# **4.6 Applying the Laws of Exponents**

Exponents laws that were developed for integral bases can also be applied to variable bases. The only difference is that the expression cannot be evaluated until a value for the variable is known. When simplifying expressions involving multiple exponent laws, you should consider the following guidelines:

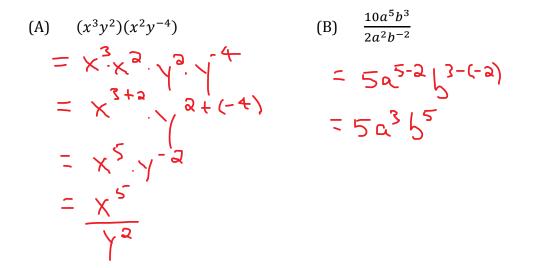
- 1. Simplify the expression inside the brackets.
- 2. Remove the brackets by applying the exponent laws for products of powers, quotients of powers, or powers of powers.
- 3. Write the simplest expression using positive exponents.

#### **Exponent Laws:**

Product of Powers:	$a^m \cdot a^n = a^{m+n}$
Quotient of Powers:	$a^m \div a^n = a^{m-n}$ , $a \neq 0$
Power of Power:	$(a^m)^n = a^{m \cdot n}$
Power of a Product:	$(ab)^m = a^m b^m$
Power of a Quotient:	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ , $b \neq 0$

## Example 1:

Simplify:



(E) 
$$\frac{(t^2)^3}{t^{-3}}$$
$$= \underbrace{t^{2-3}}_{\begin{array}{c} t^{-3} \end{array}}$$
$$= \underbrace{t^{6}}_{\begin{array}{c} t^{-3} \end{array}}$$
$$= \underbrace{t^{6-(-3)}}_{\begin{array}{c} t^{6-(-3)} \end{array}}$$
$$= \underbrace{t^{9}}_{\begin{array}{c} t^{9} \end{array}}$$

(F) 
$$\frac{2x(3xy)^{2}}{6xy^{3}}$$

$$= \Im \times (\Im \times 2)^{2}$$

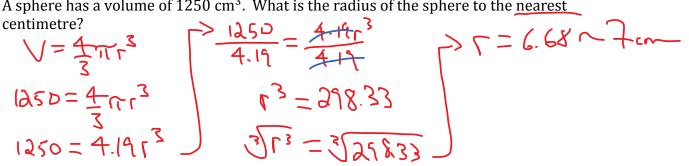
$$= \Im \times 2$$

(C) 
$$m^4 n^{-2} \cdot m^2 n^3$$
  
 $= m^{4+2} n^{-2+5}$   
 $= m^6 n^{-2+5}$   
 $= \frac{3 \times 4^{-1}}{7} \sqrt{-3-2}$   
 $= \frac{3 \times 7}{7}$   
 $= \frac{3 \times 7}{7}$   
 $= \frac{3 \times 7}{7}$ 

$$(G) \quad \left(x^{\frac{1}{5}}y^{-\frac{2}{4}}\right)^{\frac{1}{2}} \left(x^{-\frac{1}{4}}y^{\frac{1}{2}}\right)^{-1} \qquad (H) \quad \left(-\frac{3}{4}\right)^{\frac{2}{3}} \left(-\frac{3}{4}\right)^{2} \qquad = \left(-\frac{3}{4}\right)^{\frac{2}{3}} \left(-\frac{3$$

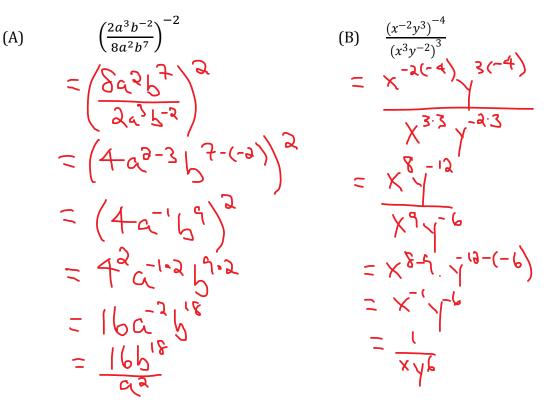
#### **Example 2:**

A sphere has a volume of 1250 cm<sup>3</sup>. What is the radius of the sphere to the nearest



**Example 3:** 

Simplify:



#### Example 4:

 $A_{\Box} = S^{2} \qquad (144 \times \frac{4}{7})^{4} = (S^{2})^{4} \qquad S = |a \times \gamma^{3}|$   $A_{\Box} = S^{2} \qquad (144 \times \frac{4}{7})^{4} = (S^{2})^{4} \qquad S = |a \times \gamma^{3}|$   $A_{\Box} = S^{2} \qquad (144 \times \frac{4}{7})^{4} = (S^{2})^{4} \qquad S = |a \times \gamma^{3}|$   $A_{\Box} = S^{2} \qquad (144 \times \frac{4}{7})^{4} = S^{2} \qquad (144 \times \frac{4}{7})^{4$ Determine the side length of a square with area  $144x^4y^6$ .

# Example 5:

Identify the errors in each solution:

(A) 
$$(a^{3}b^{-1})(a^{4}b^{-3})$$
 (B)  $(a^{-4}b^{5})^{-1}$  (C)  $(k^{\frac{1}{2}}h^{\frac{3}{2}})^{\frac{3}{2}}(k^{2}h)^{-1}$   
 $a^{3} \cdot a^{\frac{4}{4}} \cdot b^{-1} \cdot b^{-3}$   $= \frac{a^{-4}b^{4}}{ab^{5}}$   $= (k^{2}h^{3})(kh^{-1})$   
 $a^{\frac{3}{4}}b^{3} \times = a^{-4}b$  Added exponents  
 $M_{1}$  plical  $Uo(ibMS)$  mistrikes instand of multiplying.

## Example 6:

On a test, three students evaluated  $2^{-\frac{1}{3}} \times 2^{0}$  as follows:

<u>Bobby</u>	<u>Charlie</u>	<u>Michael</u>
$2^{\frac{1}{3}} \times 2^{0}$	$2^{\frac{1}{3}} \times 2^{0}$	$2^{\frac{1}{3}} \times 2^{0}$
$4^{\frac{1}{3}}$ multipl	$\frac{1}{2^{-\frac{1}{3}}}$	4 <sup>0</sup>
1 Dases	<u>ነ 1 ጋን</u>	т 1
$\frac{1}{\sqrt{3}}$	$\overline{8}$ X	1
45		

$$\frac{\sqrt{32}}{1 \times 1}$$

 $\leq$ 

- (i) What errors did each student make? What did each do correctly?
- (ii) What is the correct answer?

Textbook Questions: page 241 – 243, #3 – 19, 21