

Student: _____ Class: _____ Date: _____

Laws of exponentsStudent Activity Sheet 2; use with *Exploring* "Special exponents"1. Investigate the claim that $2^0 = 1$ by examining patterns in powers of 2.

a. Complete the table of values.

2^4	
2^3	
2^2	
2^1	

b. Analyze the patterns you see in the table. What patterns do you see in the exponents in the first column? What patterns do you see in the answers in the second column?

c. Based on the pattern you see in the table, what is the value of 2^0 ? Justify your answer.

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2. Using the patterns you see in the table, extend it to find the value of 2^{-3} .

2^4	
2^3	
2^2	
2^1	
2^0	
2^{-3}	

3. How are 2^{-3} and 2^3 related?

4. What is 2^{-5} equal to? Justify your answer in two different ways.

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5. Write a general rule for negative exponents when the base is 2.

6. **REINFORCE** Investigate different bases to see if the pattern you discovered for a base of 2 still holds true.

a.

5^3	5^2	5^1	5^0	5^{-1}	5^{-2}	5^{-3}

b.

3^3	3^2	3^1	3^0	3^{-1}	3^{-2}	3^{-3}

c.

$(-2)^3$	$(-2)^2$	$(-2)^1$	$(-2)^0$	$(-2)^{-1}$	$(-2)^{-2}$	$(-2)^{-3}$

d.

$(-3)^3$	$(-3)^2$	$(-3)^1$	$(-3)^0$	$(-3)^{-1}$	$(-3)^{-2}$	$(-3)^{-3}$

e.

$(-4)^3$	$(-4)^2$	$(-4)^1$	$(-4)^0$	$(-4)^{-1}$	$(-4)^{-2}$	$(-4)^{-3}$

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7. Complete this statement that describes two important laws of exponents:

For any number x , except zero, x _____ = _____ and x _____ = _____.

8. Complete the table to show each number written in factored form and in scientific notation.

Number in standard form	Number in factored form	Number in scientific notation
40,000	$4 \times 10,000$	4×10^4
400		
40	4×10	4×10^1
4		
0.4	$4 \cdot \frac{1}{10}$	
0.04		
0.004		4×10^{-3}
0.0004		

9. Based on the patterns in the table, express 400,000 in scientific notation.

10. Write each number using scientific notation.

a. 20,000,000

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b. 0.0003

c. $25,000$

11. REINFORCE Simplify the following.

a. $10^0 =$

b. $10^{-1} =$

c. $3^4 =$

d. $4^{-3} =$

12. Complete this table to show whole number powers of 3.

3^0	3^1	3^2	3^3	3^4	3^5

13. According to the table in question 12, what is the principal square root of 9? Why?

14. You now know that 9 to the $\frac{1}{2}$ power means the same thing as the square root of 9.
How would you use fractional exponents to write the other roots in the table?

Powers of 3	3 as a root	3 as a root
$3^0 = 1$		
$3^1 = 3$		
$3^2 = 9$	$\sqrt[2]{9} = 3$	$9^{\frac{1}{2}} = 3$
$3^3 = 27$		
$3^4 = 81$		
$3^5 = 243$		

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15. **REINFORCE** Complete the tables to investigate fractional exponents for other bases. The first entries in each table are shown for you.

a.

Powers of 2	2 as a Root	2 as a Root
$2^0 = 1$		
$2^1 = 2$		
$2^2 = 4$	$\sqrt{4} = 2$	$4^{\frac{1}{2}} = 2$
$2^3 = 8$		
$2^4 = 16$		
$2^5 = 32$		

b.

Powers of 5	5 as a Root	5 as a Root
$5^0 = 1$		
$5^1 = 5$		
$5^2 = 25$	$\sqrt{25} = 5$	$25^{\frac{1}{2}} = 5$
$5^3 = 125$		
$5^4 = 625$		
$5^5 = 3125$		

16. Evaluate each expression. [EX1, page 12]

6^{-2}	10^0	$100^{\frac{1}{2}}$	$27^{\frac{1}{3}}$	7^{-1}	$(-5)^0$