

Algebra 1

Lesson 8.3

Define and Use Zero and Negative Exponents

Warm-Up
Simplify.

(a) $(-3x)^2 = 9x^2$

(b) $\left(\frac{a^3}{2b}\right)^5 = \frac{a^{15}}{32b^5}$

(c) $\frac{1}{y^8} \cdot \frac{y^{15}}{1} = \frac{y^{15}}{y^8} = y^7$

(d) $\left(\frac{3x^3}{2y}\right)^2 \cdot \frac{1}{x^2} = \frac{9x^6}{4y^2} \cdot \frac{1}{x^2} = \frac{9x^4}{4y^2}$

Properties of Exponents

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

$$(ab)^m = a^m b^m$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

$$a^0 = 1$$

$$a^{-n} = \frac{1}{a^n}$$

$$\frac{1}{a^{-n}} = a^n$$

Example 1. Use the Definition of Zero and Negative Exponents
Simplify. Write your answer using only positive exponents.

(a) $6^{-2} = \frac{1}{6^2}$

$\frac{1}{36}$

(b) x^0

1

(c) $\left(\frac{2}{3}\right)^{-2} = \frac{2^{-2}}{3^{-2}}$

$\left(\frac{3}{2}\right)^2 = \frac{3^2}{2^2} = \frac{9}{4}$

(d) $(-1)^0$

1

Example 2. Evaluate Exponential Expressions

Evaluate each expression. For this, do not leave any exponents in your answer which means you may :

(a) $(-2)^5 \cdot (-2)^{-5}$

$(-2)^{5+(-5)}$

$(-2)^0$

1

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

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

$\frac{1}{27}$

(c) $\frac{1}{8^{-2}} = \frac{8^2}{1}$

64

(d) $\frac{7^3}{7^8} = \frac{1}{7^2}$

$= \frac{1}{49}$

Try It!

Evaluate each expression.

(a) $\frac{1}{4^{-2}} = \frac{4^2}{1}$

16

(b) $(5^{-2})^{-1}$

5^2
 25

(c) $3^5 \cdot 3^{-5}$

3^0
 1

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

$= \frac{1}{2^4}$
 $= \frac{1}{16}$

Example 3. Using All Properties of Exponents

Simplify the expression. Write your answer using only positive exponents.

(a) $(3x^{-2}y^2)^3$

$3^3 x^{-6} y^6$
 $\frac{27y^6}{x^6}$

(b) $\frac{4x^{-2}y^4}{8xy^6}$

$\frac{1}{2x^3y^2}$
 $\frac{1}{2x^3y^2}$

(c) $\frac{3xy^{-3}}{9x^3y}$

$\frac{1}{3x^2y^4}$
 $\frac{1}{3x^2y^4}$

Try It!

Simplify the expression. Write your answer using only positive exponents.

(a) $\frac{-24a^4}{8a^2}$

$-3a^2$

(b) $\left(\frac{x^2y}{yz}\right)^{-3}$

SHIFT THEM
all
 $\frac{x^{-6}y^{-3}}{y^3z^{-3}}$
 $\frac{y^3z^3}{x^6y^3}$
 $\frac{z^3}{x^6}$

(c) $\frac{7gh^2}{-14g^3h^4}$

$\frac{1}{-2g^2h^2}$
 $\frac{1}{-2g^2h^2}$

Assignment

New: Pg. 506 #4 - 38 (evens)

Review:

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

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

3. $(3x^3y^{-4})(-2x^{-4}y^6)$

4. $(1+2^{-1})^{-1}$