Integral Exponents

Definitions and Terms

Exponent – Says how many times to multiply a number with itself

4^2 = 4 x 4 = 16   "4 to the 2nd power, 4 squared"
3^3 = 3 x 3 x 3 = 27   "3 to the 3rd power, 3 cubed"
5^4 = 5 x 5 x 5 x 5 = 625   "5 to the 4th power, 5 raised to the power of 4"

Exponents make it easier to write large numbers

Base – The lower portion of a term with an exponent

5^2 5 is the base, 2 is the exponents
x^4 x is the base, 4 is the exponent

Coefficient – The leading constant of a term with an exponent

$3x^2$ 3 is the coefficient, x is the base, 2 is the exponent
$5x^5$ 5 is the coefficient, x is the base, 5 is the exponent

Negative Exponents

Negative Exponent – Says how many times to divide 1 by the number
8^{-1} = $1 \div 8$ = 0.125

5^{-3} = $1 \div 5 \div 5 \div 5$ = 0.008   OR
5^{-3} = $1 \div (5 \times 5 \times 5)$ = $\dfrac{1}{5^3}$ = $\dfrac{1}{125}$ = 0.008

General Rule: $a^{-n} = \dfrac{1}{a^n}$

Negative Exponent	Reciprocal of Positive Exponent	Answer
4^{-2}	$\dfrac{1}{4^2}$	$\dfrac{1}{16}$ = 0.0625
10^{-3}	$\dfrac{1}{10^3}$	$\dfrac{1}{1000}$ = 0.001
$(-2)^{-3}$	$\dfrac{1}{(-2)^3}$	$\dfrac{1}{(-8)}$ = -0.125

0 or 1 Exponent

If exponent is 1, then you have the number itself   ex: $9^1 = 9$

If exponent is 0, then you get 1   ex: $9^0 = 1$

If 0^0, then you say it is "indeterminate"

Example: Powers of 3		
3^3	1 x 3 x 3 x 3	27
3^2	1 x 3 x 3	9
3^1	1 x 3	3
3^0	1	1
3^{-1}	$1 \div 3$	$\dfrac{1}{3}$
3^{-2}	$1 \div 3 \div 3$	$\dfrac{1}{9}$
3^{-3}	$1\square \div 3 \div 3 \div 3$	$\dfrac{1}{27}$

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

And the law about Fractional Exponents:

$$x^{\frac{m}{n}} = \sqrt[n]{x^m}$$
$$= \left(\sqrt[n]{x}\right)^m$$

$$x^{\frac{2}{3}} = \sqrt[3]{x^2}$$
$$= \left(\sqrt[3]{x}\right)^2$$