Section 4.6 Applying the Exponent Laws

Recall:

$a^0 = 1$	$a^m \times a^n = a^{m+n}$	$a^m \div a^n = a^{m-n}$
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$(ab)^m = a^m b^m$	$(a^m)^n = a^{mn}$

Simplifying Expressions involving Multiple Exponents Laws

↳ **Take it one step at a time!**

1. If there are brackets....simplify everything inside the bracket first.

2. If there is an exponent outside the bracket, use the necessary exponent rules to further simplify the expression.

3. If there are no brackets...apply any necessary exponent rule.

4. Write the simplest expression using POSITIVE exponents.

Note:
Don't worry about fixing negative exponents until the end!

Simplifying algebraic expressions with numerical bases.

Example 1 Simplify and write all final answers with positive exponents.

a) $\left[\left(\frac{3}{5}\right)^{2}\right]^{3}$

b) $1.5^{\frac{3}{2}} \times 1.5^{\frac{5}{2}}$

c) $\left[\left(-\frac{3}{2}\right)^{-4}\right]^{2} \times \left[\left(-\frac{3}{2}\right)^{2}\right]^{3}$

d) $\left(\frac{7^{\frac{2}{3}}}{7^{\frac{1}{3}} \times 7^{\frac{5}{3}}}\right)^{6}$

Example 2: Your Turn

e) $0.3^{-3} \times 0.3^{5}$

f) $\dfrac{(1.4^{3})(1.4^{4})}{(1.4^{-2})}$

g) $\left[\left(-\frac{4}{5}\right)^{2}\right]^{-3} \times \left[\left(-\frac{4}{5}\right)^{4}\right]^{-5}$

h) $\left(\dfrac{9^{\frac{5}{4}} \times 9^{-\frac{1}{4}}}{9^{\frac{3}{4}}}\right)^{2}$

Simplifying algebraic expressions with variable bases.

Example 3 Simplify and write all final answers with positive exponents.

a) $(x^3y^2)(x^2y^{-4})$

b) $(x^{\frac{3}{2}}y^2)(x^{\frac{1}{2}}y^{-1})$

c) $\left(\dfrac{a^8b^9}{a^3b^7}\right)^{-2}$

d) $\dfrac{\left(a^6b^9\right)^{-2}}{\left(a^{-2}b^3\right)^4}$

e) $\left(\dfrac{ab^{\frac{1}{3}}}{a^4b^{-\frac{1}{2}}}\right)^{-\frac{2}{3}}$

Simplifying algebraic expressions with numerical coefficients and variables.

Example 4 Simplify and write all final answers with positive exponents.

a) $\left(8a^3b^6\right)^{\frac{1}{3}}$

b) $\dfrac{10a^5b^2}{2a^{-2}b^4}$

c) $\dfrac{4a^{-2}b^{\frac{2}{3}}}{8a^2b^{\frac{1}{3}}}$

d) $\left(\dfrac{100a}{25a^5b^{-\frac{1}{2}}}\right)^{\frac{1}{2}}$

e) $\left(3x^{-2}y^{\frac{2}{3}}\right)^4$

f) $\left(\dfrac{3a^2}{81a^5b^{-\frac{1}{2}}}\right)^{\frac{1}{3}}$

Example 5: Your Turn

a) $\left(2x^{-3}y^{\frac{1}{2}}\right)^4$

b) $\dfrac{6x^4y^{-3}}{14xy^2}$

c) $\dfrac{\left(5a^{-2}b^5\right)^{-2}}{\left(a^2b^{-3}\right)^4}$

d) $\left(\dfrac{x^4y^{-\frac{1}{2}}}{9x^{10}y^{\frac{7}{2}}}\right)^{-\frac{1}{2}}$

Example 6

Evaluate $\left(\frac{x^4 y^{-\frac{1}{2}}}{9x^{10} y^{\frac{7}{2}}}\right)^{-\frac{1}{2}}$ if $x = 2$ and $y = 1$.

Note:
When evaluating, simplify the expression first, then evaluate by substituting the numbers into the variables.

Example 7 Identify, explain and fix the error made below.

$$(a^3 \cdot b^{-1})(a^{\frac{1}{4}} \cdot b^{-3})$$
$$= a^3 \cdot a^{\frac{1}{4}} \cdot b^{-1} \cdot b^{-3}$$
$$= a^{\frac{3}{4}} b^3$$

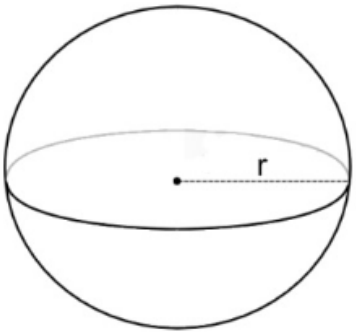
Correct Solution

$$(a^3 \cdot b^{-1})(a^{\frac{1}{4}} \cdot b^{-3})$$

Example 8

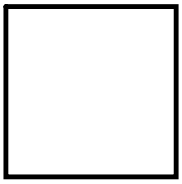
A sphere has a volume of 425 m^3. What is the radius of the sphere to the nearest tenth of a meter?

$$V = \frac{4}{3}\pi r^3$$



Example 9

What is the side length of a square if the area is $144x^4y^6$?



Work Book Questions	Extra Practice Questions
p.241-243 #3ab, 5ad, 6ab, 8cdgh, 10bef, 11,14,15a, 17	p.241-243 #3cd, 4, 5bc, 6cd, 7, 8abef, #9,10cdgh,15bcd,16,19,21