Math in Living C O L O R !!

1.07 Laws of Exponents

Intermediate Algebra: One Step at a Time, Pages 90 - 95: #35, 37, 40, 43, 51, Extra

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See Section 1.07 with explanations, examples, and exercises, coming soon!

NOTE: If the Laws of Exponents "Quickies" problems are beating you up, then maybe you could use some additional explanation. Try these links, coming soon, Chapter 1 from *Basic Algebra: One Step at a Time*:

Basic Algebra Section	2.12 Laws of Exponents Positive Exponents Coming Soon!
Basic Algebra Section	2.13 Laws of Exponents: Zero and Negative Exponents

P. 93 # 35. $\frac{x^4 x^{-10}}{x^{-6}}$

Solution:

The base number for each of these factors is x. Remember: When you multiply with the same base number, you put down the base number and you ADD exponents:

$$\frac{x^4 x^{-10}}{x^{-6}}$$

$$\frac{x^{-6}}{x^{-6}}$$

Now, a number divided by itself is 1, so the final answer is 1. However, if you wanted to do so, you could also remember: When you divide with the same base number, you put down the base number and SUBTRACT exponents:

$$x^{-6-(-6)}$$

$$x^0$$

$$1$$

P. 93 # 37. $(2x^3)^4 \bullet (x^4y^{-3})^2$

Solution:

Notice that in this exercise, you have products within parentheses raised to a power. The basic law of exponents that applies here is that when you raise a power to a power, you must put down the base number and multiply the exponents.

$$(2x^3)^4 \bullet (x^4y^{-3})^2$$
$$2^4x^{12} \bullet x^8y^{-6}$$

Next, you know that when you multiply with the same base number, you put down the base number and you add exponents: $x^{12} \bullet x^8 = x^{20}$

$$16x^{20}y^{-6}$$

To eliminate a negative exponent, remember that $y^{-6} = \frac{1}{y^6}$, so the final answer is

$$16x^{20} \bullet \frac{1}{y^6} \quad \text{or} \quad \frac{16x^{20}}{y^6}$$

P. 94 # 40. $(3x^{-3}y^2)^2 \bullet (2^{-1}x^4y^{-5})^{-2}$

Solution:

Notice that in this exercise, you have products within parentheses raised to a power. The basic law of exponents that applies here is that when you raise a power to a power, you must put down the base number and multiply the exponents.

$$(3x^{-3}y^2)^2 \bullet (2^{-1}x^4y^{-5})^{-2}$$
$$3^2x^{-6}y^4 \bullet 2^2x^{-8}y^{10}$$

Next, you know that when you multiply with the same base number, you put down the base number and you add exponents: $x^{-6} \bullet x^{-8} = x^{-14}$ and $y^4 \bullet y^{10} = y^{14}$

$$9 \bullet 4x^{-14}y^{14}$$

To eliminate a negative exponent, remember that $x^{-14} = \frac{1}{x^{14}}$, so the final answer is

$$36\frac{1}{x^{14}} \bullet y^{14} \quad \text{or} \quad \frac{36y^{14}}{x^{14}}$$

P. 94 # 43. $\dfrac{(3x^{-3}y^{2})^{-2}}{(3^{-1}x^{4}y^{-5})^{-2}}$

Solution:

Notice that in this exercise, you have a quotient whose numerator and denominator contain products within parentheses raised to a power. The basic law of exponents that applies here is that when you raise a power to a power, you must put down the base number and multiply the exponents.

$$\frac{(3x^{-3}y^{2})^{-2}}{(3^{-1}x^{4}y^{-5})^{-2}}$$

$$\frac{3^{-2}x^{6}y^{-4}}{3^{2}x^{-8}y^{10}}$$

This fraction can actually be rewritten as three separate fractions:

$$\frac{3^{-2}}{3^{2}}\bullet\frac{x^{6}}{x^{-8}}\bullet\frac{y^{-4}}{y^{10}}$$

Next, you know that when you divide with the same base number, you put down the base number and subtract the exponents:

$$3^{-2-2}\bullet x^{6-(-8)}\bullet y^{-4-10}$$

$$3^{-4}\bullet x^{14}\bullet y^{-14}$$

To eliminate a negative exponent, remember that $3^{-4}=\dfrac{1}{3^{4}}$ $x^{-14}=\dfrac{1}{x^{14}}$**, so the final answer is**

$$\frac{1}{3^{4}}\bullet x^{14}\bullet\frac{1}{y^{14}} \quad \text{or} \quad \frac{x^{14}}{81y^{14}}$$

P. 95 # 51. $\dfrac{x^{3p+2}x^{4p-6}}{x^{2p+4}}$

Solution:

The base number for each of these factors is x. Remember that when you multiply with the same base number, you put down the base number and you add exponents:

$$\frac{x^{3p+2}x^{4p-6}}{x^{2p+4}}$$

$$\frac{x^{3p+2+4p-6}}{x^{2p+4}}$$

$$\frac{x^{7p-4}}{x^{2p+4}}$$

Next, remember that when you divide with the same base number, you put down the base number and subtract exponents:

$$x^{7p-4-(2p+4)}$$

$$x^{7p-4-2p-4}$$

$$x^{5p-8}$$

Extra Problem from Dave in Australia: $\dfrac{7a^{2m} \times 3a^{-n}}{42a^{5m-6n}}$

Solution:

The base number for each of these factors is *a*. First, I recommend that you multiply the 7 times 3, which is 21. Remember that when you multiply with the same base number, you put down the base number and you add exponents. This means that you add 2m plus –n, which is 2m-n.

$$\frac{21a^{2m-n}}{42a^{5m-6n}}$$

Next, divide out the 21 with the 42. Also, remember that when you divide with the same base number, you put down the base number and subtract exponents:

$$\frac{\cancel{21}a^{2m-n}}{\cancel{42}\,2a^{5m-6n}}$$

$$\frac{a^{(2m-n)-(5m-6n)}}{2}$$

$$\frac{a^{2m-n-5m+6n}}{2}$$

$$\frac{a^{2m-5m-n+6n}}{2}$$

$$\frac{a^{-3m+5n}}{2} \quad \text{or} \quad \frac{a^{5n-3m}}{2} \quad \text{or} \quad \frac{1}{2}a^{5n-3m}$$