

What comes after trillion: the names of large numbers, their zeros and powers of ten

After trillion comes quadrillion (15 zeros), then quintillion, sextillion, septillion, octillion, nonillion, decillion. Each name is a thousand times the one before. The n-th -illion is 10 to the power $3n + 3$ (septillion is the 7th: $7 \times 3 + 3 = 24$ zeros).

Name	Zeros	Power of ten	As big as (rounded estimates)
thousand	3	10^3	
million	6	10^6	seconds in 11.6 days; a large city's population
billion	9	10^9	seconds in 31.7 years; India has 1.4 billion people
trillion	12	10^{12}	seconds in 31,700 years; national budgets, the largest companies
quadrillion	15	10^{15}	ants on Earth (about 20 quadrillion); a petabyte
quintillion	18	10^{18}	grains of sand on all beaches (about 7.5 quintillion)
sextillion	21	10^{21}	stars in the observable universe (100 sextillion or more)
septillion	24	10^{24}	Avogadro's number is 0.6 septillion (molecules in 18 g of water)
octillion	27	10^{27}	atoms in a human body (about 7 octillion)
nonillion	30	10^{30}	
decillion	33	10^{33}	
undecillion	36	10^{36}	
duodecillion	39	10^{39}	
tredecillion	42	10^{42}	
quattuordecillion	45	10^{45}	
quindecillion	48	10^{48}	
sexdecillion	51	10^{51}	
septendecillion	54	10^{54}	
octodecillion	57	10^{57}	
novemdecillion	60	10^{60}	
vigintillion	63	10^{63}	
centillion	303	10^{303}	the largest regular -illion in most dictionaries
googol	100	10^{100}	more than the atoms in the universe (about 10^{80})
googolplex	a googol of them	$10^{(10^{100})}$	cannot be written out in full

How the names are built

[] Latin for the step after million: BI-llion (2nd), TRI-llion (3rd), QUADR-illion (4th), QUINT (5), SEXT (6), SEPT (7), OCT (8), NON (9), DEC (10)

[] From eleven, a units word is bolted onto dec: un-dec-illion (11), duo-dec-illion (12), tre-dec-illion (13); vigintillion is twenty, centillion a hundred

[] Zeros of the n-th -illion: $n \times 3 + 3$. Billions in a trillion: 1,000. Millions in a trillion: 1,000,000

[] Beyond vigintillion the rule continues (trigintillion 10^{93}) but scientists write the power of ten instead

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Short scale and long scale, the SI prefixes, the Indian names, and practice

Two systems

Name	Short scale: US, UK (since 1974), Canada, Australia, India in English	Long scale: Germany, France, Spain, Italy, Netherlands, Latin America
million	10^6	10^6
milliard	not used	10^9 (Milliarde, milliard, millardo)
billion	10^9	10^{12}
trillion	10^{12}	10^{18}
quadrillion	10^{15}	10^{24}

Short scale: each name is a thousand times the last. Long scale: each -illion is a million times the last, with -illiards between. A German Billion is an English trillion. Britain used the long scale until 1974. Digits and powers of ten mean the same everywhere.

The SI prefixes (ronna and quetta were added in 2022)

Prefix	kilo	mega	giga	tera	peta	exa	zetta	yotta	ronna	quetta
Symbol	k	M	G	T	P	E	Z	Y	R	Q
Factor	10^3	10^6	10^9	10^{12}	10^{15}	10^{18}	10^{21}	10^{24}	10^{27}	10^{30}

The Indian system

Indian	lakh	crore	arab	kharab	neel	padma	shankh
Value	10^5	10^7	10^9	10^{11}	10^{13}	10^{15}	10^{17}
Short scale	hundred thousand	ten million	billion	hundred billion	ten trillion	quadrillion	hundred quadrillion

1 million = 10 lakh. 1 crore = 10 million. 1 billion = 100 crore. 1 trillion = 1 lakh crore. Indian commas: 1,00,00,000 is 10,000,000.

Practice

- [] 1. How many zeros in a quadrillion?
- [] 2. How many millions in a billion?
- [] 3. How many billions in a trillion?
- [] 4. Write 3×10^9 in words.
- [] 5. Which is bigger, 10^{15} or a quintillion?
- [] 6. What is the 8th -illion called, and how many zeros has it?
- [] 7. A German paper says a firm is worth 2 Billionen euros. In English?
- [] 8. Write 1 crore in short-scale words.
- [] 9. Write 5,000,000,000,000 as a digit times a power of ten.
- [] 10. How many zeros has a googol?

Answers

- 1) 15 2) 1,000 3) 1,000 4) three billion 5) a quintillion (10^{18}) 6) octillion, $27 (8 \times 3 + 3)$ 7) 2 trillion euros 8) ten million 9) 5×10^{12} 10) 100