

2.13 Zero and Negative Exponents

Basic Algebra: One Step at a Time. Pages 215 -226: #109, 114, 115, 117, 118

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p. 225: 109. $(2x^{-1})^{-2}$

Solution: There are two ways to simplify this problem.

First method: Notice that both the 2 and the x^{-1} are raised to the -2 power.

$$(2x^{-1})^{-2}$$
$$(2^{-2})(x^{-1})^{-2}$$

When you raise a power to a power, you multiply exponents:

$$\left(\frac{1}{2^2}\right)(x^2)$$
$$\left(\frac{1}{4}\right)(x^2) \quad \text{or} \quad \frac{x^2}{4}$$

Second Method: Work inside the parentheses first! Observe that in the expression $2x^{-1}$, the -1 exponent does NOT apply to the 2 .

$$2x^{-1} = 2 \cdot \frac{1}{x} = \frac{2}{x}$$

Therefore,

Now, $(2x^{-1})^{-2}$

$$\left(\frac{2}{x}\right)^{-2}$$

Finally, remember that when you raise a fraction to a negative 2 power, you must **invert** and **square** the fraction.

So, invert: $\left(\frac{x}{2}\right)^2$

And square: $\frac{x^2}{4}$

Final Answer: $\frac{x^2}{4}$

114.

$$\left(\frac{x^4}{x^{-2}}\right)^7$$

Solution: Again, there are **two methods**. You can begin by working within the parentheses. When you divide with the same base number, you subtract exponents:

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

$$(x^6)^7$$

Now, when you raise a power to a power, you multiply the exponents:

$$x^{42}$$

As a **second method**, you might want to raise the powers to powers (by multiplying exponents!) first.

$$\left(\frac{x^4}{x^{-2}}\right)^7$$

$$\frac{x^{28}}{x^{-14}}$$

Now, when you divide, you subtract exponents:

$$x^{28-(-14)}$$

$$x^{28+14}$$

Final Answer: x^{42}

115.

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

Solution: When you multiply with the same base number, you add exponents:

$$\frac{x^{14}}{x^{-6}}$$

When you divide, you subtract exponents:

$$x^{14-(-6)}$$

$$x^{14+6}$$

Final Answer: x^{20}

117.

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

Solution: When you multiply with the same base number, you add exponents:

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

A quantity divided by itself is **1**, so this is the final answer!

OR-- You can say when you divide with the same base number, you subtract exponents:

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

$$x^{-6+6}$$

$$x^0$$

Final Answer: **1** (Since any nonzero number raised to the zero power is **1**).

118.

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

Solution: When you multiply with the same base number, you add exponents:

$$\frac{x^{-14}}{x^{-6}}$$

When you divide with the same base number, you subtract exponents:

$$x^{-14-(-6)}$$

$$x^{-14+6}$$

$$x^{-8}$$

Eliminate the negative exponent:

Final Answer: $\frac{1}{x^8}$