# 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.

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

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

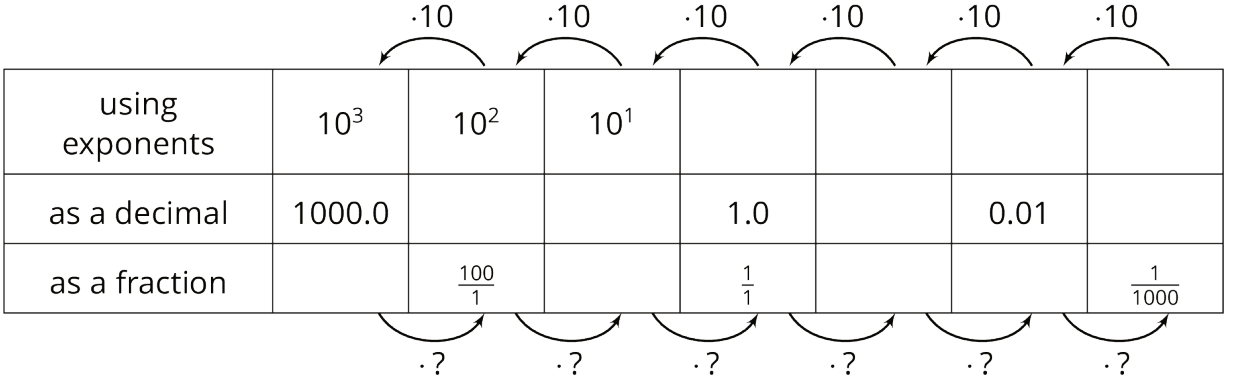
$\frac{x}{100} = 10^0$

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

# 2 Negative Exponent Table

## Student Task Statement

Complete the table to explore what negative exponents mean.




1. As you move toward the left, each number is being multiplied by 10. What is the multiplier as you move right?
2. 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?
3. Use the patterns you found in the table to write $10^{-7}$ as a fraction.
4. Use the patterns you found in the table to write $10^{-5}$ as a decimal.
5. Write $\frac{1}{100{,}000{,}000}$ using a single exponent.
6. 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:

| | |
|---|---|
| $(10^2)^3$ | $\frac{1}{(10 \cdot 10)} \cdot \frac{1}{(10 \cdot 10)} \cdot \frac{1}{(10 \cdot 10)}$ |
| $(10^2)^{-3}$ | $\left(\frac{1}{10} \cdot \frac{1}{10}\right)\left(\frac{1}{10} \cdot \frac{1}{10}\right)\left(\frac{1}{10} \cdot \frac{1}{10}\right)$ |
| $(10^{-2})^3$ | $\frac{1}{\frac{1}{10} \cdot \frac{1}{10}} \cdot \frac{1}{\frac{1}{10} \cdot \frac{1}{10}} \cdot \frac{1}{\frac{1}{10} \cdot \frac{1}{10}}$ |
| $(10^{-2})^{-3}$ | $(10 \cdot 10)(10 \cdot 10)(10 \cdot 10)$ |

   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:

| | |
|---|---|
| $\frac{10^2}{10^5}$ | $\frac{\frac{1}{10} \cdot \frac{1}{10}}{\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}}$ |
| $\frac{10^2}{10^{-5}}$ | $\frac{10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$ |
| $\frac{10^{-2}}{10^5}$ | $\frac{\frac{1}{10} \cdot \frac{1}{10}}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$ |
| $\frac{10^{-2}}{10^{-5}}$ | $\frac{10 \cdot 10}{\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}}$ |

   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:

| | |
|---|---|
| $10^4 \cdot 10^3$ | $(10 \cdot 10 \cdot 10 \cdot 10) \cdot (\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10})$ |
| $10^4 \cdot 10^{-3}$ | $(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}) \cdot (\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10})$ |
| $10^{-4} \cdot 10^3$ | $(\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}) \cdot (10 \cdot 10 \cdot 10)$ |
| $10^{-4} \cdot 10^{-3}$ | $(10 \cdot 10 \cdot 10 \cdot 10) \cdot (10 \cdot 10 \cdot 10)$ |

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