

2.5 Combining Powers

Key idea $(2^2 \times 5^3)^3 = (2^2 \times 5^3)(2^2 \times 5^3)(2^2 \times 5^3)$
 An exponent can be applied to a product or a quotient

Power of a Product Law $(ab)^m = a^m b^m$ $(2 \times 5)^3 = 2^3 \times 5^3$
 $(2^2 \times 5^3)^3 = 2^{2 \times 3} \times 5^{3 \times 3} = 2^6 \times 5^9$

Quotient Law $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ $\left(\frac{7}{2}\right)^3 = \frac{7^3}{2^3}$

$(a^m)^n = a^{mn}$ $(4^3)^2 = 4^{3 \times 2} = 4^6$

Simplify completely, in exponent form.

- $(5 \times 2)^3 = 5^3 \times 2^3$
- $\left(\frac{10}{3}\right)^4 = \frac{10^4}{3^4}$

Simplify and express as a single power, where possible

3. $(2^3 \times 7^2)^4 = 2^{3 \times 4} \times 7^{2 \times 4} = 2^{12} \times 7^8$

4. $(8^2 \times 4^3)$ → rewrite by substituting new base/exponent for the '8' and '4'

$8 = 2^3$ $4 = 2^2$

$(2^3)^2 \times (2^2)^3 = 2^6 \times 2^6$ (power law)
 $= 2^{6+6}$ (multi. law)
 $= 2^{12}$

5. $\frac{(2^3 \times 6^2)^3}{(2^4 \times 6^3)^3} = \frac{2^{15} \times 6^{10}}{2^{12} \times 6^9} = 2^{15-12} \times 6^{10-9} = 2^3 \times 6$

6. $[(3^2)(5^3)]^2 (3^3 \times 5^4)^3 = (3^4 \times 5^6)(3^9 \times 5^{12})$
 $= 3^4 \times 5^6 \times 3^9 \times 5^{12}$
 $= 3^4 \times 3^9 \times 5^6 \times 5^{12}$
 $= 3^{4+9} \times 5^{6+12}$
 $= 3^{13} \times 5^{18}$