

Dividing Monomials

Quotients of Monomials To divide two powers with the same base, subtract the exponents.

Quotient of Powers	For all integers m and n and any nonzero number a , $\frac{a^m}{a^n} = a^{m-n}$.
Power of a Quotient	For any integer m and any real numbers a and b , $b \neq 0$, $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$.

Example 1 Simplify $\frac{a^4b^7}{ab^2}$. Assume neither a nor b is equal to zero.

$$\begin{aligned}\frac{a^4b^7}{ab^2} &= \left(\frac{a^4}{a}\right)\left(\frac{b^7}{b^2}\right) && \text{Group powers with the same base.} \\ &= (a^{4-1})(b^{7-2}) && \text{Quotient of Powers} \\ &= a^3b^5 && \text{Simplify.}\end{aligned}$$

The quotient is a^3b^5 .

Example 2 Simplify $\left(\frac{2a^3b^5}{3b^2}\right)^3$. Assume that b is not equal to zero.

$$\begin{aligned}\left(\frac{2a^3b^5}{3b^2}\right)^3 &= \frac{(2a^3b^5)^3}{(3b^2)^3} && \text{Power of a Quotient} \\ &= \frac{2^3(a^3)^3(b^5)^3}{(3)^3(b^2)^3} && \text{Power of a Product} \\ &= \frac{8a^9b^{15}}{27b^6} && \text{Power of a Power} \\ &= \frac{8a^9b^9}{27} && \text{Quotient of Powers}\end{aligned}$$

The quotient is $\frac{8a^9b^9}{27}$.

Exercises

Simplify. Assume that no denominator is equal to zero.

1. $\frac{5^5}{5^2}$ **5^3 or 125**

2. $\frac{m^6}{m^4}$ **m^2**

3. $\frac{p^5n^4}{p^2n}$ **p^3n^3**

4. $\frac{a^2}{a}$ **a**

5. $\frac{x^5y^3}{x^6y^2}$ **y**

6. $\frac{-2y^7}{14y^5}$ **$-\frac{1}{7}y^2$**

7. $\frac{xy^6}{y^4x}$ **y^2**

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

9. $\left(\frac{4p^4q^4}{3p^2q^2}\right)^3$ **$\frac{64}{27}p^6q^6$**

10. $\left(\frac{2v^5w^3}{v^4w^3}\right)^4$ **$16v^4$**

11. $\left(\frac{3r^6s^3}{2r^6s}\right)^4$ **$\frac{81}{16}r^4s^8$**

12. $\frac{r^7s^7t^2}{s^3r^3t^2}$ **r^4s^4**