

Strand: Numbers and Operations **Name:** KEY

Skill Addressed: Understand the Patterns of Numbers in Exponential Form

Activity: *Why the Laws?*

Here are 3 Laws of Exponents written as Examples:

LAW #1	$2^6 \times 2^5 = (2 \times 2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2) = 2^{11}$
LAW #2	$2^8 \div 2^5 = \frac{(2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2)}{(2 \times 2 \times 2 \times 2 \times 2)} = 2^3$
LAW #3	$(2^4)^3 = (2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2) = 2^{12}$

Explain how each law works and describe a shortcut to find the answer.

1) **because they are all the same base, can add up all of them to get 6+5=11**

2) **because they are all the same base, can cancel five 2s and get 8-5=3**

3) **because they are all the same base, three groups of four 3 X 4 = 12**

4) If one base was 2 and the other base was 3, would the first two laws still work? Explain why or why not? **They would not work because you can't combine them – it would just be 2⁶ x 3⁵ and no more simplifying possible**

5) Is 2⁶ x 2³ = 4⁹? Explain why or why not. **No because the answer should be 2⁹ since the bases must be the same and don't change in the answer**

Complete the following chart and look for patterns:

2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	2 ⁻¹	2 ⁻²	2 ⁻³	2 ⁻⁴	2 ⁻⁵
						$\frac{1}{2^1}$	$\frac{1}{2^2}$	$\frac{1}{2^3}$	$\frac{1}{2^4}$	$\frac{1}{2^5}$
32	16	8	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$
						0.5	0.25	0.125	0.0625	0.03125

On the back of this page, describe any patterns that you found in the chart.

I noticed that all of the columns have equivalent numbers in them. They are just written in different ways.

Negative exponents cause a reciprocal to occur – for example: 2^{-3} is the same as $\frac{1}{2^3}$.

Every step to the right, the number values are halved, and every step to the left, they are doubled. This is because the base is 2.

I wonder what would happen if the greyed-out boxes were completed. Would each column still have equal numbers?