PROPERTIES OF EXPONENTS

Definition: base $\longrightarrow$ 7^5 $\nwarrow$ exponent $\qquad 7^5 = 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$

Property Name	Property	Example
One-to-one	$b^x = b^y \iff x = y,$ for $b > 0, b \neq 1$	$2^x = 2^3 \iff x = 3$
Zero as an Exponent *Any number to the zero power is 1*	$x^0 = 1$ ***Note***: 0^0 is not defined.	$94^0 = 1$ $394^0 = 1$
Multiplication *Keep the base and <u>add</u> exponents*	$(x^m)(x^n) = x^{m+n}$	$(x^2)(x^3) = x^{2+3} = x^5$
Quotient *Keep the base and <u>subtract</u> exponents*	$\frac{x^m}{x^n} = x^{m-n}$	$\frac{x^7}{x^2} = x^{7-2} = x^5$
Negative Exponent *Use the reciprocal and change the exponent sign*	$x^{-n} = \frac{1}{x^n}$ and $\frac{1}{x^{-n}} = x^n$	$x^{-2} = \frac{1}{x^2}$ and $\frac{1}{x^{-2}} = x^2$
Power Property *<u>Multiply</u> exponents*	$(x^m)^n = x^{mn}$	$(x^2)^3 = x^{(2)(3)} = x^6$
Power of Products and Quotients *Multiply the exponents and simplify*	$(x^m y^n)^p = x^{mp} y^{np}$ **AND** $\left(\frac{x^m}{y^n}\right)^p = \frac{x^{mp}}{y^{np}}$	$(x^2 y^3)^4 = x^{(2)(4)} y^{(3)(4)} = x^8 y^{12}$ **AND** $\left(\frac{x^3}{y^2}\right)^4 = \frac{x^{(3)(4)}}{y^{(2)(4)}} = \frac{x^{12}}{y^8}$
Fractional Exponents	$b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m = \sqrt[n]{b^m}$	$b^{\frac{2}{3}} = \left(\sqrt[3]{b}\right)^2 = \sqrt[3]{b^2}$ **AND** $b^{-\frac{2}{3}} = \frac{1}{\left(\sqrt[3]{b}\right)^2} = \frac{1}{\sqrt[3]{b^2}}$
Power Rule for a Product *Same exponents, multiply the base*	$(a^n)(b^n) = (a \cdot b)^n$	$(2^4)(3^4) = (2 \cdot 3)^4 = 6^4 = 1296$