Properties of Exponents

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$\boldsymbol{b^n}$ is pronounced "*b* raised to the n^{th} power" or "*b* to the *n*" for short.
<u>Don't</u> pronounce b^n "*b n*", because "*b n*" is the pronunciation of *b* times *n*.

n^2 is pronounced "*n* squared";
n^3 is pronounced "*n* cubed".

n is the **exponent** or **power** or **index;** *b* is the **base**.

Examples

$5^3 = 5 \times 5 \times 5 = 125$
$y^6 = y \times y \times y \times y \times y \times y$

Property *	Examples
1. $b^m \times b^n = b^{m+n}$	$2^2\ 2^3 = 2^{2+3} = 2^5$
2. $\left(b^m\right)^n = b^{m\times n}$	$(2^2)^3 = 2^{2\times 3} = 2^6$
$(b^m)^n = (b^n)^m$ Note: $(b^m)^n \neq b^{(m^n)}$	$\left(2^3\right)^5 = \left(2^5\right)^3$
3. $\dfrac{a^m}{a^n} = a^{(m-n)}$	$\dfrac{x^7}{x^3} = x^{7-3} = x^4$
4. $(a\,b)^m = a^m \times b^m$	$(2x^2y)^3 = 8x^6y^3$
5. $a^{-n} = \dfrac{1}{a^n}$	$4^{-2} = \dfrac{1}{4^2} = \dfrac{1}{16}$
$\dfrac{1}{a^{-n}} = a^n$	$\dfrac{1}{4^{-2}} = 4^2 = 16$
$\left(\dfrac{a}{b}\right)^{-n} = \left(\dfrac{b}{a}\right)^n$	$\left(\dfrac{2}{3}\right)^{-3} = \left(\dfrac{3}{2}\right)^3$
6. $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$	$\left(\dfrac{3}{2}\right)^3 = \dfrac{3^3}{2^3} = \dfrac{27}{8}$
7. $a^0 = 1$	$3\,(y^2)^0 = 3$
8. $\sqrt[n]{a} = a^{\frac{1}{n}}$	$\sqrt[3]{8} = 8^{\frac{1}{3}} = 2$
$\left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m} = a^{m/n}$	$27^{2/3} = (\sqrt[3]{27})^2 = 3^2 = 9$

* Some of these properties are not true for $a, b \leq 0$, but normally we will not consider this case.