

8.2: Apply Exponent Properties Involving Quotients

Goals: *Divide expressions with the same base and having exponents

*Raise a quotient to a power

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

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

Write out the following as a quotient:

$$\frac{a^5}{a^3} = \frac{a \cdot a \cdot a \cdot a \cdot a}{a \cdot a \cdot a} = a \cdot a = a^2$$

Can you come up with a rule for dividing expressions with the same base raised to a power?

Same base, subtract the exponents

Simplify the following expressions. Write the answer using an exponent.

Ex: $\frac{4^7}{4^2}$

4^5

Ex: $\frac{8^{10}}{8^4}$

8^6

Ex: $\frac{5^4 \cdot 5^8}{5^7}$

5^5

Ex: $\frac{(-3)^9}{(-3)^3}$

3^6

Ex: $\frac{1}{x^4} \cdot x^6$

x^2

Ex: $\frac{9^{12}}{9^5}$

9^7

Ex: $\frac{(-2)^4}{(-2)^3}$

-2

Ex: $\frac{6^3 \cdot 6^4}{6^2}$

6^5

Ex: $\frac{1}{r^5} \cdot r^8$

r^3

Write the following out as a product:

$$\left(\frac{a}{b}\right)^4 = \frac{a}{b} \cdot \frac{a}{b} \cdot \frac{a}{b} \cdot \frac{a}{b} = \frac{a \cdot a \cdot a \cdot a}{b \cdot b \cdot b \cdot b} = \frac{a^4}{b^4}$$

Can you come up with a rule to simplify a quotient being raised to a power?

Fraction raised to a power, both numerator and denominator get raised to the power

Use the rule you came up with to simplify the following expressions.

Ex: $\left(\frac{3}{2}\right)^7$

$$\frac{3^7}{2^7}$$

Ex: $\left(\frac{x}{y}\right)^3$

$$\frac{x^3}{y^3}$$

Ex: $\left(\frac{-7}{x}\right)^2$

$$\frac{49}{x^2}$$

Ex: $\left(\frac{c}{d}\right)^6$

$$\frac{c^6}{d^6}$$

Ex: $\left(\frac{-2}{y}\right)^4$

$$\frac{16}{y^4}$$

Ex: $\left(\frac{4x^2}{5y}\right)^3$

$$\frac{64x^6}{125y^3}$$

Ex: $\left(\frac{a^2}{b}\right)^5$

$$\frac{a^{10}}{b^5}$$

Try some more difficult ones:

Ex: $\left(\frac{2f^2g^3}{3fg}\right)^4$

$$\frac{16f^8g^{12}}{81f^4g^4}$$

$$\frac{16f^4g^8}{81}$$

Ex: $\frac{2s^3t^3}{st^2} \cdot \frac{(3st)^3}{s^2t}$

$$\frac{2s^3t^3}{st^2} \cdot \frac{27s^3t^3}{s^2t}$$

$$54s^3t^3$$

Ex: $\left(\frac{2m^5n}{4m^2}\right)^2 \cdot \left(\frac{mn^4}{5n}\right)^2$

$$\frac{4m^{10}n^2}{16m^4} \cdot \frac{m^2n^8}{25n^2}$$

$$\frac{m^8n^8}{100}$$

Ex: $\left(\frac{3x^3y}{x^2}\right)^3 \cdot \left(\frac{y^2x^4}{5y}\right)^2$

$$\frac{27x^9y^3}{x^6} \cdot \frac{y^4x^8}{25y^2}$$

$$\frac{27x^{11}y^5}{25}$$