1) $\frac{2^3}{2^5} = \frac{2^{-2}}{1} = \frac{1}{2^2} = \frac{1}{4}$

2) $\frac{(-3)^8}{(-3)^4} = (-3)^4 = 81$

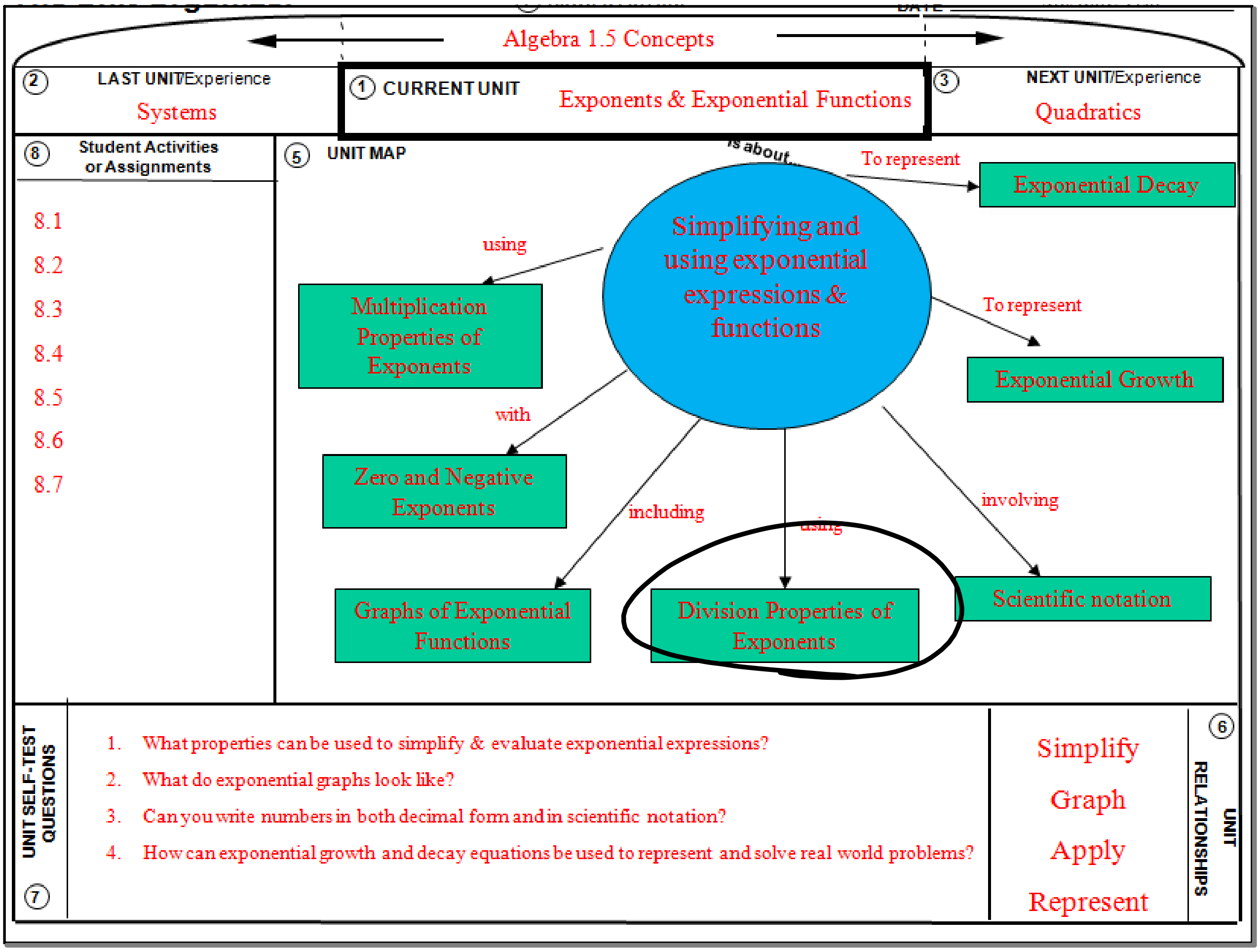
3) $\frac{45 \cdot 4^{-3}}{45} = \frac{4^2}{45} = \frac{4^{-3}}{1} = \frac{1}{4^3} = 1/64$

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?



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:** $\left(\frac{4}{5}\right)^3 = \frac{4^3}{5^3} = \boxed{\frac{64}{125}}$

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

Example 1: Using the Quotient of Powers Property

a. $\frac{8^4}{8^3} = 8^{4-3}$

$= 8^1$

$= 8$

b. $\frac{(-7)^5}{(-7)^5} = (-7)^0$

$= 1$

c. $\frac{5^3 \cdot 5}{5^5} = \frac{5^4}{5^5}$

$= \frac{5^{-1}}{1} = \frac{1}{5}$

d. $\frac{1}{x^7} \cdot \frac{x^4}{1} = \frac{x^4}{x^7}$

$= \frac{x^{-3}}{1} = \frac{1}{x^3}$

Steps to Follow for Exponents

+ powers

① × ⟶

② ÷ − powers

③ Neg Exp. More

Example 2: Use the Power of a Quotient Property

Simplify the expression $\left(-\frac{8}{5}\right)^{-3}$.

$$\left(\frac{-8}{5}\right)^{-3} = \frac{(-8)^{-3}}{5^{-3}} = \frac{5^3}{(-8)^3}$$

$$= \boxed{\frac{125}{-512}}$$

$$= \frac{-125}{512}$$

Try It

Evaluate the expression. Write fractions in simplest form.

1. $\frac{4^7}{4^4} = 4^3$

$= 64$

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

$\frac{(-1)^8 \cdot \cancel{7^8}}{-1 \cdot \cancel{7^8}} = -1$

3. $\frac{2^2}{2^{-8}} = 2^{2-8}$

$= 2^{10} = \boxed{1024}$

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

Example 3: Simplifying Expressions

Simplify the expression.

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

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

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?

+ powers

1 x

2 ÷ - powers

3 Neg. Exp. Move

8.3 Homework

- Dividing Exponents wkst
- 8.3 p.466 #4-48 even