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Zero and Negative Exponents

Unit 7 Lesson 1

Students will be able to:

Simplify and evaluate powers with negative and zero exponent.

Key Vocabulary:

- Negative Exponent
- Zero Exponent
- Properties of Power

ZERO AND NEGATIVE EXPONENTS

DEFINITION FOR NEGATIVE AND ZERO EXPONENT

$$a^0 = 1, a \neq 0$$

$$a^{-n} = \frac{1}{a^n} \quad \text{for any positive integer,} \quad a \neq 0$$

Sample Problem 1: simplify the following expression.

$1. -4^0 - 2^2 =$

$2. -2x^0 =$

$3. -2^{-4} - \dfrac{1}{2x^0} =$

$4. \left(-x^0 - 1^{-1}\right)^{-1} =$

Sample Problem 1: simplify the following expressions.

$$1. -4^0 - 2^2 = \boxed{-5}$$

$$2. -2x^0 = \boxed{-2}$$

$$3. -2^{-4} - \frac{1}{2x^0} =$$

$$\boxed{-\frac{1}{16} - \frac{1}{2} = -\frac{9}{16}}$$

$$4. \left(-x^0 - 1^{-1}\right)^{-1} =$$

$$\boxed{\left(-1-1\right)^{-1} = -2^{-1} = -\frac{1}{2}}$$

Sample Problem 2: Evaluate the following using properties of powers.

1. $\left(\dfrac{-5}{4}\right)^{-3} =$

2. $\left(\dfrac{2x}{3y^4}\right)^{-1} =$

3. $\left[\dfrac{-(2x)^0}{2x^0}\right]^{-3} =$

4. $(-2)^{-3} =$

Sample Problem 2: Evaluate the following using properties of powers.

$1. \left(\dfrac{-5}{4}\right)^{-3} = \left(-\dfrac{4}{5}\right)^{3}$

$$-\dfrac{64}{125}$$

$2. \left(\dfrac{2x}{3y^4}\right)^{-1} = \left(\dfrac{3y^4}{2x}\right)^{1}$

$$\dfrac{3y^4}{2x}$$

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Sample Problem 2: Evaluate the following using properties of powers.

$$3. \left[\frac{-(2x)^0}{2x^0} \right]^{-3} = \left(\frac{-1}{2} \right)^{-3}$$

$$4. (-2)^{-3} = -\frac{1}{2^3} \quad \boxed{-\frac{1}{8}}$$

$$(-2)^3 = -8$$

ZERO AND NEGATIVE EXPONENTS

Sample Problem 3: Simplify the following without negative exponents.

$$1. \frac{2^{-1} - 3^{-1}}{2^{-1} + 3^{-1}} =$$

$$2. -2^{-1} - (-2^2)^0 =$$

$$3. \frac{\left(-4^{-1} - 2^{-1}\right)^{-1}}{6^{-1} - 2^{-1}} =$$

Sample Problem 3: Simplify the following without negative exponents.

$$1. \frac{2^{-1} - 3^{-1}}{2^{-1} + 3^{-1}} = \frac{\dfrac{1}{2} - \dfrac{1}{3}}{\dfrac{1}{2} + \dfrac{1}{3}} = \frac{\dfrac{3-2}{6}}{\dfrac{3+2}{6}} = \frac{\dfrac{1}{6}}{\dfrac{5}{6}} = \frac{1}{6} \times \frac{6}{5} = \frac{6}{30} \, or \, \frac{1}{5}$$

$$2. -2^{-1} - (-2^2)^0 = -\frac{1}{2} - \left(-\frac{1}{4}\right)^0 = -\frac{1}{2} - 1 = \frac{-3}{2}$$

ZERO AND NEGATIVE EXPONENTS

Sample Problem 3: Simplify the following without negative exponents.

$$3.\frac{\left(-4^{-1}-2^{-1}\right)^{-1}}{6^{-1}-2^{-1}} = \frac{\left(-\dfrac{1}{4}-\dfrac{1}{2}\right)^{-1}}{\dfrac{1}{6}-\dfrac{1}{2}} = \frac{\left(\dfrac{-1-2}{4}\right)^{-1}}{\dfrac{1-3}{6}} = \frac{\left(-\dfrac{3}{4}\right)^{-1}}{-\dfrac{1}{3}} =$$

$$\frac{-\dfrac{4}{3}}{-\dfrac{1}{3}} = \frac{4}{3}\times\frac{3}{1} = \frac{12}{3} \, or \, 4$$