

REVIEW: Zero and Negative Exponents

Name _____

Key Concept and Vocabulary

Zero Exponents

Any nonzero number to the zero power is equal to 1. Zero to the zero power, 0^0 , is undefined.

Numbers: $6^0 = 1$

Algebra: $a^0 = 1$, where $a \neq 0$



Negative Exponents

For any integer n and any number a not equal to 0, a^{-n} is equal to 1 divided by a^n .

Numbers: $4^{-2} = \frac{1}{4^2}$

Algebra: $a^{-n} = \frac{1}{a^n}$, where $a \neq 0$

Skill Examples

- $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$
- $3^{-6} \cdot 3^6 = 3^{-6+6} = 3^0 = 1$
- $\frac{4^2}{4^5} = 4^{2-5} = 4^{-3} = \frac{1}{4^3} = \frac{1}{64}$
- $\frac{7b^{-4}}{b^3} = 7b^{-4-3} = 7b^{-7} = \frac{7}{b^7}$

Application Example

- A faucet leaks water at a rate of 5^{-4} liter per second. How many liters of water leak from the faucet in 1 hour?

There are 3600 seconds in 1 hour. Multiply the time by the rate.

$$\begin{aligned} 3600 \times 5^{-4} &= 3600 \cdot \frac{1}{5^4} \\ &= 3600 \cdot \frac{1}{625} \\ &= 5\frac{19}{25} = 5.76 \end{aligned}$$

So, 5.76 liters of water leak from the faucet in 1 hour.



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Evaluate the expression.

- $4^{-4} = \underline{\hspace{2cm}}$
- $8^{-2} = \underline{\hspace{2cm}}$
- $(-5)^{-6} = \underline{\hspace{2cm}}$
- $9^{-4} \cdot 9^4 = \underline{\hspace{2cm}}$
- $\frac{2^3}{2^8} = \underline{\hspace{2cm}}$
- $\frac{5^3}{5^5} = \underline{\hspace{2cm}}$
- $\frac{(-4)^4}{(-4)^6} = \underline{\hspace{2cm}}$
- $\frac{1}{3^{-3}} \cdot \frac{1}{3^7} = \underline{\hspace{2cm}}$
- $\frac{4^5 \cdot 4^{-2}}{4^4} = \underline{\hspace{2cm}}$

Simplify. Write the expression using only positive exponents.

- $\frac{3x^4}{x^9} = \underline{\hspace{2cm}}$
- $\frac{a^{-5}}{14a^8} = \underline{\hspace{2cm}}$
- $\frac{3w^{-4}}{w^{-2}} = \underline{\hspace{2cm}}$

METRIC UNITS In Exercises 18–21, use the table.

- How many millimeters are in a centimeter? _____
- How many decimeters are in a micrometer? _____
- How many nanometers are in a centimeter? _____
- How many micrometers are in a millimeter? _____

Unit of Length	Length
decimeter	10^{-1} m
centimeter	10^{-2} m
millimeter	10^{-3} m
micrometer	10^{-6} m
nanometer	10^{-9} m