Warm Up:
Simplify.

\[5^3 \cdot 5^4 = 5^{3+4} = 5^7 = 78,125\]

\[x^3 \cdot x^7 = x^{3+7} = x^{10}\]

\[2^4 \cdot 2^{-3} = 2^{4-3} = 2\]

\[y^{10} \cdot y^{-12} = y^{10-12} = y^{-2} = \frac{1}{y^2}\]

7.3 More Multiplication
Properties of Exponents

Learning Goal: I will be able to raise a power to a power and raise a product to a power.

Property:
Raising a Power to a Power:
To raise a power to a power, multiply the exponents.

\[(a^m)^n = a^{mn}\]

Examples:

\[(5^4)^2 = 5^{4 \cdot 2} = 5^8\]

\[(m^3)^5 = m^{3 \cdot 5} = m^{15}\]

Examples 1-2:
Simplify.

\[\left(\frac{4}{7}\right)^2\]

\[\left(\frac{x^{2/3}}{y^{1/2}}\right)^{1/2}\]
Examples 3-5: Simplify.

(\(p^5\))^4 \quad (\(p^4\))^5 \quad (\(p^{1/2}\))^{1/4}

\[ p^{20} \quad p^{20} \quad p^{1/4} \]

Examples 6-11: Evaluate if you can.

\((2^3)^4 \quad (10^3)^2 \quad (p^2)^5\)

\[ 2^{12} = 40,96 \quad 10^6 = 1,000,000 \quad p^{10} \]

\((3^2)^4 \quad (2^5)^4 \quad (x^4)^6\)

\[ 3^8 = 6,561 \quad 2^{20} = 1,048,576 \quad x^{24} \]

Examples 12-13: Simplify.

\[ y^3(y^{5/2})^{-2} \quad \frac{x^2(x^8)^{-4}}{} \quad \frac{x^2}{x^{-24}} \]

\[ y^{-3} \cdot y^{-5} = y^{-8} \quad \frac{1}{x^{22}} \]

Examples 14-15: With your shoulder buddy.

\[ w^2(w^{5/3})^3 \quad (s^{-5})^{-1/2}(s^{3/2})\]

\[ w^{-2} \cdot w^5 = w^3 \quad s^{5/2} \cdot s^{3/2} = s^4 \]

\[ \frac{\sqrt{5}}{3} \cdot \frac{2}{1} \quad \frac{5}{2} + \frac{3}{2} = \frac{8}{2} \]

\[ \frac{-5}{2} - \frac{1}{2} = \frac{5}{2} \]

\[ \frac{5}{2} + \frac{3}{2} = \frac{8}{2} \]

\[ \frac{5}{2} \]
**Property:**

**Raising a Product to a Power:**
To raise a product to a power, raise each factor to the power and multiply.

\[(ab)^n = a^n b^n \text{ where } a \neq 0, b \neq 0\]

Examples:

\[(3x)^4 = 3^4 x^4 = 81x^4\]

\[(4b)^{3/2} = 4^{3/2} b^{3/2} = 8b^{3/2}\]

\[\sqrt{4^3} = \sqrt{64}\]

**Examples 16-17:**

Simplify.

\[(xy^2)^3\]

\[(x^3y^4)^2\]

**Examples 18-20:**

Simplify.

\[(a^3b)^2\]

\[(3cd)^2\]

\[(x^3y^5)^3\]

\[a^6 b^2\]

\[3^2c^2 d^2\]

\[x^9 y^{15}\]

**Examples 21-22:**

With your shoulder buddy.

\[(5x^4y^6)(2x^5y^2)^2\]

\[(3x^2y^4)^5(2x^4y^3)^2\]

\[125x^{24}y^{18}z^{10}\]

\[243x^{10}y^{20}\]

\[972 x^{16} y^{20}\]

\[125 x^{12} y^{10} z^{10}\]
Examples 23-24:
Simplify. Write each answer in scientific notation.

\[
\begin{align*}
(3 \times 10^5)^2 & = 9 \times 10^{10} \\
3^2 \times 10^{10} & = 9 \times 10^{10}
\end{align*}
\]

\[
\begin{align*}
(2 \times 10^{-10})^3 & = 8 \times 10^{-30} \\
2^3 \times 10^{-30} & = 8 \times 10^{-30}
\end{align*}
\]

right subtract left add

Summary
When you raise a power to a power you ______ multiply ______!!!

In your own words describe how you would simplify this problem.

\[
(x^4 y^9)^2
\]

Coursework
Worksheet!!