

Rules of Exponents

Key Points:

- Products of exponential expressions with the same base can be simplified by adding exponents.

$$a^m \cdot a^n = a^{m+n}$$

- Quotients of exponential expressions with the same base can be simplified by subtracting exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

- Powers of exponential expressions with the same base can be simplified by multiplying exponents.

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

- An expression with exponent zero is defined as 1.

$$a^0 = 1$$

- An expression with a negative exponent is defined as a reciprocal.

$$a^{-n} = \frac{1}{a^n}$$

- The power of a product of factors is the same as the product of the powers of the same factors.

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

- The power of a quotient of factors is the same as the quotient of the powers of the same factors

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

- Radicals can be rewritten as rational exponents and rational exponents can be rewritten as radicals; the properties of exponents apply to rational exponents.

$$a^{1/n} = \sqrt[n]{a}$$

$$a^{m/n} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$$

Rules of Exponents Videos

- [The Product Rule of Exponents](#)
- [The Quotient Rule of Exponents](#)
- [The Power Rule of Exponents](#)
- [The Zero Exponent Rule of Exponents](#)
- [The Negative Rule of Exponents](#)
- [The Power of a Product Rule of Exponents](#)
- [The Power of a Quotient Rule of Exponents](#)
- [Simplifying Exponential Expression \(combing rules\)](#)

Practice Exercises

Simplify each expression and write the answer with positive exponent only:

1. $2^2 \cdot 2^4$

2. $\frac{4^5}{4^3}$

3. $\left(\frac{a^2}{b^3}\right)^4$

4. $\frac{6a^2 \cdot a^0}{2a^{-4}}$

5. $\frac{(xy)^4}{y^3} \cdot \frac{2}{x^5}$

6. $\frac{4^{-2} \cdot x^3 \cdot y^{-3}}{2x^0}$

7. $\left(\frac{2x^2}{y}\right)^{-2}$

8. $\left(\frac{16a^3}{b^2}\right) \cdot (4ab^{-1})^{-2}$

Answers:

1. 64

2. 16

3. $\frac{a^8}{b^{12}}$

4. $3a^6$

5. $\frac{2y}{x}$

6. $\frac{x^3}{32y^3}$

7. $\frac{y^2}{4x^4}$

8. a