

Exponent Rules Cheat Sheet

The 9 laws of exponents

Product rule	$a^m \cdot a^n = a^{m+n}$ $2^3 \cdot 2^2 = 2^5 = 32$	Quotient rule	$a^m \div a^n = a^{m-n}$ $3^5 \div 3^2 = 3^3 = 27$
Power of a power	$(a^m)^n = a^{m \cdot n}$ $(2^2)^3 = 2^6 = 64$	Power of a product	$(a \cdot b)^n = a^n \cdot b^n$ $(2 \cdot 3)^2 = 4 \cdot 9 = 36$
Power of a quotient	$(a/b)^n = a^n / b^n$ $(3/4)^2 = 9/16$	Zero exponent	$a^0 = 1 \ (a \neq 0)$ $7^0 = 1$
Negative exponent	$a^{-n} = 1 / a^n$ $2^{-3} = 1/8 = 0.125$	Fractional exponent	$a^{1/n} = \sqrt[n]{a}$ $9^{1/2} = \sqrt{9} = 3$
Rational exponent	$a^{m/n} = \sqrt[n]{a^m}$ $8^{2/3} = (\sqrt[3]{8})^2 = 4$		

Watch out — the two classic mistakes:

- $(a + b)^2 \neq a^2 + b^2$ — $(2 + 3)^2 = 25$, but $2^2 + 3^2 = 13$. Exponents don't distribute over addition.
- $-3^2 = -9$, but $(-3)^2 = 9$. Without parentheses, the exponent applies before the minus sign.

Powers of 2		Powers of 10		Squares		Cubes	
2^1	2	10^{-6}	0.000001 <i>millionth</i>	1^2	1	1^3	1
2^2	4			2^2	4		
2^3	8	10^{-3}	0.001 <i>thousandth</i>	3^2	9	2^3	8
2^4	16			4^2	16		
2^5	32	10^{-2}	0.01 <i>hundredth</i>	5^2	25	3^3	27
2^6	64			6^2	36		
2^7	128	10^{-1}	0.1 <i>tenth</i>	7^2	49	4^3	64
2^8	256			8^2	64		
2^9	512	10^0	1 <i>one</i>	9^2	81	5^3	125
2^{10}	1,024			10^2	100		
2^{11}	2,048	10^1	10 <i>ten</i>	11^2	121	6^3	216
2^{12}	4,096			12^2	144		
2^{13}	8,192	10^2	100 <i>hundred</i>	13^2	169	7^3	343
2^{14}	16,384			14^2	196		
2^{15}	32,768	10^3	1,000 <i>thousand</i>	15^2	225	8^3	512
2^{16}	65,536			16^2	256		
2^{17}	131,072	10^6	1,000,000 <i>million</i>	17^2	289	9^3	729
2^{18}	262,144			18^2	324		
2^{19}	524,288	10^9	1,000,000,000 <i>billion</i>	19^2	361	10^3	1,000
2^{20}	1,048,576			20^2	400		
		10^{12}	1,000,000,000,000 <i>trillion</i>				

Bonus — the Rule of 72: divide 72 by a growth rate to estimate doubling time. Money at 8% doubles in about $72 \div 8 = 9$ years. It works because growth is an exponent: $(1.08)^9 \approx 2$.