

Name _____

Date _____

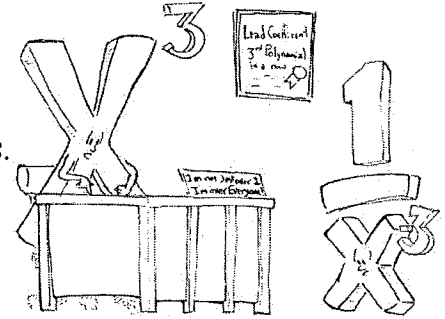
Zero and Negative Exponents

Algebra 1 (A-SSE.B.3)

AIM: How can we rewrite expressions with negative or zero exponents?

By the end of this lesson I will be able to:

- ✓ Explain how to rewrite expressions with zero or negative exponents.
- ✓ Calculate values of expressions with zero or negative exponents.



DO NOW:

Directions: Simplify the expressions below.

1. $a^6 \cdot a^3$

2. $(x^5)^2$

3. $(4a^2b^3)^5$

4. $\frac{x^8}{x^6}$

5. $\frac{x^5}{x^8}$

6. $\frac{x^6}{x^6}$

CHALLENGE:

7. $\left(\frac{4a^3}{2b^4}\right)^2$

8. $(2^3x^2)^5$

Key Concept

Zero and Negative Exponents

Words Any nonzero number to the zero power is 1. Any nonzero number to the negative n power is the multiplicative inverse of its n th power.

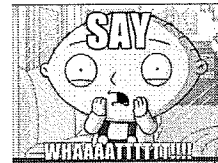
Examples

Numbers

Algebra

$5^0 = 1$
 $7^{-3} = \frac{1}{7} \cdot \frac{1}{7} \cdot \frac{1}{7}$ or $\frac{1}{7^3}$

$x^0 = 1, x \neq 0$
 $x^{-n} = \frac{1}{x^n}, x \neq 0$



Zero Exponents: Any base raised to the zero power equals _____!

Negative Exponents: Rewrite the base as it's _____ and make the exponent _____!

GUIDED PRACTICE:

Study Tip

Negative Exponents
Remember that 6^{-3} is
equal to $\frac{1}{6^3}$, not -216 or
 -18 .

Write each expression using a positive exponent.

Example 1: a) 6^{-3}

b) m^{-5}

c) $(-7)^0$

d) y^0

Example 2: a) 3^{-4}

b) $(-6)^{-2}$

c) $-5x^0$

d) $\frac{24}{6y^0}$

Evaluate each expression.



EXAMPLES

Write Expressions using Negative Exponents

If we can write expressions with negative exponents into fractions, we can also convert fractions back into expressions with negative exponents!

Example 3: a) $\frac{1}{8^3}$

b) $\frac{1}{c^5}$

c) $\frac{1}{4}$

d) $\frac{1}{27}$



EXAMPLES

Multiply and Divide with Negative Exponents

Sometimes when we use the other laws we've already learned, we'll end up with a negative or zero exponent. Now we know what to do with them!

Example 4: a) $3^{-8} \cdot 3^2$

b) $n^9 \cdot n^{-9}$

c) $\frac{11^{-2}}{11^8}$

d) $\frac{b^{-4}}{b^{-4}}$

INDEPENDENT PRACTICE:

Write each expression using a positive exponent.

1. 2^{-4}

2. 4^{-3}

3. a^{-4}

4. g^{-7}

Evaluate each expression.

5. 3^{-6}

6. 5^{-2}

7. $(-2)^{-6}$

8. $(-4)^{-3}$

Write each fraction as an expression using a negative exponent.

9. $\frac{1}{3^4}$

10. $\frac{1}{m^5}$

11. $\frac{1}{16}$

12. $\frac{1}{49}$

Simplify. Express using positive exponents.

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

15. $3^{-3} \cdot 3^{-2}$

16. $r^{-7} \cdot r^3$

17. $m^{-4} \cdot m^{-3}$

18. $\frac{15^{-6}}{15^2}$

19. $\frac{12^{-3}}{12^{-5}}$

20. $\frac{h^5}{h^{-5}}$

21. $\frac{p^1}{p^{-4}}$

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Zero and Negative Exponents

Algebra 1 (A-SSE.B.3)

Homework:**Directions:** Complete ALL homework problems below; remember to show all of your work for full credit ☺

Write each expression using a positive exponent.

1) 6^{-8}

2) 7^{-10}

3) $(-3)^{-5}$

Write each fraction as an expression using a negative exponent.

4) $\frac{1}{9^8}$

5) $\frac{1}{12^4}$

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

7) $\frac{1}{(-5)^7}$

Simplify. Express using positive exponents.

8) $4^{-2} \cdot 4^3$

9) $2^{-3} \cdot 2^{-4}$

10) $x^6 \cdot x^{-3}$

11) $\frac{3^{-1}}{3^{-5}}$

12) $\frac{b^{-7}}{b^5}$

13) $\frac{a^{-4}}{a^{-6}}$

14) Which of the following shows the expressions 6^3 , 6^0 , 6^{-1} , 6^{-2} , and 6^1 in order from least to greatest?

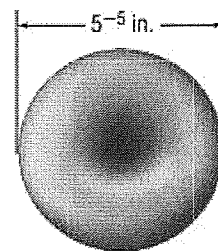
A. $6^{-2}, 6^{-1}, 6^0, 6^1, 6^3$

B. $6^{-1}, 6^0, 6^1, 6^{-2}, 6^3$

C. $6^3, 6^{-2}, 6^{-1}, 6^1, 6^0$

D. $6^3, 6^1, 6^0, 6^{-1}, 6^{-2}$

15) A blood cell has a diameter of about 5^{-5} inches.

Write 5^{-5} using positive exponents.

F. 5^5

H. $\frac{5^5}{1}$

G. $\frac{1}{5^{-5}}$

I. $\frac{1}{5^5}$

How Did the Light Dress Up for the Costume Party?

Write a fraction (or 1) for each power.
For each set of exercises, there is one extra answer. Write the letter of this answer in the corresponding box at the right.

8	3	5	10	4	1	7	9	6	2
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1	7^{-2}	Answers		6	10^{-1}	Answers	
	2^{-3}	(B) $\frac{1}{9}$	(V) $\frac{1}{49}$		20^{-2}	(U) $\frac{1}{400}$	(A) $\frac{1}{10}$
	3^{-2}	(L) $\frac{1}{8}$	(A) $\frac{1}{12}$		100^{-3}	(E) $\frac{1}{2000}$	(O) $\frac{1}{1,000,000}$
2	10^{-4}			7	2^{-7}		
	4^{-3}	(G) $\frac{1}{64}$	(D) $\frac{1}{81}$		5^{-4}	(T) $\frac{1}{500}$	(L) 1
	9^{-2}	(R) $\frac{1}{27}$	(N) $\frac{1}{10,000}$		15^0	(M) $\frac{1}{625}$	(V) $\frac{1}{128}$
3	15^{-1}			8	8^{-2}		
	8^{-3}	(S) $\frac{1}{40}$	(J) $\frac{1}{32}$		10^{-5}	(I) $\frac{1}{256}$	(O) $\frac{1}{64}$
	2^{-5}	(P) $\frac{1}{15}$	(C) $\frac{1}{512}$		4^{-4}	(Y) $\frac{1}{100,000}$	(A) $\frac{1}{196}$
4	5^{-3}			9	7^{-3}		
	3^{-4}	(H) $\frac{1}{125}$	(P) $\frac{1}{144}$		15^{-2}	(E) $\frac{1}{343}$	(H) $\frac{1}{300}$
	12^{-2}	(E) $\frac{1}{96}$	(F) $\frac{1}{81}$		11^0	(L) 1	(T) $\frac{1}{225}$
5	6^0			10	13^{-2}		
	1000^{-1}	(T) $\frac{1}{1000}$	(A) $\frac{1}{693}$		2^{-6}	(B) $\frac{1}{64}$	(M) $\frac{1}{169}$
	9^{-3}	(L) 1	(I) $\frac{1}{729}$		16^{-1}	(F) $\frac{1}{72}$	(S) $\frac{1}{16}$