Exponent Rules 5 to 7 Notes

Definitions:	A **coefficient** is a regular number (usually a whole number) which multiplies some other number. A **base** is a regular number (usually a whole number) which can be raised to another power. An **exponent** is the super-scripted value which notes how many times a base is multiplied by itself. **Expanded notation** uses the none-exponent version of numbers to show or check the simplified value of bases and exponents.

Formulas:	Rule #5 $\frac{x^a}{x^b} = x^{a-b}$	Rule #6 $\left(\frac{x}{y}\right)^a = \left(\frac{x^a}{y^a}\right)$	Rule #7-a $x^{-a} = \left(\frac{1}{x^a}\right)$	Rule #7-b $\left(\frac{1}{x^{-a}}\right) = x^a$

Example #1 *...using rule #5*	$\frac{x^8}{x^5} = x^{8-5}$ x^3 $\frac{\cancel{xxxxx}xxx}{\cancel{xxxxx}}$	$\frac{20x^8}{28x^5} = \frac{4\cdot5x^{8-5}}{4\cdot7}$ $\frac{5x^3}{7}$ $\frac{\cancel{4}\cdot5\cancel{xxxxx}xxx}{\cancel{4}\cdot7\cancel{xxxxx}}$	$\left(\frac{20x^8}{28x^5}\right)^2 = \left(\frac{5x^3}{7}\right)^2 =$ $\frac{25x^6}{49}$
Example #2 *...using rule #5*	$\frac{x^4}{x^2} = x^{4-2}$ x^2 $\frac{\cancel{xx}xx}{\cancel{xx}}$	$\frac{38x^4}{190x^2} = \frac{38x^{4-2}}{38\cdot5} =$ $\frac{x^2}{5}$ $\frac{\cancel{19}\cdot\cancel{2}xx\cancel{xx}}{\cancel{19}\cdot\cancel{2}\cdot5\cancel{xx}}$	$\left(\frac{38x^4}{190x^2}\right)^3 = \left(\frac{x^2}{5}\right)^3 =$ $\frac{x^6}{125}$

$$\frac{x^a}{x^b} = x^{a-b}$$

Our work with rule five shows what the division of exponents looks like. The exponents seem to sbtract. Expanded notation shows us why it works.

Example #3 *...using rule #6*	$\left(\frac{x}{y}\right)^4 = \frac{x^4}{y^4}$ $\frac{xxxx}{yyyy}$	$\left(\frac{2x}{3y}\right)^4 = \frac{16x^4}{81y^4}$ $\frac{2x\cdot2x\cdot2x\cdot2x}{3y\cdot3y\cdot3y\cdot3y} = \frac{2^4\cdot x^4}{3^4\cdot y^4}$	$5*\left(\frac{2x}{3y}\right)^4 = 5\cdot\frac{16x^4}{81y^4} =$ $\frac{80x^4}{81y^4}$
Example #4 *...using rule #6*	$\left(\frac{xy}{wz}\right)^2 = \frac{(xy)^2}{(wz)^2}$ $\frac{xy}{wz}\cdot\frac{xy}{wz} = \frac{x^2y^2}{w^2z^2}$	$\left(\frac{5xy}{7wz}\right)^2 = \frac{5^2x^2y^2}{7^2w^2z^2}$ $\frac{25x^2y^2}{49w^2z^2}$	$-3*\left(\frac{5xy}{7wz}\right)^2 = \frac{-75x^2y^2}{49w^2z^2}$ $-3\cdot\left(\frac{25x^2y^2}{49w^2z^2}\right) =$

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

Rule six tells us that an exponent effects everything inside the parentheses, top and bottom of a fraction.

Example #5 *...using rule #7-a*	$x^{-3} = \frac{x^{-3}}{1}$ $\frac{1}{x}\cdot\frac{1}{x}\cdot\frac{1}{x} = \frac{1}{x^3}$	$4x^{-3} = \frac{4x^{-3}}{1}$ $\frac{4}{xxx} = \frac{4}{x^3}$	$\frac{4x^{-3}}{3} = \frac{4x^{-3}}{3}$ $\frac{4}{3xxx} = \frac{4}{3x^3}$

Example #6 *...using rule #7-a*	$x^{-7} = \frac{x^{-7}}{1} =$ $\frac{1}{xxxxxxx} = \frac{1}{x^7}$	$5x^{-7}y^3 = \frac{5x^{-7}y^3}{1}$ $\frac{5yyy}{xxxxxxx} = \frac{5y^3}{x^7}$	$\frac{5x^{-7}y^3}{10y^2} = \frac{1y}{2x^7}$ $\frac{\cancel{5}\cancel{y}\cancel{y}y}{2\cdot\cancel{5}xxxxxxx\cancel{y}\cancel{y}}$

$x^{-a} = \left(\frac{1}{x^a}\right)$

Rule seven tells us that if we have a base with a negative exponent on the top we will move the base and the exponent to the bottom, making the exponent positive.

Example #7 *...using rule #7-b*	$\frac{1}{x^{-5}} = \frac{1}{x^{-5}} =$ $\frac{xxxxx}{1}$ $\frac{x^5}{1}$	$\frac{13}{x^{-5}} = \frac{13}{x^{-5}} =$ $\frac{13xxxxx}{1} =$ $13x^5$	$\frac{13}{2x^{-5}} = \frac{13}{2x^{-5}} =$ $\frac{13xxxxx}{2} = \frac{13x^5}{2}$

Example #8 *...using rule #7-b*	$\frac{4}{x^{-3}} = \frac{4}{x^{-3}} =$ $\frac{4xxx}{1} = \frac{4x^3}{1}$	$\frac{4}{3x^{-3}} = \frac{4}{3x^{-3}} =$ $\frac{4xxx}{3} = \frac{4x^3}{3}$	$\frac{4z^2}{3x^{-3}y} = \frac{4z^2}{3x^{-3}y^1} =$ $\frac{4zzxxx}{3y} = \frac{4x^3z^2}{3y}$

$\left(\frac{1}{x^{-a}}\right) = x^a$

Rule seven tells us that if we have a base with a negative exponent on the bottom of a fraction we need to move it up and make the exponent positive.

Example #9 *...using rule #7-b*	$\frac{x^{-7}}{y^{-3}} = \frac{x^{-7}}{y^{-3}}$ $\frac{y^3}{x^7}$	$\frac{4x^{-7}}{5y^{-3}} = \frac{4x^{-7}}{5y^{-3}}$ $\frac{4y^3}{5x^7}$	$\left(\frac{4x^{-7}}{5y^{-3}}\right)^{-2} = \left(\frac{4y^3}{5x^7}\right)^{-2}$ $\frac{25x^{14}}{16y^6}$