Properties of Exponents

$a^0 = 1$ (0^0 is undefined)	Any number or variable (except zero) raised to the zero power equals 1. $7^0 = 1 \quad y^0 = 1 \quad (-5)^0 = 1 \quad -2(x-3)^0 = -2$
$a^1 = a$	Any number or variable raised to the 1st power equals itself $7^1 = 7 \quad y^1 = y \quad (-5)^1 = -5 \quad -2(x-3)^1 = -2(x-3)$
$a^m a^n = a^{(m+n)}$	To MULTIPLY the SAME base, keep the base and ADD the exponents $x^2x^5 = (x \cdot x)(x \cdot x \cdot x \cdot x \cdot x) = x^{2+5} = x^7$ $4^3 \cdot 4^5 = (4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4 \cdot 4 \cdot 4) = 4^{3+5} = 4^8$ $(x+6)^4(x+6)^{11} = (x+6)^{4+11} = (x+6)^{15}$
$(a^m)^n = a^{(mn)}$	To Raise a POWER to a POWER, keep the base and MULTIPLY the exponents $(x^2)^5 = (x \cdot x)(x \cdot x)(x \cdot x)(x \cdot x)(x \cdot x) = x^{2 \cdot 5} = x^{10}$ $(3^4)^2 = (3 = 3^{2 \cdot 4} = 3^8$ $((x+6)^4)^{11} = (x+6)^{4 \cdot 11} = (x+6)^{44}$
$\frac{a^m}{a^n} = a^{(m-n)}$	To DIVIDE the SAME base, keep the base and SUBTRACT the exponents $\frac{x^5}{x^2} = x^{5-2} = x^3 \quad OR \quad \frac{x^5}{x^2} = \frac{x \cdot \cancel{x \cdot x} \cdot x \cdot x}{\cancel{x \cdot x}} = \frac{x \cdot x \cdot x}{1} = x^3$ $\frac{5^3}{5^6} = 5^{3-6} = 5^{-3} = \frac{1}{5^3} = \frac{1}{125} \quad OR \quad \frac{5^3}{5^6} = \frac{\cancel{5 \cdot 5 \cdot 5}}{\cancel{5 \cdot 5 \cdot 5} \cdot 5 \cdot 5 \cdot 5} = \frac{1}{5 \cdot 5 \cdot 5} = \frac{1}{125}$
$a^{-m} = \frac{1}{a^m}$	A NEGATIVE exponent moves the number or variable that it touches across the fraction bar and makes the exponent positive. $3^{-2} = \frac{3^{-2}}{1} = \frac{1}{3^2} = \frac{1}{9} \qquad \frac{4^{-3}x^7}{n^6x^{-2}} = \frac{x^7x^2}{4^3n^6} = \frac{x^{(7+2)}}{4^3n^6} = \frac{x^9}{64n^6}$
$(ab)^n = a^n b^n$	An exponent outside of a term is applied to every factor in that term $(5xy^3)^2 = 5^2x^2y^{3 \cdot 2} = 25x^2y^6$ This does **NOT** apply if you are adding or subtracting inside the parenthesis *Watch out*!!!! $(x+5)^3 \neq x^3 + 5^3$!!!!! (They are **NOT** equal) $(x+5)^3 = (x+5)(x+5)(x+5) = x^3 + 15x^2 + 75x + 125$
$(\frac{a}{b})^n = \frac{a^n}{b^n}$	An exponent outside of a fraction is applied to both the numerator and denominator of the fraction (both top and bottom) $(\frac{9}{k})^2 = \frac{9^2}{k^2} = \frac{81}{k^2}$
$a^{\frac{n}{m}} = \sqrt[m]{a^n}$	The denominator of the rational exponent becomes the index of a radical. $27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9$

Properties of n^{th} Roots

Property	Example
1.) $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$	$\sqrt[3]{-8 \cdot 27} = \sqrt[3]{-8} \cdot \sqrt[3]{27} = (-2)(3) = -6$
2.) $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$	
3.) $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$	
4.) $\sqrt[n]{a^n} = a$ if n is odd	
5.) $\sqrt[n]{a^n} = \lvert a \rvert$ if n is even	