

Unit 7 Lesson 5: Negative Exponents with Powers of 10

1 Number Talk: What's That Exponent? (Warm up)

Student Task Statement

Solve each equation mentally.

$$\frac{100}{1} = 10^x$$

$$\frac{100}{x} = 10^1$$

$$\frac{x}{100} = 10^0$$

$$\frac{100}{1000} = 10^x$$

2 Negative Exponent Table

Student Task Statement

Complete the table to explore what negative exponents mean.

		$\cdot 10$	$\cdot 10$	$\cdot 10$	$\cdot 10$	$\cdot 10$	$\cdot 10$
using exponents	10^3	10^2	10^1				
as a decimal	1000.0			1.0		0.01	
as a fraction		$\frac{100}{1}$		$\frac{1}{1}$			$\frac{1}{1000}$
		$\cdot ?$	$\cdot ?$	$\cdot ?$	$\cdot ?$	$\cdot ?$	$\cdot ?$

- As you move toward the left, each number is being multiplied by 10. What is the multiplier as you move right?
- How does a multiplier of 10 affect the placement of the decimal in the product? How does the other multiplier affect the placement of the decimal in the product?
- Use the patterns you found in the table to write 10^{-7} as a fraction.
- Use the patterns you found in the table to write 10^{-5} as a decimal.
- Write $\frac{1}{100,000,000}$ using a single exponent.
- Use the patterns in the table to write 10^{-n} as a fraction.

3 Follow the Exponent Rules

Student Task Statement

1. a. Match each exponential expression with an equivalent multiplication expression:

$$(10^2)^3$$

$$(10^2)^{-3}$$

$$(10^{-2})^3$$

$$(10^{-2})^{-3}$$

$\frac{1}{(10 \cdot 10)} \cdot \frac{1}{(10 \cdot 10)} \cdot \frac{1}{(10 \cdot 10)}$
$(\frac{1}{10} \cdot \frac{1}{10}) (\frac{1}{10} \cdot \frac{1}{10}) (\frac{1}{10} \cdot \frac{1}{10})$
$\frac{1}{\frac{1}{10} \cdot \frac{1}{10}} \cdot \frac{1}{\frac{1}{10} \cdot \frac{1}{10}} \cdot \frac{1}{\frac{1}{10} \cdot \frac{1}{10}}$
$(10 \cdot 10)(10 \cdot 10)(10 \cdot 10)$

- b. Write $(10^2)^{-3}$ as a power of 10 with a single exponent. Be prepared to explain your reasoning.

2. a. Match each exponential expression with an equivalent multiplication expression:

$$\frac{10^2}{10^5}$$

$$\frac{10^2}{10^{-5}}$$

$$\frac{10^{-2}}{10^5}$$

$$\frac{10^{-2}}{10^{-5}}$$

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

- b. Write $\frac{10^{-2}}{10^{-5}}$ as a power of 10 with a single exponent. Be prepared to explain your reasoning.

3. a. Match each exponential expression with an equivalent multiplication expression:

$$10^4 \cdot 10^3$$

$$(10 \cdot 10 \cdot 10 \cdot 10) \cdot \left(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}\right)$$

$$10^4 \cdot 10^{-3}$$

$$\left(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}\right) \cdot \left(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}\right)$$

$$10^{-4} \cdot 10^3$$

$$\left(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}\right) \cdot (10 \cdot 10 \cdot 10)$$

$$10^{-4} \cdot 10^{-3}$$

$$(10 \cdot 10 \cdot 10 \cdot 10) \cdot (10 \cdot 10 \cdot 10)$$

- b. Write $10^{-4} \cdot 10^3$ as a power of 10 with a single exponent. Be prepared to explain your reasoning.