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

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

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