

Warm - Up

1. Write the following as a power: $4 \times 4 \times 4 \times 4$
2. What is 6^0 ?
3. Evaluate: a^2b^3 if $a = 4$ and $b = -2$

Objectives

Evaluate expressions containing zero and integer exponents.

Simplify expressions containing zero and integer exponents.

Objectives

Evaluate and multiply by powers of 10.

Convert between standard notation and scientific notation.

You have seen positive exponents. Recall that to simplify 3^2 , use 3 as a factor 2 times: $3^2 = 3 \cdot 3 = 9$.

But what does it mean for an exponent to be negative or 0? You can use a table and look for a pattern to figure it out.

Power	5^5	5^4	5^3	5^2	5^1	5^0	5^{-1}	5^{-2}
Value	3125	625	125	25	5	1	$\frac{1}{5}$	$\frac{1}{25}$

$\underbrace{\hspace{1.5cm}}_{\div 5}$
 $\underbrace{\hspace{1.5cm}}_{\div 5}$
 $\underbrace{\hspace{1.5cm}}_{\div 5}$
 $\underbrace{\hspace{1.5cm}}_{\div 5}$
 $\frac{1}{5}$
 $\frac{1}{25}$

Zero Exponent:

ANY nonzero number raised to the zero power is ONE

$3^0 = 1$

$(-16)^0 = 1$

$a^0 = 1$

$(-3ab)^0 = 1$

Discovery....

$4^5 = 1024$
 $4^4 = 256$
 $4^3 = 64$
 $4^2 = 16$
 $4^1 = 4$
 $4^0 = 1$

$4^{-1} = \frac{1}{4}$
 $4^{-2} = \frac{1}{16}$
 $4^{-3} = \frac{1}{64}$
 $4^{-4} = \frac{1}{256}$
 $4^{-5} = \frac{1}{1024}$
 $4^{-6} = \frac{1}{4096}$

What type of pattern or relationship do you see?

Negative Exponents:

number raised to a NEGATIVE exponent is equal to ONE divided by that number raised to the POSITIVE exponent.

$3^{-2} =$

$\frac{1}{9}$

$2^{-4} =$

$\frac{1}{16}$

$10^{-3} =$

$\frac{1}{1000}$

Examples

1. One cup is 2^{-4} gallons. Simplify this expression.

2. 4^{-3}

3. 7^0

$(-5)^4$ $(-5)^4$
 $\frac{1}{(-5)^4}$ $\frac{1}{625}$

5. -5^{-4}

6. -4^0

7. 2^{-5}

Neg # raised to odd power is neg
 Neg # raised to even power is even

Evaluate each expression for the given value(s) of the variable(s).

8. x^{-2} for $x = 2$ 9. a^0b^{-3} for $a = 8$ and $b = -2$

$\frac{1}{4}$ $\frac{1}{-8}$

10. p^{-3} for $p = 4$ 11. $8a^{-2}b^0$ for $a = -2$ and $b = 6$

Example 4: Simplifying Expressions with Zero and Negative Numbers

Simplify.

A. $7w^{-4}$

$\frac{7}{(w)^4}$

B. $\frac{-5}{k^{-2}}$

$-5k^2$

Neg exp. move their base to the other side of fraction bar then become positive

Check it Out! Example 4

Simplify.

a. $2r^0m^{-3}$

$\frac{2}{m^3}$

b. $\frac{r^{-3}}{7r^3}$

c. $\frac{g^4}{h^{-6}}$

g^4h^6

Example 4: Simplifying Expressions with Zero and Negative Numbers

Simplify.

A. $7w^{-4}$

B. $\frac{-5}{k^{-2}}$

Simplify.

16. $4m^0$

17. $3k^{-4}$

18. $\frac{7}{r^{-2}}$

19. $\frac{3^{10}}{d^{-3}}$

20. $2x^0y^{-4}$

21. $\frac{r^{-4}}{8^{-5}}$

22. $\frac{r^4}{d^{-3}}$

23. p^4q^{-1}

$\frac{a^5 b^{-3} c^7}{x^4 y^6 z^8}$

$\frac{a^5 c^7 x^4 z^8}{b^3 y^6}$

Scientific notation is a method of writing numbers that are very large or very small. A number written in scientific notation has two parts that are multiplied.

The first part is a number that is greater than or equal to 1 and less than 10.



The second part is a power of 10.

* If your exponent is POSITIVE, move the decimal to the right, if it's NEGATIVE, move the decimal to the left.

Write each in scientific notation.

1. 38,216

$$3.8216 \times 10^4$$

2. 0.00000000432

$$4.32 \times 10^{-9}$$

3. 9632

$$9.632 \times 10^3$$

4. 0.000238

$$2.38 \times 10^{-4}$$

Write each in standard notation.

1. 3.85×10^{-7}

$$.000000385$$

2. 93.57×10^4

3. 0.00124×10^3

4. 67×10^{-5}

Daily Practice

Integer Exponents and Scientific Notation WS

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