Enrichment: Quantities Raised to a Negative Exponent

When raising a quantity to a negative exponent, it is difficult to write the expression in expanded form. Therefore, we must rely on our power raised to a power rule that states:

$$(x^a)^b = x^{ab}$$ or for example: $$(x^3)^4 = x^{12}$$

Observe the following examples:

EX1:

$$(x^4 y^2 z^{-3})^{-3} = x^{-12} y^{-6} z^9 = \frac{z^9}{x^{12} y^6}$$

EX2:

$$\left(\frac{5a^{-2}b}{c^{-4}}\right)^{-2} = \frac{5^{-2} a^4 b^{-2}}{c^8} = \frac{a^4}{25b^2 c^8}$$

Helpful Hints to Remember:

1. Any term that has NO Exponent, really has an exponent of 1!!

2. Check for any simplification inside the parenthesis before dealing with the negative exponent.

3. Multiply each power by the exponent outside the parenthesis BEFORE you move the terms with negative exponents!!

You Try (White Boards):

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

2. $\left(\frac{4ad}{bc}\right)^{-2}$

3. $(-8a^{-4} n^{-9})^{-3}$

4. $\left(\frac{z^3 y^{-7} z^2}{x^4}\right)^{-4}$

5. $\left(5m^{-13} d^{-5} g\right)\left(\frac{m^{-5}}{7d^2 g^4}\right)^{-2}$

Answer Key:

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

$(2x^3 y^{-7})^{-4} = 2^{-4} x^{-12} y^{28} = \boxed{\dfrac{y^{28}}{16x^{12}}}$

3. $\left(\dfrac{4ad}{bc}\right)^{-2}$

$\left(\dfrac{4ad}{bc}\right)^{-2} = \left(\dfrac{4^{-2} a^{-2} d^{-2}}{b^{-2} c^{-2}}\right) = \boxed{\left(\dfrac{b^2 c^2}{16a^2 d^2}\right)}$

3. $(-8a^{-4} n^{-9})^{-3}$

$(-8a^{-4} n^{-9})^{-3} = (-8)^{-3} a^{12} n^{27} = \boxed{\dfrac{a^{12} n^{27}}{-512}}$

4. $\left(\dfrac{z^3 y^{-7} z^2}{x^4}\right)^{-4}$

$\left(\dfrac{z^3 y^{-7} z^2}{x^4}\right)^{-4} = \left(\dfrac{z^5 y^{-7}}{x^4}\right)^{-4} = \dfrac{z^{-20} y^{28}}{x^{-16}} = \boxed{\dfrac{x^{16} y^{28}}{z^{20}}}$

5. $\left(5m^{-13} d^{-5} g\right)\left(\dfrac{m^{-5}}{7d^2 g^4}\right)^{-2}$

$\left(5m^{-13} d^{-5} g\right)\left(\dfrac{m^{-5}}{7d^2 g^4}\right)^{-2} = \left(5m^{-13} d^{-5} g\right)\left(\dfrac{m^{10}}{7^{-2} d^{-4} g^{-8}}\right) = \left(5m^{-13} d^{-5} g\right)\left(49 m^{10} d^4 g^8\right) = 245 m^{-3} d^{-1} g^9 = \boxed{\dfrac{245 g^9}{m^3 d}}$