## Lesson 18: Bases and Exponents

* Let’s rewrite expressions using the property $\left(x^{a}\right)^{b}=x^{ab}$.

### 18.1: Math Talk: Different Bases

Decide if each expression is equal to $9^{16}$.

$\left(9^{8}\right)^{8}$

$\left(9^{4}\right)^{4}$

$\left(3^{2}\right)^{16}$

$3^{32}$

### 18.2: What’s the Factor?

1. Refer to the first table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| * step
 | * 0
 | * 1
 | * 2
 | * 3
 | * 4
 | * 5
 | * 6
 |
| * value
 | * 10
 | * 30
 | * 90
 | * 270
 | *
 | *
 | *
 |
| * expression
 | * $10⋅3^{0}$
 | * $10⋅3^{1}$
 | * $10⋅3^{2}$
 | *
 | *
 | *
 | *
 |

* 1. Predict the value in steps 4, 5, and 6.
	2. By what factor does the value change . . .
		1. from step 1 to step 4?
		2. from step 3 to step 6?
		3. Conjecture about the factor from step 7 to step 10.
	3. By what factor does the value change . . .
		1. from step 0 to step 5?
		2. from step 1 to step 6?
		3. Conjecture about the factor from step 10 to step 15.
1. Refer to the second table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| * step
 | * 0
 | * 1
 | * 2
 | * 3
 | * 4
 | * 5
 | * 6
 |
| * value
 | * 3
 | * 6
 | * 12
 | * 24
 | *
 | *
 | *
 |
| * expression
 | * $3⋅2^{0}$
 | *
 | *
 | *
 | *
 | *
 | *
 |

* 1. Predict the value in steps 4, 5, and 6.
	2. By what factor does the value change . . .
		1. from step 1 to step 3?
		2. from step 3 to step 5?
		3. Conjecture about the factor from step 10 to step 12.
	3. By what factor does the value change . . .
		1. from step 0 to step 3?
		2. from step 2 to step 5?
		3. Conjecture about the factor from step 10 to step 13.
1. Refer to the third table.

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

* 1. Predict the value in steps 4, 5, and 6.
	2. By what factor does the value change . . .
		1. from step 1 to step 3?
		2. from step 3 to step 5?
		3. Conjecture about the factor from step 10 to step 12.
	3. By what factor does the value change . . .
		1. from step 0 to step 3?
		2. from step 2 to step 5?
		3. Conjecture about the factor from step 10 to step 13.

### 18.3: Rewriting Expressions

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

| * given expression
 | * equal expression 1
 | * equal expression 2
 |
| --- | --- | --- |
| * $5⋅10^{8}$
 | * $5⋅100^{}$
 | * $5⋅^{2}$
 |
| * $7⋅16^{9}$
 | * $7⋅^{4⋅9}$
 | * $7⋅4^{}$
 |
| * $\left(0.25\right)^{3}$
 | * $\left(0.5\right)^{}$
 | * $^{1}$
 |
| * $3⋅\left(1.2\right)^{6}$
 | * $3⋅1.44^{}$
 | * $3⋅1.728^{}$
 |
| * $6⋅0.09^{10}$
 | * $6⋅^{5}$
 | * $6⋅0.3^{}$
 |

1. Write at least 3 new expressions that are equal to $4⋅27^{6}$.



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