

Name: LEY Hour: _____ Date: _____

NOTES: Section 8.2 – Zero and Negative Exponents

Goals: #1 - I can apply exponent properties involving quotients.



#2 - I can evaluate powers that have zero or negative exponents.

Homework: Section 8.2 Worksheet

Warm Up:

Simplify the expression. Write your answer using exponents.

1. $7^3 \cdot 7^6$
 7^{3+6}
 7^9

2. $(y^4)^3$
 $y^{4 \cdot 3}$
 y^{12}

Simplify the expression.

1. $(2y)^4$
 $2^4 y^4$
 $16y^4$

2. $(3b^3)^2 \cdot b$
 $3^2 b^{3 \cdot 2} \cdot b$
 $9b^6 \cdot b$
 $9b^7$

Exploration #1: Work with a partner and answer the following questions.

1. Evaluate the following exponents:

a. $10^1 = 10$

b. $10^2 = 100$

c. $10^3 = 1000$

d. $10^0 = 1$

2. Use your calculator to evaluate the following exponents and write your answer as

FRACTIONS:

a. $10^{-1} = \frac{1}{10}$

b. $10^{-2} = \frac{1}{100}$

c. $10^{-3} = \frac{1}{1000}$

$\frac{1}{10^1}$

$\frac{1}{10^2}$

$\frac{1}{10^3}$

d. Can you write your answer in letters a - c using EXPONENTS?

3. What do you notice?

reciprocals

Notes:

Anything to the power of zero is one.

Example: $5^0 = 1$ $(-\pi)^0 = 1$ $100000^0 = 1$

When numbers have a negative exponent, it is also their reciprocal

Example: $3^{-2} = \frac{1}{3^2}$ $\frac{1}{3^{-2}} = \frac{3^2}{1} = 3^2$

Example #1: Evaluate the expression.

1. 7^{-2}

$$\frac{1}{7^2}$$

$$\boxed{\frac{1}{49}}$$

2. $(-6)^0$

$$\boxed{1}$$

3. $(-5)^{-3}$

$$\frac{1}{(-5)^3}$$

$$\boxed{\frac{1}{-125}}$$

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

$$\frac{2^{-2}}{3^{-2}}$$

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

$$\boxed{\frac{9}{4}}$$

You practice: Evaluate the expression.

1. $(-7)^{-1}$

$$\frac{1}{(-7)^1}$$

$$\boxed{-\frac{1}{7}}$$

2. $(\frac{1}{5})^{-3}$

$$\frac{1^{-3}}{5^{-3}}$$

$$\frac{5^3}{1^3} \quad \boxed{125}$$

3. $(5)^{-3}$

$$\frac{1}{(5)^3}$$

$$\boxed{\frac{1}{125}}$$

4. $(-100)^0$

$$1$$

Example #2: Simplify the expression. Write your answer using only positive exponents.

1. $2x^2y^{-3}$

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

2. $(5a)^{-2}$

$$5^{-2}a^{-2}$$

$$\frac{1}{5^2a^2} \quad \boxed{\frac{1}{25a^2}}$$

3. $\frac{c^{-2}}{d^{-3}}$

$$\boxed{\frac{d^3}{c^2}}$$

You practice: Simplify the expression. Write your answer using only positive exponents.

1. $(5b)^{-3}$

$$5^{-3}b^{-3}$$

$$\frac{1}{5^3b^3} \quad \boxed{\frac{1}{125b^3}}$$

2. $2x^{-3}y^3$

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

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

$$\boxed{3x^2}$$

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Exploration #2: Work with a partner and answer the following questions.

1. How can you write 7^5 as products?

$$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$$

2. How can you write 7^3 as products?

$$7 \cdot 7 \cdot 7$$

3. How can you divide $\frac{7^5}{7^3}$? What about $\frac{x^{10}}{x^4}$? Can you write your answer using exponents?

$$\frac{7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}{7 \cdot 7 \cdot 7} = 7 \cdot 7 = 7^2$$

$$\frac{\cancel{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}}{\cancel{x \cdot x \cdot x \cdot x}} = \boxed{x^6}$$

4. Complete: $\frac{a^m}{a^n} = a^{\boxed{m-n}}$

Notes:

To divide powers that have the same base, we subtract the exponents.

Example:

Example #3: Simplify the expression.

1. $\frac{x^9}{x^2}$
 x^{9-2}
 $\boxed{x^7}$

2. $\frac{(-4)^7}{(-4)^5}$
 $(-4)^{7-5}$
 $\boxed{(-4)^2}$

3. $\frac{p^8 \cdot p^{10}}{p^{18}}$
 $\frac{p^{18}}{p^{18}}$
 p^0
 $\boxed{1}$

You practice: Simplify the expression.

1. $\frac{3^{10}}{3^7}$
 3^{10-7}
 $\boxed{3^3}$

2. $\frac{y^{100}}{y^{99}}$
 y^{100-99}
 y^1
 \boxed{y}

3. $\frac{m^7}{m^2 \cdot m}$
 $\frac{m^7}{m^{2+1}}$
 $\frac{m^7}{m^3}$
 m^{7-3} $\boxed{m^4}$