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# Zero and Negative Exponents

Unit 7 Lesson 1

# ZERO AND NEGATIVE EXPONENTS

**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

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

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

## ZERO AND NEGATIVE EXPONENTS

**Sample Problem 1:** simplify the following expression.

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

$$2. -2x^0 =$$

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

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

## ZERO AND NEGATIVE EXPONENTS

**Sample Problem 1:** simplify the following expressions.

$$1. -4^0 - 2^2 = -5$$

$$2. -2x^0 = -2$$

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

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

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

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

## ZERO AND NEGATIVE EXPONENTS

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

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

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

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

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

## ZERO AND NEGATIVE EXPONENTS

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

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

$$-\frac{64}{125}$$

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

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

## ZERO AND NEGATIVE EXPONENTS

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

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

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

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



## ZERO AND NEGATIVE EXPONENTS

**Sample Problem 3:** Simplify the following without negative exponents.

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

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

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

## ZERO AND NEGATIVE EXPONENTS

**Sample Problem 3:** Simplify the following without negative exponents.

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

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

## ZERO AND NEGATIVE EXPONENTS

**Sample Problem 3:** Simplify the following without negative exponents.

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

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