Unit 5: Exponentials
Part 1: Properties

SWBAT use properties of exponents to simplify expressions.

Assignments:

HW37

Review: What are exponents?

- Exponents indicate the number of times a number, variable, or term is multiplied by itself.
  - Example: $5^4 = 5 \times 5 \times 5 \times 5 = 625$
- The *base* is the number, variable, or term being multiplied by itself.
- A few special exponents to remember:
  - b^0: No matter what the base is, if the exponent is 0, the expression equals 1
  - Radicals have fractions as exponents. Therefore, $\sqrt{x} = x^{\frac{1}{2}}$
- The exponent is "stuck" to whatever it's closest to. This means that in $5x^3$, the exponent is only on the x, not the 5, so $5x^3 = 5xxx$. To make it "stick" to more things, use parentheses: $(5x)^3 = (5x)(5x)(5x) = 125x^3$
  - This is why $(-3)^2 = (-3)(-3) = 9$, but $-3^2 = -1 * 3^2 = -1(3)(3) = -9$

Negative Exponents

- Negative exponents indicate how many times we are *dividing* by the base. This means that a negative exponent indicates the *reciprocal* of the positive exponent.
- $b^{-p} = \frac{1}{b^p}$
- Example 1: 4^{-2}
- Example 2: x^{-5}

- Simplify. Use only positive exponents.

1. 6^{-3}
2. 5^{-2}
3. 7^{-4}
4. x^{-7}
5. y^{-9}
6. $(2x)^{-3}$

Multiplying

- The bases must be the same!
- When multiplying two terms with the same base, add the exponents.
- Multiply coefficients separately.
- General rule: $x^m * x^n = x^{m+n}$
- Example 3: $3r^{-1} * 2r^3$

1. x^3x^2
2. $2n * 2n^4$
3. $b * 2b^{-2}$
4. $4x^{-4} * 3x^4$
5. $x * 3x^{-3} * 4x^{-3}$
6. $4x^0 * 2x^3$

Raising a Power to a Power

- When a base raised to a power is raised to another power, multiply the exponents.
- General Rule: $(x^m)^n = x^{mn}$
- Example 4: $(3x^3)^{-3}$

1. $(2r^{-1})^0$
2. $(3b^4)^3$
3. $(3v)^2$
4. $(4r^2)^4$
5. $(4x^{-4})^{-1}$

Dividing

- Separate the fraction in two – one with coefficients, one with the terms with exponents.
- When dividing terms with the same base, subtract the exponents.
- General Rule: $\frac{x^m}{x^n} = x^{m-n}$
- Example 5: $\frac{2n^2}{n^4}$

1. $\frac{4x}{2x^{-4}}$
2. $\frac{4a}{2a^4}$
3. $\frac{3m^2}{2m^{-1}}$
4. $\frac{2b^{-4}}{2b^4}$
5. $\frac{n^4}{3n^{-4}}$

Putting it together

- Follow the order of operations:
  - Parentheses
  - Multiplication
  - Division
- Wait until the end to turn negative exponents into positive
- Example 1: $\frac{2n^3 * 2n^{-4}}{(n^2)^3}$

1. $(m^3)^2 * 2m^3$
2. $(p^{-3})^{-4} * p^2$
3. $(x^2)^0$
4. $\frac{2v^{-3} * (v^3)^{-4}}{2v^3}$
5. $\frac{(2b^2 * b)^3}{b^3}$
6. $\frac{(b^{-4})^4 * b}{b^3 * 2b^{-4}}$