

Algebra 8-7: Quotients of Powers

Warm-Up

1. Simplify. $(y^5)^4$
 y^{20}

2. Simplify. $x^3y^6z^2(xy^0z^5)$
 $x^3 \cdot x^1 \cdot y^6 \cdot y^0 \cdot z^2 \cdot z^5$
 $x^4 y^6 z^7$

3. Simplify. $\frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x} = x^2$

4. Simplify. $\frac{x \cdot x \cdot x}{x \cdot x \cdot x \cdot x \cdot x} = \frac{1}{x^2}$

$$\frac{x^5}{x^3} = x^{5-3} = x^2$$

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

Property	Definition	Example
Quotient of Powers	$\frac{b^m}{b^n} = b^{m-n}$	$\frac{X^8}{X^5} = X^{8-5} = X^3$

Remember...

- When in doubt, write it out!
- If there are numbers in front of the variables, coefficients reduce them.

$$\frac{4x}{2y} = \frac{2x}{1y}$$

Examples

Simplify. Write without negative exponents.

$$1. \frac{x^{15}}{x^8} = x^{15-8} = x^7$$

$$2. \frac{y^{31}}{y^{60}} = y^{31-60} = y^{-29} = \frac{1}{y^{29}}$$

$$3. \frac{5^5}{5^9} = 5^{5-9} = 5^{-4} = \frac{1}{5^4} = \frac{1}{625}$$

Coefficients

$$4. \frac{30x^2y^{10}}{25xy^{15}}$$

$$= \frac{6}{5} x^{2-1} y^{10-15}$$

$$= \frac{6}{5} x y^{-5}$$

$$= \frac{6x}{5y^5}$$

$$5. \frac{8^{12}}{8^8} = 8^{12-8} = 8^4 = 4096$$

$$6. \frac{x^{19}}{x^8} = x^{19-8} = x^{11}$$

7. $\frac{x^5}{y^8}$

8. $\frac{7a^2b^8c^0}{21a^5b^3c^{15}}$
 $\frac{1}{3} a^{2-5} b^{8-3} c^{0-15}$
 $\frac{1}{3} a^{-3} b^5 c^{-15}$
 $= \frac{1 b^5}{3 a^3 c^{15}}$

9. $\frac{40a^4b^2c^{10}}{2a^6b^3c^{15}}$
 $= 20 a^{4-6} b^{2-3} c^{10-15}$
 $= 20 a^{-2} b^{-1} c^{-5}$
 $= \frac{20}{a^2 b c^5}$

10. Rewrite the multiplication problem $16 \cdot 64$ using powers of 2.

Note
 $(2^4)^6 = 2^{24}$

$(2^4) \cdot (2^6) = 2^{10}$

11. In March 1992 there was a total of 283.9 billion dollars in U.S. currency in circulation. The U.S. population was about 252.7 million. How much currency per person was in circulation?

$\frac{2.839 \times 10^{11}}{2.527 \times 10^8}$

$283,900,000,000$

2.839×10^{11}

$252,700,000$

2.527×10^8

1.123466×10^3

$\$1,123.47$

Rule

$\frac{x^5}{x^3} = x^{5-3} = x^2$