<name>
Class: Algebra 2
Date: <date>
Topic: Lesson Pre 5.1 (Properties of Exponents)

Exponent	a^n …n is the exponent, # of times the base appears as a factor
Base	a^n … a is the base, the number used as a factor

Properties of Exponents

Product of Powers

$$a^m \cdot a^n = a^{m+n} \qquad 2^3 \cdot 2^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5 = 2^{3+2}$$

Power of a Power

$$(a^m)^n = a^{m \cdot n} \qquad (2^3)^2 = 2^3 \cdot 2^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^6 = 2^{3 \cdot 2}$$

Power of a Product

$$(a \cdot b)^m = a^m b^m \qquad (2 \cdot 3)^2 = (2 \cdot 3)(2 \cdot 3) = 2 \cdot 3 \cdot 2 \cdot 3 = 2^2 \cdot 3^2$$

Quotient of Powers

$$\frac{a^m}{a^n} = a^{m-n} \qquad \frac{2^4}{2^2} = \frac{2 \cdot 2 \cdot \cancel{2} \cdot \cancel{2}}{\cancel{2} \cdot \cancel{2}} = \frac{2 \cdot 2}{1} = 2^2 = 2^{4-2}$$

Power of Quotient

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \qquad \left(\frac{2}{3}\right)^2 = \frac{2}{3} \cdot \frac{2}{3} = \frac{2 \cdot 2}{3 \cdot 3} = \frac{2^2}{3^2}$$

Zero Power

$$a^0 = 1 \qquad \text{…any number raised to the zero'th power is 1}$$

Negative Power

$$a^{-m} = \frac{1}{a^m} \qquad \text{…flip any number raised to a negative power}$$

Evaluate Examples

1. $(-4)(-4)^3$ $\qquad (-4)(-4)^3 = (-4)^1(-4)^3 = (-4)^{1+3} = (-4)^4 = 256$

2. $[(-3)^2]^3$ $\qquad [(-3)^2]^3 = (-3)^{2 \cdot 3} = (-3)^6 = 729$

3. $(3^2 x^2 y)^2$ $\qquad (3^2 x^2 y)^2 = 3^{2 \cdot 2} x^{2 \cdot 2} y^{1 \cdot 2} = 3^4 x^4 y^2 = 81 x^4 y^2$

4. $5^{-4} \cdot 5^3$ $\qquad 5^{-4} \cdot 5^3 = 5^{-4+3} = 5^{-1} = \dfrac{1}{5}$

5. $\left(2^{-3}\right)^2$ $\qquad \left(2^{-3}\right)^2 = 2^{-3 \cdot 2} = 2^{-6} = \dfrac{1}{2^6} = \dfrac{1}{64}$

6. $m^7 \cdot \dfrac{1}{m^4}$ $\qquad m^7 \cdot \dfrac{1}{m^4} = \dfrac{m^7}{m^4} = m^{7-4} = m^3$

7. $\dfrac{8^3 \cdot 8^5}{8^9}$ $\qquad \dfrac{8^3 \cdot 8^5}{8^9} = \dfrac{8^{3+5}}{8^9} = \dfrac{8^8}{8^9} = 8^{8-9} = 8^{-1} = \dfrac{1}{8}$

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8. $\left(\dfrac{5}{6}\right)^{-3}$

$\left(\dfrac{5}{6}\right)^{-3} = \left(\dfrac{6}{5}\right)^{3} = \dfrac{6^3}{5^3} = \dfrac{216}{125}$

Simplify Examples

1. $\dfrac{5x^4 y^3}{8x^5} \cdot \dfrac{3x^3 y^5}{6y^4}$

$\dfrac{5x^4 y^3}{8x^5} \cdot \dfrac{3x^3 y^5}{6y^4} = \dfrac{15x^7 y^8}{48x^5 y^4} = \dfrac{5}{16} x^{7-5} y^{8-4} = \dfrac{5x^2 y}{16}$

2. $\dfrac{2x^6 y^4}{6x^3} \cdot \dfrac{4x^2 y^3}{12y^5}$

$\dfrac{2x^6 y^4}{6x^3} \cdot \dfrac{4x^2 y^3}{12y^5} = \dfrac{8x^8 y^7}{72x^3 y^5} = \dfrac{1}{9} x^{8-3} y^{7-5} = \dfrac{x^5 y^2}{9}$