

$$\begin{array}{l}
 1) \frac{2^3}{2^5} = 2^{-2} \\
 = \frac{1}{2^2} = \frac{1}{4} \\
 \\
 2) \frac{(-3)^8}{(-3)^4} = (-3)^4 \\
 = 81 \\
 \\
 3) \frac{45 \cdot 4^{-3}}{45} = \frac{4^{-3}}{1} = \frac{1}{4^3} = \frac{1}{64}
 \end{array}$$

8.3 Division Properties of Exponents

Goals:

- Use the division properties of exponents to evaluate powers and simplify expressions.
- Use powers to model real-life problems.

EQ: What is the general process for solving division problems with exponents?

Algebra 1.5 Concepts	
② LAST UNIT/Experience Systems	① CURRENT UNIT Exponents & Exponential Functions
③ NEXT UNIT/Experience Quadratics	
⑧ Student Activities or Assignments 8.1 8.2 8.3 8.4 8.5 8.6 8.7	⑤ UNIT MAP
⑦ UNIT SELF-TEST QUESTIONS 1. What properties can be used to simplify & evaluate exponential expressions? 2. What do exponential graphs look like? 3. Can you write numbers in both decimal form and in scientific notation? 4. How can exponential growth and decay equations be used to represent and solve real world problems?	⑥ RELATIONSHIPS Simplify Graph Apply Represent

DIVISION PROPERTIES OF EXPONENTS

Let a and b be numbers and let m and n be integers.

Quotient of Powers Property
 To divide powers having the same base, subtract exponents.
 $\frac{a^m}{a^n} = a^{m-n}$, $a \neq 0$ Example: $\frac{3^7}{3^5} = 3^{7-5} = 3^2 = 9$

Power of a Quotient Property
 To find a power of a quotient, find the power of the numerator and the power of the denominator and divide.
 $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, $b \neq 0$ Example: $\left(\frac{4}{5}\right)^3 = \frac{4^3}{5^3} = \frac{64}{125}$

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

Example 1: Using the Quotient of Powers Property

$$\begin{aligned} \text{a. } \frac{8^4}{8^3} &= 8^{4-3} \\ &= 8^1 \\ &= \textcircled{8} \end{aligned}$$

$$\begin{aligned} \text{b. } \frac{(-7)^5}{(-7)^5} &= (-7)^0 \\ &= \textcircled{1} \end{aligned}$$

$$\begin{aligned} \text{c. } \frac{5^3 \cdot 5}{5^5} &= \frac{5^4}{5^5} \\ &= 5^{-1} \\ &= \textcircled{\frac{1}{5}} \end{aligned}$$

$$\begin{aligned} \text{d. } \frac{1}{x^7} \cdot \frac{x^4}{1} &= \frac{x^4}{x^7} \\ &= \frac{x^{-3}}{1} \\ &= \boxed{\frac{1}{x^3}} \end{aligned}$$

Steps to Follow for Exponents

$$\textcircled{1} \times \xrightarrow{\text{+ powers}}$$

$$\downarrow \textcircled{2} \div \text{ - powers}$$

$\textcircled{3}$ Neg Exp. More

Example 2: Use the Power of a Quotient PropertySimplify the expression $\left(-\frac{8}{5}\right)^{-3}$.

$$\begin{aligned} \left(\frac{-8}{5}\right)^{-3} &= \frac{(-8)^{-3}}{5^{-3}} = \frac{5^3}{(-8)^3} \\ &= \frac{125}{-512} \\ &= -\frac{125}{512} \end{aligned}$$

Try It

Evaluate the expression. Write fractions in simplest form.

$$\begin{aligned} 1. \frac{4^7}{4^4} &= 4^3 \\ &= 64 \end{aligned}$$

$$\begin{aligned} 2. \frac{(-7)^8}{-7^8} &= \frac{(-1 \cdot 7)^8}{-1 \cdot 7^8} \\ &= \frac{(-1)^8 \cdot 7^8}{-1 \cdot 7^8} = -1 \end{aligned}$$

$$\begin{aligned} 3. \frac{2^2}{2^{-8}} &= 2^{2-(-8)} \\ &= 2^{10} = 1024 \end{aligned}$$

$$4. \left(\frac{3}{4}\right)^4 = \frac{3^4}{4^4} = \frac{81}{256}$$

Example 3: Simplifying Expressions

Simplify the expression.

$$\text{a. } \frac{3xy^4}{4x^3} \cdot \frac{12x^3y^2}{x^2} = \frac{36x^4y^6}{4x^5} = 9x^{-1}y^6$$

$$\text{b. } \left(\frac{2x^2}{y^3}\right)^5 = \frac{2^5x^{10}}{y^{15}} = \frac{32x^{10}}{y^{15}}$$

Try It

Simplify the expression. The simplified expression should have no negative exponents.

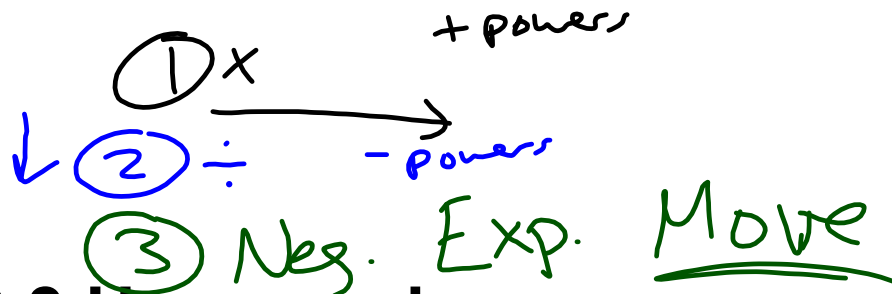
$$5. \left(\frac{2}{y^2}\right)^6 = \frac{2^6}{y^{12}} = \frac{64}{y^{12}}$$

$$6. \frac{x^5}{1} \cdot \frac{2}{x^{11}} = \frac{2x^5}{x^{11}} = 2x^{-6} = \frac{2}{x^6}$$

$$7. \frac{5x^2y^3}{6x^4} \cdot \frac{24x^5y^2}{x^6y^3} = \frac{120x^7y^5}{6x^{10}y^3} = \frac{20x^{-3}y^2}{1} = \frac{20y^2}{x^3}$$

Summary

EQ: What is the general process for solving division problems with exponents?



8.3 Homework

- Dividing Exponents w/ test
- 8.3 p. 466 # 4-4/8 even