Integer Exponents

Warm Up

Problem of the Day

Lesson Presentation

Lesson Quizzes

Integer Exponents

Warm Up

Evaluate.

1. 10^3 1000

2. 10^1 1

3. 10^4 10,000

4. 10^5 100,000

5. 10^6 1,000,000

Problem of the Day

Find two different numbers for the values of x and y that will make x^y and y^x equal.

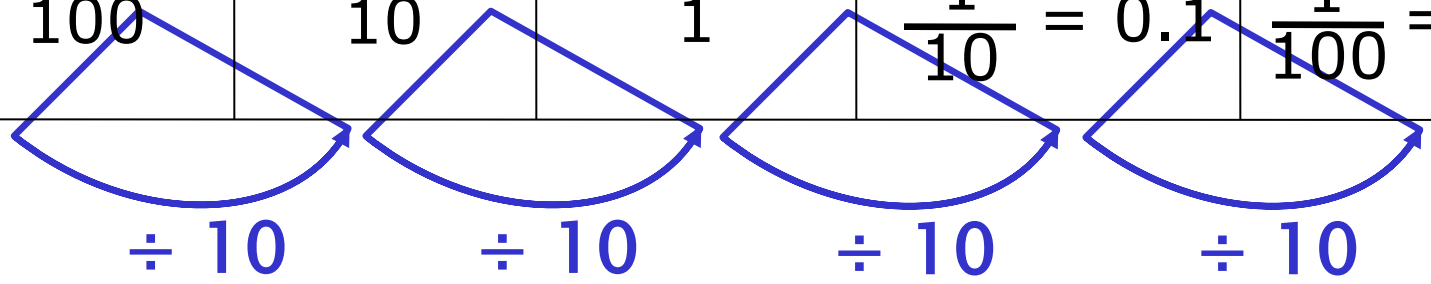
2 and 4

Integer Exponents

Learn to simplify expressions with negative exponents and to evaluate the zero exponent.

Integer Exponents

10^2	10^1	10^0	10^{-1}	10^{-2}
$10 \cdot 10$	10	1	$\frac{1}{10}$	$\frac{1}{10 \cdot 10}$
100	10	1	$\frac{1}{10} = 0.1$	$\frac{1}{100} = 0.01$



Look for a pattern in the table to extend what you know about exponents to include negative exponents.

Additional Example 1: Using a Pattern to Simplify Negative Exponents

Simplify. Write in decimal form.

A. 10^{-2}

$$10^{-2} = \frac{1}{10 \cdot 10}$$

Extend the pattern from the table.

$$= \frac{1}{100} = 0.01$$

Multiply. Write as a decimal.

B. 10^{-1}

$$= \frac{1}{10}$$

Extend the pattern from the table.

$$= \frac{1}{10} = 0.1$$

Multiply. Write as a decimal.

Check It Out: Example 1A

Simplify. Write in decimal form.

10^{-8}

Extend the pattern from the table.

$$= \frac{1}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$$

Multiply.

$$= \frac{1}{100{,}000{,}000}$$

Write as a decimal.

$$= 0.00000001$$

Check It Out: Example 1B

10^{-9}

Extend the pattern from example 1A.

$$= \frac{1}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$$

Multiply.

$$= \frac{1}{1{,}000{,}000{,}000}$$

Write as a decimal.

$$= 0.000000001$$

Integer Exponents

NEGATIVE EXPONENTS		
Words	**Numbers**	**Algebra**
Any nonzero number raised to a negative power equals 1 divided by that number raised to the opposite (positive) power.	$5^{-3} = \frac{1}{5^3} = \frac{1}{125}$	$b^{-n} = \frac{1}{b^n}$, if $b \neq 0$

Additional Example 2A: Evaluating Negative Exponents

Simplify.

5^{-3}

$\frac{1}{5^3}$ *Write the power under 1; change the sign of the exponent.*

$\frac{1}{5 \cdot 5 \cdot 5}$ *Find the product of three $\frac{1}{5}$'s.*

$\frac{1}{125}$ *Simplify.*

Additional Example 2B: Evaluating Negative Exponents

Simplify.

$(-10)^{-3}$

$\left(\frac{1}{-10}\right)^3$ *Write the power under 1; change the sign of the exponent.*

$\frac{1}{-10 \cdot -10 \cdot -10}$ *Find the product of three $\frac{1}{-10}$'s.*

$\frac{1}{-1000} = -0.001$ *Simplify.*

Check It Out: Example 2A

Simplify.

4^{-2}

$\left(\frac{1}{4}\right)^2$ *Write the reciprocal; change the sign of the exponent.*

$\frac{1}{4 \cdot 4}$ *Find the product of two $\frac{1}{4}$'s.*

$\frac{1}{16}$ *Simplify.*

Check It Out: Example 2B

Simplfy.

$(-7)^{-4}$

$\left(\frac{1}{-7}\right)^{4}$ *Write the reciprocal; change the sign of the exponent.*

$\frac{1}{-7 \bullet -7 \bullet -7 \bullet -7}$ *Find the product of four $\frac{1}{-7}$'s.*

$\frac{1}{2401}$ *Simplify.*

Integer Exponents

THE ZERO POWER		
Words	**Numbers**	**Algebra**
The zero power of any number except 0 equals 1.	$100^0 = 1$ $(-7)^0 = 1$	$a^0 = 1$, if $a \neq 0$

Additional Example 3: Using the Order of Operations

Evaluate $5 - (6 - 4)^{-3} + (-2)^0$.

$5 - (6 - 4)^{-3} + (-2)^0$

$= 5 - (2)^{-3} + (-2)^0$ *Subtract inside the parentheses.*

$= 5 - \frac{1}{8} + 1$ *Evaluate the exponents.*

$= 5\frac{7}{8}$ *Add and subtract from left to right.*

Check It Out: Example 3

Evaluate $3 + (7 - 4)^{-2} + (-8)^0$.

$3 + (7 - 4)^{-2} + (-8)^0$

$= 3 + (3)^{-2} + (-8)^0$ *Subtract inside the parentheses.*

$= 3 + \frac{1}{9} + 1$ *Evaluate the exponents.*

$= 4\frac{1}{9}$ *Add.*

Lesson Quizzes

Standard Lesson Quiz

Lesson Quiz for Student Response Systems

Integer Exponents

Lesson Quiz

Evaluate the powers of 10.

1. 10^{-3} 0.001

2. 10^{-7} 0.0000001

Evaluate.

3. $(-6)^{-2}$ $\frac{1}{36}$

4. $4 \cdot 2^{-3} + 10^{-1}$ $\frac{3}{5}$

5. $8^0 - (11 - 2^4)^{-2}$ $\frac{24}{25}$

6. $(4w)^{-2} + w^{-1}$ for $w = 4$ $\frac{65}{256}$

Integer Exponents

Lesson Quiz for Student Response Systems

1. Evaluate 10^{-4}.

A. −40

B. 0.001

C. 0.0001

D. 0.00001

Lesson Quiz for Student Response Systems

2. Evaluate 2^{-4}.

A. -8

B. 8

C. 16

D. $\frac{1}{16}$

Lesson Quiz for Student Response Systems

3. Evaluate $8^2 - (1^1 - 2^0)^{-2}$.

A. -8

B. 62

C. 64

D. 156