Exponent Rules

Here is a review of some rules about exponents:

1. **Zero Exponent**: \( a^0 = 1 \). In other words, any number we have to the zero power is equal to 1.

2. **Negative exponents**: \( a^{-n} = \frac{1}{a^n} \). So \( x^{-4} = \frac{1}{x^4} \).

3. **Quotient rule**: \( \frac{a^m}{a^n} = a^{m-n} \). So \( \frac{x^4}{x^2} = x^{4-2} \) or \( x^2 \).

4. **Product rule**: \( a^m(a^n) = a^{m+n} \). So \( x^4(x^2) = x^{4+2} = x^6 \).

5. **Negative to positive**: \( \frac{a^{-n}}{b^{-n}} = \frac{b^n}{a^n}, \text{ both } a \text{ and } b \neq 0 \). So \( \frac{x^{-2}}{x^4} = \frac{x^4}{x^2} \). And \( \left( \frac{a}{b} \right)^{-m} = \left( \frac{b}{a} \right)^m, \text{ both } a \text{ and } b \neq 0 \). So, \( \left( \frac{x}{y} \right)^{-2} = \left( \frac{y}{x} \right)^2 \).

**Sample problems**

\[
\frac{10x^8y^5}{20xy^{-5}}
\]
Now let’s solve this problem. First we can see that we have a negative exponent in the denominator. We use the **negative to positive rule**. The rule shows we “flip” the variable to the numerator and change the symbol on the exponent.

\[
\frac{10x^8y^5}{20x}
\]
Here we have applied the negative to positive rule. Now, let’s combine our like terms in the numerator. We use the **product rule** to combine.

\[
\frac{10x^8y^{10}}{20x}
\]
Here we have combined our variables using the product rule. Next we will separate our variables.

\[
\frac{10x^8}{20x} \quad \left( \frac{y^{10}}{1} \right)
\]
Here the variables are separated into like terms. Now we can simplify each variable. We know that \( y^{10} \) can be written as \( y^{10} \). We can simplify the 10 and 20 to 1 and 2 by factoring out the 10. So let’s look at \( \frac{1x^8}{2x} \) and apply the **quotient rule**.

\[
\frac{1x^{8-1}}{2} \quad (y^{10})
\]
Here we applied the quotient rule. Now we can write the expression out in its simplest form.
Another example:

\[
\frac{4x^5}{x^7} = \frac{4x^{5-7}}{1} = \frac{4}{x^2}
\]

This is our final answer!