Powers Chart

Powers Chart - $Base^{Power}$

	Power	2	3	4	5	6	7	8	9	10
Base										
2		4	8	16	32	64	128	256	512	1024
3		9	27	81	243	729				
4		16	64	256	1024					
5		25	125	625						
6		36	216	1296						
7		49	343							
8		64	512							
9		81	729							
10		100	1000							
11		121								
12		144								
13		169								
14		196								
15		225								

$2^2=4$
$2^1=2$
$2^0=1$
$2^{-1}=\frac{1}{2^1}=\frac{1}{2}$
$2^{-2}=\frac{1}{2^2}=\frac{1}{4}$
$2^{-3}=\frac{1}{8}$
$2^{-4}=\frac{1}{16}$
$2^{-5}=\frac{1}{32}$
$2^{-6}=\frac{1}{64}$
$2^{-7}=\frac{1}{128}$

$3^2=9$
$3^1=3$
$3^0=1$
$3^{-1}=\frac{1}{3^1}=\frac{1}{3}$
$3^{-2}=\frac{1}{3^2}=\frac{1}{9}$
$3^{-3}=\frac{1}{27}$
$3^{-4}=\frac{1}{81}$
$3^{-5}=\frac{1}{243}=\frac{1}{3^5}$

$4^2=16$
$4^1=4$
$4^0=1$
$4^{-1}=\frac{1}{4}$
$4^{-2}=\frac{1}{16}$
$4^{-3}=\frac{1}{64}$

$5^2=25$
$5^1=5$
$5^0=1$
$5^{-1}=\frac{1}{5}$
$5^{-2}=\frac{1}{25}$
$5^{-3}=\frac{1}{125}$

$6^2=36$
$6^1=6$
$6^0=1$
$6^{-1}=\frac{1}{6}$
$6^{-2}=\frac{1}{36}$
$6^{-3}=\frac{1}{216}$

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Properties of Rational Exponents

Property

1. $a^m \cdot a^n = a^{m+n}$

$12^{\frac{1}{8}} \cdot 12^{\frac{5}{6}} = 12^{\frac{1}{8}+\frac{5}{6}} = 12^{\frac{3}{24}+\frac{20}{24}}$

$= 12^{\frac{23}{24}}$

2. $(a^m)^n = a^{mn}$

$(5^{\frac{1}{3}})^2 = 5^{(\frac{1}{3})2} = 5^{\frac{2}{3}} = \sqrt[3]{5^2}$

3. $(ab)^m = a^m b^m$

$(5^{\frac{1}{3}} \cdot 7^{\frac{1}{4}})^3 = (5^{\frac{1}{3}})^3 \cdot (7^{\frac{1}{4}})^3$

$= 5^1 \cdot 7^{\frac{3}{4}}$

4. $a^{-m} = \frac{1}{a^m}, a \neq 0$

$5^{-\frac{1}{2}} = \frac{1}{5^{\frac{1}{2}}} = \frac{1}{\sqrt{5}}$

5. $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$

$\frac{10}{10^{\frac{2}{5}}} = \frac{10^1}{10^{2/5}} = 10^{1-\frac{2}{5}} = 10^{\frac{3}{5}}$

6. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

$\left(\frac{56^{\frac{1}{4}}}{7^{\frac{1}{4}}}\right)^5 = \left(\frac{\sqrt[4]{56}}{\sqrt[4]{7}}\right)^5 = \left(\sqrt[4]{8}\right)^5$

$= 8^{\frac{5}{4}}$

PROPERTIES OF RADICALS

Product Property of Radicals

$\sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

Quotient Property of Radicals

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}, b \neq 0$

1. $(6^6 \cdot 5^6)^{-1/6} = (6^6)^{-\frac{1}{6}} \cdot (5^6)^{-\frac{1}{6}}$

$= 6^{-1} \cdot 5^{-1} = \frac{1}{6^1} \cdot \frac{1}{5^1} = \frac{1}{30}$

2. $\frac{\sqrt{245}}{\sqrt{5}} = \sqrt{\frac{245}{5}} = \sqrt{49} = 7$

SIMPLEST FORM A radical with index n is in **simplest form** if the radicand has no perfect nth powers as factors and any denominator has been rationalized.

No perfect n^{th} powers inside the radical

No radical in denominator

3. $\sqrt[3]{\frac{5}{9}} = \frac{\sqrt[3]{5}}{\sqrt[3]{9}} = \frac{\sqrt[3]{5}}{\sqrt[3]{3\cdot 3}} \cdot \frac{\sqrt[3]{3}}{\sqrt[3]{3}} = \frac{\sqrt[3]{15}}{\sqrt[3]{27}} = \frac{\sqrt[3]{15}}{3}$

LIKE RADICALS Radical expressions with the same index and radicand are **like radicals**. To add or subtract like radicals, use the distributive property.

4. $6\sqrt[4]{6} + 2\sqrt[4]{6} = 8\sqrt[4]{6}$

5. $\sqrt[3]{8x^7y^3z^{11}}$

$\sqrt[3]{2\cdot 2\cdot 2\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z}$

$2\cdot x\cdot x\cdot y\cdot z\cdot z\cdot z\sqrt[3]{x\cdot z\cdot z} = 2x^2y\cdot z^3\sqrt[3]{xz^2}$

6. $7\sqrt[3]{2a^5} - a\sqrt[3]{128a^2}$

$7\sqrt[3]{2aaaaa} - a\sqrt[3]{2\cdot 2\cdot 2\cdot 2\cdot 2\cdot 2\cdot 2\cdot a\cdot a}$

$7\cdot a\sqrt[3]{2a^2} - a\cdot 2\cdot 2\sqrt[3]{2a^2}$

$7a\sqrt[3]{2a^2} - 4a\sqrt[3]{2a^2}$

$3a\sqrt[3]{2a^2}$