8.2 Apply Exponent Properties Involving Quotients

Goal • Use properties of exponents involving quotients.

Your Notes

QUOTIENT OF POWERS PROPERTY

Let a be a nonzero real number, and let m and n be positive integers such that $m > n$.

Words: To divide powers having the same base, subtract the exponents.

Algebra: $\frac{a^m}{a^n} = a^{m-n}$, $a \neq 0$

Example: $\frac{4^7}{4^2} = 4^{7-2} = 4^5$

Example 1 *Use the quotient of powers property*

Simplify the expression.

a. $\frac{6^{12}}{6^5} = 6^{12-5} = 6^7$

b. $\frac{(-2)^7}{(-2)^4} = (-2)^{7-4} = (-2)^3$

When simplifying powers with numerical bases only, write your answers using exponents.

c. $\frac{4^2 \cdot 4^8}{4^4} = \frac{4^{10}}{4^4}$

$= 4^{10-4}$

$= 4^6$

d. $\frac{1}{y^9} \cdot y^{12} = \frac{y^{12}}{y^9}$

$= y^{12-9}$

$= y^3$

Your Notes

POWER OF A QUOTIENT PROPERTY

Let a and b be real numbers with $b \neq 0$, and let m be a positive integer.

Words: To find a power of a quotient, find the power of the numerator and the power of the denominator and divide.

Algebra: $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, $b \neq 0$ **Example:** $\left(\frac{4}{7}\right)^3 = \frac{4^3}{7^3}$

Example 2 ***Use the power of a quotient property***

When simplifying powers with numerical and variable bases, evaluate the numerical power.

Simplify the expression.

a. $\left(\frac{r}{s}\right)^5 = \frac{r^5}{s^5}$

b. $\left(-\frac{4}{w}\right)^3 = \left(\frac{-4}{w}\right)^3 = \frac{(-4)^3}{w^3} = \frac{-64}{w^3} = -\frac{64}{w^3}$

Checkpoint **Simplify the expression.**

1. $\frac{(-8)^8}{(-8)^5}$

$(-8)^3$

2. $\frac{3^5 \cdot 3^4}{3^3}$

3^6

3. $\left(-\frac{r}{3}\right)^2$

$\frac{r^2}{9}$

4. $\left(\frac{5}{t}\right)^4$

$\frac{625}{t^4}$

Your Notes

Example 3 ***Use properties of exponents***

Simplify $\left(\frac{2y^7}{y^5}\right)^3$.

Solution

$\left(\frac{2y^7}{y^5}\right)^3 = \frac{(2y^7)^3}{(y^5)^3}$ Power of a quotient **property**

$= \frac{2^3 \cdot (y^7)^3}{(y^5)^3}$ Power of a product **property**

$= \frac{8y^{21}}{y^{15}}$ Power of a power **property**

$= 8y^6$ Quotient of powers **property**

✔ ***Checkpoint*** **Simplify the expression.**

5. $\left(\frac{7y^3z}{y}\right)^2$

$49y^5z^2$

6. $\frac{2s^4}{t} \cdot \left(\frac{2t}{s}\right)^3$

$16st^2$

7. $\left(\frac{6m^3n^2}{3mn}\right)^3$

$8m^6n^3$

8. $\frac{4a}{b^2} \cdot \left(\frac{2a^2b^3}{a}\right)^4$

$64a^5b^{10}$

Homework