

# REVIEW: Zero and Negative Exponents

Name \_\_\_\_\_

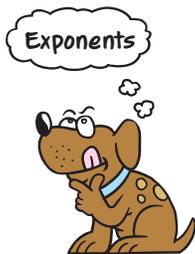
## Key Concept and Vocabulary

### 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

1.  $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

2.  $3^{-6} \cdot 3^6 = 3^{-6+6} = 3^0 = 1$

3.  $\frac{4^2}{4^5} = 4^{2-5} = 4^{-3} = \frac{1}{4^3} = \frac{1}{64}$

4.  $\frac{7b^{-4}}{b^3} = 7b^{-4-3} = 7b^{-7} = \frac{7}{b^7}$

## Application Example

5. 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.

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



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

## PRACTICE MAKES PURR-FECT™

Check your answers at [BigIdeasMath.com](http://BigIdeasMath.com).

Evaluate the expression.

6.  $4^{-4} = \frac{1}{256}$

7.  $8^{-2} = \frac{1}{64}$

8.  $(-5)^{-6} = \frac{1}{15,625}$

9.  $9^{-4} \cdot 9^4 = 1$

10.  $\frac{2^3}{2^8} = \frac{1}{32}$

11.  $\frac{5^3}{5^5} = \frac{1}{25}$

12.  $\frac{(-4)^4}{(-4)^6} = \frac{1}{16}$

13.  $\frac{1}{3^{-3}} \cdot \frac{1}{3^7} = \frac{1}{81}$

14.  $\frac{4^5 \cdot 4^{-2}}{4^4} = \frac{1}{4}$

Simplify. Write the expression using only positive exponents.

15.  $\frac{3x^4}{x^9} = \frac{3}{x^5}$

16.  $\frac{a^{-5}}{14a^8} = \frac{1}{14a^{13}}$

17.  $\frac{3w^{-4}}{w^{-2}} = \frac{3}{w^2}$

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

18. How many millimeters are in a centimeter?  $\frac{10}{1} = 10$
19. How many decimeters are in a micrometer?  $\frac{1}{10^5} = 10^{-5}$
20. How many nanometers are in a centimeter?  $\frac{10^7}{1} = 10^7$
21. How many micrometers are in a millimeter?  $\frac{10^3}{1} = 10^3$

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