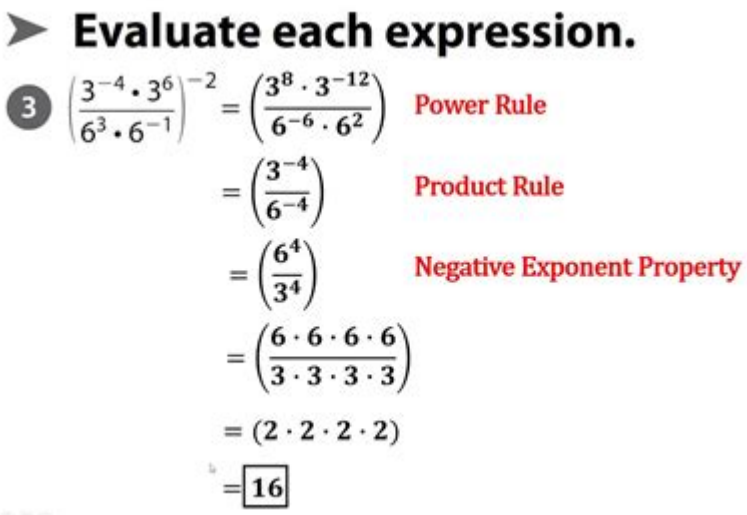
Lesson 1 Properties Of Integer Exponents Answer Key



Lesson 1 properties of integer exponents answer key is a fundamental concept in mathematics, particularly in algebra. Understanding the properties of integer exponents is essential for simplifying expressions and solving equations. In this article, we will explore the key properties of integer exponents, provide examples, and discuss the answer key for common exercises related to these properties.

Understanding Integer Exponents

Integer exponents are a way of expressing repeated multiplication of a base number. For example, \(a^n \) represents the base \(a \) multiplied by itself \(n \) times. Here, \(a \) is the base, and \(n \) is the exponent. If \(n \) is a positive integer, the exponent indicates how many times to multiply \(a \). If \(n \) is zero or negative, the interpretation changes slightly, which we will discuss later.

Key Properties of Integer Exponents

There are several key properties of integer exponents that are crucial for simplifying expressions. These properties include:

1. Product of Powers:
\[
a^m \cdot a^n = a^{m+n}
\]
This property states that when multiplying two powers with the same base, you can add the exponents.

2. Quotient of Powers:

$$
\frac{a^m}{a^n} = a^{m-n} \quad (a \neq 0)
$$

When dividing two powers with the same base, you can subtract the exponents.

3. Power of a Power:

$$
(a^m)^n = a^{m \cdot n}
$$

When raising a power to another power, you multiply the exponents.

4. Power of a Product:

$$
(ab)^n = a^n \cdot b^n
$$

This property indicates that when raising a product to a power, you can distribute the exponent to each factor in the product.

5. Power of a Quotient:

$$
\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad (b \neq 0)
$$

Similar to the product property, this property allows you to distribute the exponent to the numerator and denominator when raising a quotient to a power.

6. Zero Exponent:

$$
a^0 = 1 \quad (a \neq 0)
$$

Any non-zero base raised to the power of zero equals one.

7. Negative Exponent:

$$
a^{-n} = \frac{1}{a^n} \quad (a \neq 0)
$$

A negative exponent indicates the reciprocal of the base raised to the absolute value of the exponent.

Examples of Integer Exponents

To better understand these properties, let’s look at some examples.

Example 1: Product of Powers

Simplify $3^4 \cdot 3^2$.

Applying the product of powers property:

$$
3^4 \cdot 3^2 = 3^{4+2} = 3^6
$$

Example 2: Quotient of Powers

Simplify $\frac{5^7}{5^3}$.

Using the quotient of powers property:

$$
\frac{5^7}{5^3} = 5^{7-3} = 5^4
$$

Example 3: Power of a Power

Simplify $(2^3)^2$.

Using the power of a power property:

$$
(2^3)^2 = 2^{3 \cdot 2} = 2^6
$$

Example 4: Power of a Product

Simplify $(xy)^3$.

Using the power of a product property:

$$
(xy)^3 = x^3 \cdot y^3
$$

Example 5: Power of a Quotient

Simplify $\left(\frac{a}{b}\right)^2$.

Using the power of a quotient property:

$$
\left(\frac{a}{b}\right)^2 = \frac{a^2}{b^2}
$$

Example 6: Zero Exponent

Evaluate 7^0.

Using the zero exponent property:

$$
7^0 = 1
$$

Example 7: Negative Exponent

Simplify 4^{-2}.

Using the negative exponent property:

$$
4^{-2} = \frac{1}{4^2} = \frac{1}{16}
$$

Applying Properties in Exercises

When practicing the properties of integer exponents, students often encounter exercises that require them to apply these rules consistently. Here are some exercises along with their answer key.

Exercise Set

1. Simplify $2^3 \cdot 2^5$.
2. Simplify $\frac{10^6}{10^2}$.

3. Simplify $(3^4)^2$.
4. Simplify $(ab^2)^3$.
5. Evaluate 6^0.
6. Simplify 5^{-3}.

Answer Key

1. $2^3 \cdot 2^5 = 2^{3+5} = 2^8$
2. $\frac{10^6}{10^2} = 10^{6-2} = 10^4$
3. $(3^4)^2 = 3^{4 \cdot 2} = 3^8$
4. $(ab^2)^3 = a^3b^6$
5. $6^0 = 1$
6. $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

Conclusion

Understanding the properties of integer exponents is essential for mastering algebra. The properties discussed in this article provide a solid foundation for simplifying expressions and solving mathematical problems. By practicing these rules through exercises, students can gain confidence in their ability to manipulate exponents accurately. With a clear grasp of integer exponents, learners can tackle more advanced mathematical concepts with ease.

Frequently Asked Questions

What is the product of two powers with the same base?

When multiplying two powers with the same base, you add the exponents. For example, a^m a^n = a^(m+n).

How do you handle the quotient of two powers with the same base?

When dividing two powers with the same base, you subtract the exponents. For example, a^m / a^n = a^(m-n).

What is the value of any non-zero base raised to the power of zero?

Any non-zero base raised to the power of zero is equal to one. For example, a^0 = 1, where a ≠ 0.

What happens when you raise a power to another power?

When raising a power to another power, you multiply the exponents. For example, (a^m)^n = a^(mn).

What is the value of a negative exponent?

A negative exponent represents the reciprocal of the base raised to the absolute value of the exponent. For example, a^(-n) = 1/(a^n), where a ≠ 0.

Can you provide an example of applying the properties of exponents?

Sure! For instance, using the properties: (2^3) (2^2) = 2^(3+2) = 2^5 = 32.

What is the property of exponents for multiplying different bases?

When multiplying different bases, you simply multiply the bases together and keep the exponents separate. For example, a^m b^n remains as is.

How do you simplify expressions with integer exponents?

To simplify expressions with integer exponents, apply the exponent rules consistently, combining like terms and using operations as needed.

What is the relationship between exponents and roots?

Exponents and roots are inversely related. For example, a^(1/n) is equivalent to the nth root of a.

How can you check your work with properties of exponents?

You can check your work by substituting numbers for variables and verifying that both sides of the equation yield the same result.

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