## Lesson 1: Properties of Exponents

* Let’s use integer exponents.

### 1.1: Which One Doesn’t Belong: Exponents and Equations

A. $2^{3}=9$

B. $9=3^{2}$

C. $2⋅2⋅2⋅2=16$

D. $a⋅2^{0}=a$

### 1.2: Name That Power

Find the value of each variable that makes the equation true. Be prepared to explain your reasoning.

1. $2^{3}⋅2^{5}=2^{a}$
2. $3^{b}⋅3^{7}=3^{11}$
3. $\frac{4^{3}}{4^{2}}=4^{c}$
4. $\frac{5^{8}}{5^{d}}=5^{2}$
5. $6^{m}⋅6^{m}⋅6^{m}=6^{21}$
6. $\left(7^{n}\right)^{4}=7^{20}$
7. $2^{4}⋅3^{4}=6^{s}$
8. $5^{3}⋅t^{3}=50^{3}$

### 1.3: The Power of Zero

1. Use exponent rules to write each expression as a single power of 2. Find the value of the expression. Record these in the table. The first row is done for you.

| * expression
 | * power of 2
 | * value
 |
| --- | --- | --- |
| * $\frac{2^{5}}{2^{1}}$
 | * $2^{4}$
 | * 16
 |
| * $\frac{2^{5}}{2^{2}}$
 | *
 | *
 |
| * $\frac{2^{5}}{2^{3}}$
 | *
 | *
 |
| * $\frac{2^{5}}{2^{4}}$
 | *
 | *
 |
| * $\frac{2^{5}}{2^{5}}$
 | *
 | *
 |
| * $\frac{2^{5}}{2^{6}}$
 | *
 | *
 |
| * $\frac{2^{5}}{2^{7}}$
 | *
 | *
 |

1. What is the value of $5^{0}$?
2. What is the value of $3^{-1}$?
3. What is the value of $7^{-3}$?

#### Are you ready for more?

Explain why the argument used to assign a value to the expression $2^{0}$ does not apply to make sense of the expression $0^{0}$.

### 1.4: Matching Exponent Expressions

Sort expressions that are equal into groups. Some expressions may not have a match, and some may have more than one match. Be prepared to explain your reasoning.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $2^{-4}$ | $\frac{1}{2^{4}}$ | $-2^{4}$ | $-\frac{1}{2^{4}}$ | $4^{2}$ | $4^{-2}$ | $-4^{2}$ | $-4^{-2}$ |
| $2^{7}⋅2^{-3}$ | $\frac{2^{7}}{2^{-3}}$ | $2^{-7}⋅2^{3}$ | $\frac{2^{-7}}{2^{-3}}$ | $\left(-4\right)^{2}$ |  |  |  |

### Lesson 1 Summary

Exponent rules help us keep track of a base’s repeated factors. Negative exponents help us keep track of repeated factors that are the *reciprocal* of the base. We can define a number to the power of 0 to have a value of 1. These rules can be written symbolically as:

$\begin{matrix}b^{m}⋅b^{n}&=b^{m+n}\\\left(b^{m}\right)^{n}&=b^{m⋅n}\\\frac{b^{m}}{b^{n}}&=b^{m−n}\\b^{-n}&=\frac{1}{b^{n}}\\b^{0}&=1\\a^{n}⋅b^{n}&=\left(a⋅b\right)^{n}\end{matrix}$

Here, the base $b$ can be any positive number, and the exponents $n$ and $m$ can be any integer.



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