

Off-Site Learning Packet Day 1

Property of Exponents Review

WORDS	NUMBERS	ALGEBRA
Zero Exponent Property <i>A nonzero quantity raised to the zero power is equal to 1.</i>	$100^0 = 1$	$a^0 = 1$
Negative Exponent Property <i>A nonzero base raised to a negative exponent is equal to the reciprocal of the base raised to the opposite, positive exponent.</i>	$7^{-2} = \left(\frac{1}{7}\right)^2 = \frac{1}{7^2}$ $\left(\frac{3}{2}\right)^{-4} = \left(\frac{2}{3}\right)^4$	$a^{-n} = \left(\frac{1}{a}\right)^n = \frac{1}{a^n}$ $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

WORDS	NUMBERS	ALGEBRA
Product of Powers Property <i>To multiply powers with the same base, add the exponents.</i>	$4^3 \cdot 4^2 = 4^{3+2} = 4^5$	$a^m \cdot a^n = a^{m+n}$
Quotient of Powers Property <i>To divide powers with the same base, subtract the exponents.</i>	$\frac{3^7}{3^2} = 3^{7-2} = 3^5$	$\frac{a^m}{a^n} = a^{m-n}$
Power of a Powers Property <i>To raise one power to another, multiply the exponents.</i>	$(4^3)^2 = 4^{3 \cdot 2} = 4^6$	$(a^m)^n = a^{m \cdot n}$
Power of a Product Property <i>To find the power of a product, apply the exponent to each factor.</i>	$(3 \cdot 4)^2 = 3^2 \cdot 4^2$	$(ab)^m = a^m \cdot b^m$
Power of a Quotient Property <i>To find the power of a quotient, apply the exponent to the numerator and denominator.</i>	$\left(\frac{3}{5}\right)^2 = \frac{3^2}{5^2}$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

EXAMPLES:

- Simplifying Expressions with Negative Exponents

Simplify each expression

a. 2^{-3}

$$= \frac{1}{2^3}$$

b. $-\left(\frac{3}{4}\right)^{-4}$

$$= -\left(\frac{4}{3}\right)^4 = -\frac{4^4}{3^4} = -\frac{256}{81}$$

$$\begin{aligned} \text{c. } & \left(\frac{1}{3}\right)^{-2} \\ & = \left(\frac{3}{1}\right)^2 = 3^2 = 9 \end{aligned}$$

$$\begin{aligned} \text{d. } & (-5)^{-5} \\ & = \left(-\frac{1}{5}\right)^5 = -\frac{1}{5^5} = -\frac{1}{3125} \end{aligned}$$

2. Simplify each expression. Assume all variables nonzero.

$$\begin{aligned} \text{a. } & 2x^3(-5x) \\ & = -10x^{3+1} = -10x^4 \end{aligned}$$

$$\begin{aligned} \text{b. } & \left(\frac{ab^4}{b^7}\right)^2 \\ & = \frac{a^2b^{4 \cdot 2}}{b^{7 \cdot 2}} = \frac{a^2 \cdot b^8}{b^{14}} = \frac{a^2}{b^{14-8}} = \frac{a^2}{b^6} \end{aligned}$$

$$\begin{aligned} \text{c. } & (5x^6)^3 \\ & = 5^3x^{6 \cdot 3} = 125x^{18} \end{aligned}$$

$$\begin{aligned} \text{d. } & (-2a^3b)^{-3} \\ & = \frac{1}{(-2a^3b)^3} = \frac{1}{(-2)^3a^{3 \cdot 3}b^3} = \frac{1}{-8a^9b^3} \end{aligned}$$

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Properties of Exponents

Simplify the following.

1. $3r^2(-3r^3)$ 1. _____

2. $(4f^5g)(2fg^3)$ 2. _____

3. $\frac{9k^3m^8}{3k^5m^2}$ 3. _____

4. $\frac{16p^{-2}q^{-3}}{2p^{-5}q^{-4}}$ 4. _____

5. $\frac{68f^5g^{-3}}{4f^{-3}g^6}$ 5. _____

6. $(-4a^3b^7)^{-2}$

6. _____

7. $6m^4n^9(-3m^2n^3)^{-2}$

7. _____

8. $(-5x^5y^{-3}z^8)^3$

8. _____

9. $7g^2h^3(-2h^5k^0)^{-3}$

9. _____

10. $\left(\frac{24m^7n^3}{4mn^{-5}}\right)^{-2}$

10. _____