

4-3 Properties of Exponents

You can use patterns to discover properties of exponents.

1. Complete the table.

Product of Powers	Write the Factors	Write As a Single Power
$3^2 \cdot 3^5$	$(3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3) =$ $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	3^7
$4^3 \cdot 4^2$		
$7^4 \cdot 7^4$		
$5^2 \cdot 5^4$		

2. Look at the left-hand and right-hand columns of the table. What patterns do you notice?

3. Complete the table.

Product of Powers	Write the Factors	Write As a Single Power
$\frac{3^6}{3^2}$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3} = 3 \cdot 3 \cdot 3 \cdot 3$	3^4
$\frac{4^5}{4^3}$		
$\frac{5^4}{5^3}$		
$\frac{8^7}{8^3}$		

4. Look at the left-hand and right-hand columns of the table. What patterns do you notice?

Think and Discuss

5. **Explain** how you can use what you discovered to write $2^7 \cdot 2^{10}$ as a single power.
6. **Explain** how you can use what you discovered to write $\frac{2^{10}}{2^7}$ as a single power.

Activity 5

Title: Exponents- Zero and Negative
Teaching Strategy: Inductive Learning

Objective: To discover the rule for zero and negative exponents through inductive processes.

Students: Lets first review the definition of whole number exponents by example.

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

$$2^3 = 2 \times 2 \times 2 = 8$$

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

$$5^2 = 5 \times 5 = 25$$

$$5^1 = 5$$

Exercise 1: In the chart below, compute the values of the numbers with exponents by applying the definition. Do only the problems with exponents greater than or equal to 1.

$2^5 =$	$3^5 =$	$5^5 =$	$1^5 =$	$n^5 =$
$2^4 =$	$3^4 =$	$5^4 =$	$1^4 =$	$n^4 =$
$2^3 =$	$3^3 =$	$5^3 =$	$1^3 =$	$n^3 =$
$2^2 =$	$3^2 =$	$5^2 =$	$1^2 =$	$n^2 =$
$2^1 =$	$3^1 =$	$5^1 =$	$1^1 =$	$n^1 =$
$2^0 =$	$3^0 =$	$5^0 =$	$1^0 =$	$n^0 =$
$2^{-1} =$	$3^{-1} =$	$5^{-1} =$	$1^{-1} =$	$n^{-1} =$
$2^{-2} =$	$3^{-2} =$	$5^{-2} =$	$1^{-2} =$	$n^{-2} =$
$2^{-3} =$	$3^{-3} =$	$5^{-3} =$	$1^{-3} =$	$n^{-3} =$

Exercise 2: Complete the chart by determining the remaining values of numbers with exponents. Since our definition of exponents does not explain zero exponents and negative exponents, you must use another strategy to determine their values. Study each column of answers to determine a possible pattern. Continue the patterns to obtain the remaining values. Use these values to expand the definition of exponents to include zero and negative numbers.