Math-3-A

7-2: Properties of Exponents (Part 2)

Negative Exponent Property "Grab and drag"

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

When you "Grab and drag" the base and its exponent across the "boundary line" between numerator and denominator, you just change the sign of the exponent.

$$x^2 y^{-2} = \frac{x^2}{y^2}$$

$$\left(\frac{1}{x^3}\right)^{-2} = \frac{1}{x^{-6}} = \frac{1}{x^{-6}} = x^6$$

Negative Exponent Property

Possible errors

$$4x^{-2} = \frac{4 * x^{-2}}{1} = \frac{4}{x^2}$$

When you “Grab and drag” the base and its exponent across the “boundary line” between numerator and denominator, you just change the sign of the exponent.

DO NOT GRAB the coefficient!

$$\frac{4 * x^{-2}}{1} \neq \frac{1}{4x^2}$$

Quotient of Powers Property

$$\frac{x^5}{x^2} = \frac{x*x*x*x*x}{x*x} = x*x*x = x^3$$

$$\frac{x^5}{x^2} = x^5 x^{-2} = x^{5-2} = x^3$$

This is really a silly property. We don't even need to memorize this as a separate property. It's just the negative exponent property.

$$\frac{x^m}{x^n} = x^{m-n}$$

Power of a Quotient Property

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

General form of Power of a quotient: $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$

This is another silly property. Isn't it just exponent of a product?

Zero Exponent Property

Any base raised to the zero power simplifies to one.

$10^3 = 1000$

$10^2 = 100$

$10^1 = 10$

$10^0 = 1$

$2^0 = 1$

$(2x)^0 = 1$

$2x^0 = 2*1 = 2$

Combination: (1) Negative Exponent, (2) Product of Powers, (3) Power of a Power, (4) Power of a Quotient

$$\left(\frac{3x^2}{2x^{-4}y}\right)^2 = \left(\frac{3x^2x^4}{2y}\right)^2 = \left(\frac{3x^6}{2y}\right)^2 = \left(\frac{3^1x^6}{2^1y^1}\right)^2$$

$$= \frac{3^{1*2}x^{6*2}}{2^{1*2}y^{1*2}} = \frac{3^2x^{12}}{2^2y^2} = \frac{9x^{12}}{4y^2}$$

$$(w^{-2})^5 = \frac{1}{w^{10}}$$

$$\frac{1}{2}(3x^{-3})^2 = \frac{9}{2x^6}$$

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

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

$$\frac{32x^{10}}{x^{2}y^{17}} = \frac{32x^{10}x^{-2}}{y^{17}} = \frac{32x^{10-2}}{y^{17}}$$

"Grab and drag"

Product of powers: add the exponents of same based powers

$$= \frac{32x^{8}}{y^{17}}$$

Your Turn:

20. $\dfrac{2x^3}{4x^5} = \dfrac{1}{2x^2}$

21. $\dfrac{9(2x)^4}{2x} = 72x^3$

22. $\dfrac{(x^{-2})^4}{2x^{-3}} = \dfrac{1}{2x^5}$

23. $\dfrac{(-2y^2x^{-3})^4}{2yx^{-3}} = \dfrac{8y^7}{x^9}$

Do you "grab and drag (up or down)??

It doesn't matter!!!!

$$\frac{3x^2}{2x^{-4}y} = \frac{3x^2x^4}{2y} = \frac{3x^{2+4}}{2y} = \boxed{\frac{3x^6}{2y}}$$

Product of powers property: add the exponents of like-based powers

$$\frac{3x^2}{2x^{-4}y} = \frac{3}{2x^{-4}x^{-2}y} = \frac{3}{2x^{-4-2}y} = \frac{3}{2x^{-6}y} = \boxed{\frac{3x^6}{2y}}$$

Product of powers property: add the exponents of like-based powers

Make sure when you're all done, there are NO NEGATIVE EXPONENTS remaining.

Combination of:

1. Power of a Power
2. Power of a Quotient

$$\left(\frac{x^2}{y^4}\right)^3 = \frac{x^{2*3}}{y^{4*3}} = \frac{x^6}{y^{12}}$$

Your turn:

24. Explain, in your own words, what the negative exponent property allows you to do with powers.

Include in your answer the words: "base," "exponent" "numerator" and "denominator".

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

$$\left(\frac{yx^3}{xz}\right)^4$$

$$\left(\frac{4x^{-3}y^2z^4}{2x^{-5}y^{-3}z^5}\right)^{-3}$$

Remember: if you don't see an exponent, what is the exponent? → (1)

Examples: $5\left(x^{0}\right)^{6} = 5x^{0} = 5$

$$\left(\frac{3x^{0}}{2x^{-1}y}\right)^{2} = \left(\frac{3x^{0}x^{+1}}{2y}\right)^{2} = \left(\frac{3x^{1}}{2y}\right)^{2} = \left(\frac{3^{1}x^{1}}{2^{1}y^{1}}\right)^{2}$$

$$= \left(\frac{3^{1*2}x^{1*2}}{2^{1*2}y^{1*2}}\right) = \left(\frac{3^{2}x^{2}}{2^{2}y^{2}}\right) = \frac{9x^{2}}{4y^{2}}$$

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

$$\frac{\left(yx^3\right)^4}{yx^{12}z^0}$$

$$\left(\frac{6x^2y^{-1}z^{-3}}{8x^{-2}y^{-1}z^2}\right)^{-2}$$