x^4}{5x^{-3}y} = \frac{2x^7}{5y}$$

$$4. \frac{2x^{-2}}{4y^{-3}} = \frac{y^3}{2x^2}$$

$$5. \left( \frac{x^2 y^{-4}}{x^3 y} \right)^{-2} = x^2 y^{10}$$

$$6. \left( ab^{-2}c^4 \right)^{-3} = \frac{b^6}{a^3 c^{12}}$$