CHAPTER 8: EXPONENTS & EXPONENTIAL FUNCTIONS

Exponent Rules

OBJECTIVES

- I can simplify expressions with exponents

RULE #1: MULTIPLYING WITH THE SAME BASE

The law that $x^m x^n = x^{m+n}$

With $x^m x^n$, how many times will you end up multiplying "x"? *Answer:* first "m" times, then **by another** "n" times, for a total of "m+n" times.

Example: $x^2x^3 = (xx)(xxx) = xxxxx = x^5$

So, $x^2x^3 = x^{(2+3)} = x^5$

RULE #2: POWER TO A POWER

The law that $(x^m)^n = x^{mn}$

First you multiply "m" times. Then you have **to do that "n" times**, for a total of m×n times.

Example: $(x^3)^4 = (xxx)^4 = (xxx)(xxx)(xxx)(xxx) = xxxxxxxxxxxx = x^{12}$

So $(x^3)^4 = x^{3\times4} = x^{12}$

RULE #3: DIVIDING WITH THE SAME BASE

The law that $x^m/x^n = x^{m-n}$

Like the previous example, how many times will you end up multiplying "x"? Answer: "m" times, then **reduce that** by "n" times (because you are dividing), for a total of "m-n" times.

Example: $x^4/x^2 = (xxxx) / (xx) = xx = x^2$

So, $x^4/x^2 = x^{(4-2)} = x^2$

RULE #4: PRODUCT TO A POWER

The law that $(xy)^n = x^n y^n$

To show how this one works, just think of re-arranging all the "x"s and "y" as in this example:

Example: $(xy)^3 = (xy)(xy)(xy) = xyxyxy = xxxyyy = (xxx)(yyy) = x^3y^3$

RULE #5: QUOTIENT OF A POWER

The law that $(x/y)^n = x^n/y^n$

Similar to the previous example, just re-arrange the "x"s and "y"s

Example: $(x/y)^3 = (x/y)(x/y)(x/y) = (xxx)/(yyy) = x^3/y^3$

RULE #6: ZERO EXPONENT

Example: Powers of 5		
	.. etc..	
5^2	$1 \times 5 \times 5$	25
5^1	1×5	5
5^0	1	1

(Remember that $x/x = 1$, so every time you see an **x** "above the line" and one "below the line" you can cancel them out.)

This law can also show you why $x^0=1$:

Example: $x^2/x^2 = x^{2-2} = x^0 = 1$

RULE #7: NEGATIVE EXPONENTS

Example: Powers of 5			
	.. etc..		
5^2	1 × 5 × 5	25	5x Larger
5^1	1 × 5	5	
5^0	1	1	
5^{-1}	1 ÷ 5	0.2	5x Smaller
5^{-2}	1 ÷ 5 ÷ 5	0.04	
	.. etc..		

EXPONENT RULES

Law	Example
$x^1 = x$	$6^1 = 6$
$x^0 = 1$	$7^0 = 1$
$x^{-1} = 1/x$	$4^{-1} = 1/4$
$x^m x^n = x^{m+n}$	$x^2x^3 = x^{2+3} = x^5$
$x^m/x^n = x^{m-n}$	$x^6/x^2 = x^{6-2} = x^4$
$(x^m)^n = x^{mn}$	$(x^2)^3 = x^{2\times3} = x^6$
$(xy)^n = x^n y^n$	$(xy)^3 = x^3y^3$
$(x/y)^n = x^n/y^n$	$(x/y)^2 = x^2 / y^2$
$x^{-n} = 1/x^n$	$x^{-3} = 1/x^3$

CAN YOU?? PROVE IT!!

- I can simplify expressions with exponents

31. $\frac{24x^6}{12x^{-8}}$
32. $\frac{3x^2y^{-3}}{12x^6y^3}$
33. $(2x^3y^{-3})^{-2}$
34. $\frac{2x^4y^{-4}}{8x^7y^3}$