Bases and Exponents

Let's rewrite expressions using the property $(x^a)^b = x^{ab}$.

21.1 Math Talk: Different Bases

Mentally decide if each expression is equal to 9^{16}.

- $(9^8)^8$
- $(9^4)^4$
- $(3^2)^{16}$
- 3^{32}

21.2 What's the Factor?

1. Refer to the first table.

step	0	1	2	3	4	5	6
value	10	30	90	270			
expression	$10 \cdot 3^0$	$10 \cdot 3^1$	$10 \cdot 3^2$				

   a. Predict the value in Steps 4, 5, and 6.

   b. By what factor does the value change between each of these steps?

      i. from Step 1 to Step 4

      ii. from Step 3 to Step 6

      iii. Conjecture about the factor from Step 7 to Step 10.

   c. By what factor does the value change between each of these steps?

      i. from Step 0 to Step 5

      ii. from Step 1 to Step 6

      iii. Conjecture about the factor from Step 10 to Step 15.

2. Refer to the second table.

step	0	1	2	3	4	5	6
value	3	6	12	24			
expression	$3 \cdot 2^0$						

   a. Predict the value in Steps 4, 5, and 6.

   b. By what factor does the value change between each of these steps?

      i. from Step 1 to Step 3

      ii. from Step 3 to Step 5

      iii. Conjecture about the factor from Step 10 to Step 12.

   c. By what factor does the value change between each of these steps?

      i. from Step 0 to Step 3

      ii. from Step 2 to Step 5

      iii. Conjecture about the factor from Step 10 to Step 13.

3. Refer to the third table.

step	0	1	2	3	4	5	6
value	2,048	1,024	512				
expression							

   a. Predict the value in Steps 4, 5, and 6.

   b. By what factor does the value change between each of these steps?

      i. from Step 1 to Step 3

      ii. from Step 3 to Step 5

      iii. Conjecture about the factor from Step 10 to Step 12.

   c. By what factor does the value change between each of these steps?

      i. from Step 0 to Step 3

      ii. from Step 2 to Step 5

      iii. Conjecture about the factor from Step 10 to Step 13.

21.3 Rewriting Expressions

1. For each given expression, decide what to write in the boxes to create equal expressions.

given expression	equal expression 1	equal expression 2
$5 \cdot 10^8$	$5 \cdot 100^{\square}$	$5 \cdot \square^2$
$7 \cdot 16^9$	$7 \cdot \square^{4 \cdot 9}$	$7 \cdot 4^{\square}$
$(0.25)^3$	$(0.5)^{\square}$	$\square^1$
$3 \cdot (1.2)^6$	$3 \cdot 1.44^{\square}$	$3 \cdot 1.728^{\square}$
$6 \cdot 0.09^{10}$	$6 \cdot \square^5$	$6 \cdot 0.3^{\square}$

2. Write at least 3 new expressions that are equal to $4 \cdot 27^6$.