Properties of Exponents

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$\mathbf{b^n}$ is pronounced "b raised to the n^{th} power" or "b to the n" for short.

Never pronounce b^n "b n", because "b n" is a correct pronunciation of b times n, which is something completely different, of course.

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. $(a\,b)^m = a^m \times b^m$	$(xy)^3 = x^3y^3$, $3^{½}12^{½} = (3\times 12)^{½} = 36^{½} = \sqrt{36} = 6$
4. $a^{-n} = \frac{1}{a^n}$	$4^{-2} = \frac{1}{4^2} = \frac{1}{16}$
$\frac{1}{a^{-n}} = a^n$	$\frac{1}{4^{-2}} = 4^2 = 16$
$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$	$\left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3$
5. $a^0 = 1$	$3\,(y^2 + 45x^2y^2 + 7x^2 + 2)^0 = 3$
6. $\frac{a^m}{a^n} = a^{(m-n)}$	$\frac{x^3}{x^2} = x^{3-2} = x^1 = x$
7. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	$\left(\frac{3}{2}\right)^3 = \frac{3^3}{2^3} = \frac{27}{8}$
8. $\sqrt[n]{a} = a^{\frac{1}{n}}$	$\sqrt[3]{8} = 8^{\frac{1}{3}} = 2$
$(\sqrt[n]{a})^m = \sqrt[n]{a^m} = a^{m/n}$	$27^{2/3} = (\sqrt[3]{27})^2 = 3^2 = 9$
$\frac{1}{(\sqrt[n]{a})^m} = \frac{1}{\sqrt[n]{a^m}} = a^{-m/n}$	$27^{-2/3} = \frac{1}{\left(\sqrt[3]{27}\right)^2} = \frac{1}{3^2} = \frac{1}{9}$

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