Instructions to Create a Million Chart (Color-coded to see each Power of Ten)

Instructions follow that will allow you to show 1; 10; 100; 1000; 10,000; 100,000; and 1,000,000 cells on paper. It is best to print all 29 pages in color, but satisfactory in just black. Also, here is a document dealing with large numbers and a little math to help show how large they are.

I cut off the bottom half of the first page "a-Million Chart…" and just use the top half to show 1 cell (upper left), 10 green cells (horizontal bar in upper left), 100 green cells (second "red square"), 1,000 blue cells (third column), 10,000 green cells (upper right quadrant). Each quadrant has 10,000 cells—a full page is 40,000 cells.

I print 3 copies of the second page "b-million chart…" and cut off two quadrants so that I have 10 quadrants of 10,000 cells each or 100,000 cells. I tape the 10 quadrants together so there is no overlapping and all 100,000 cells are visible.

I print 25 copies of the third page "c-Million chart…" and cut of the extra white space above and below the printed cells and have them laminated two wide so I have a 2x12 array of sheets with one more sheet at the end. 25 x 40,000 = 1 million. Make sure that they don't overlap any of the cells when they laminate. The sheet of plastic will be about 2 yards long.

I start my lesson by having someone (or everyone) look at the first sheet and determine that the 1, 10, 100, 1000, and 10,000 are all on the sheet. Then 10 quadrants (2.5 sheets) are 100,000 cells. I then kick open the laminated model of 1 million and ask them how many cells are on the sheets. Some wild guesses (a zillion?) and some correct guesses.

I then ask them why I didn't bring in the model for 1 billion. Some guess that it would be twice as long as a million, or 100 times as long and usually not many know that a billion is a thousand times a million so instead of 2 yards long, it would be 2,000 yards long (more than a mile).

I then ask how many of my students have lived a billion seconds (many hands go up). None have!

A billion seconds is 31 years, 251 days, 7 hours, 46 minutes, and 40 seconds.

1 thousand seconds occurs during the 17th minute of life.
1 million seconds occurs during the 12th day of life
1 billion seconds occurs during the 32nd year of life
1 trillion seconds occurs during the 31,689th year (nothing has ever lived that long).

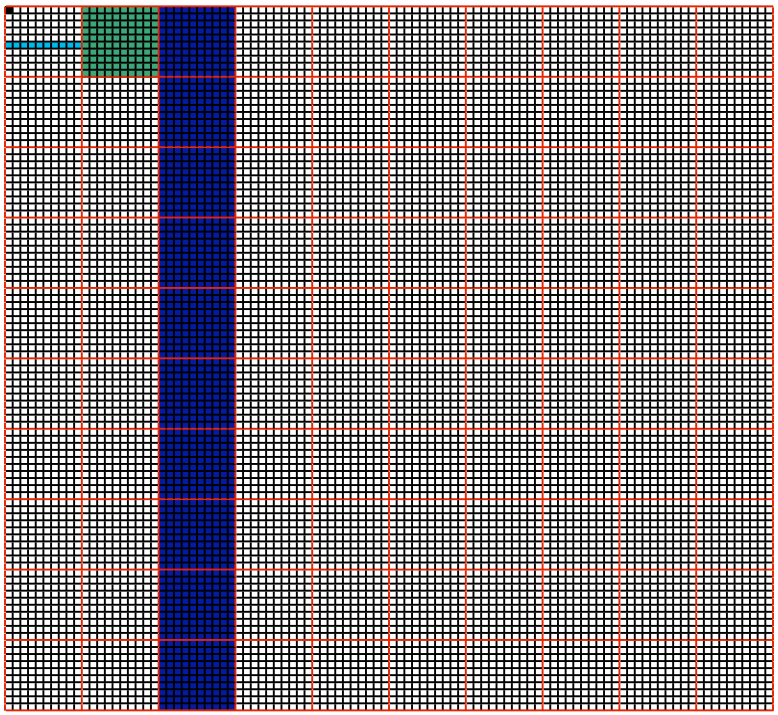
Going from one comma name to the next comma name is "just 3 zeroes more" and outside our normal understanding of place value.

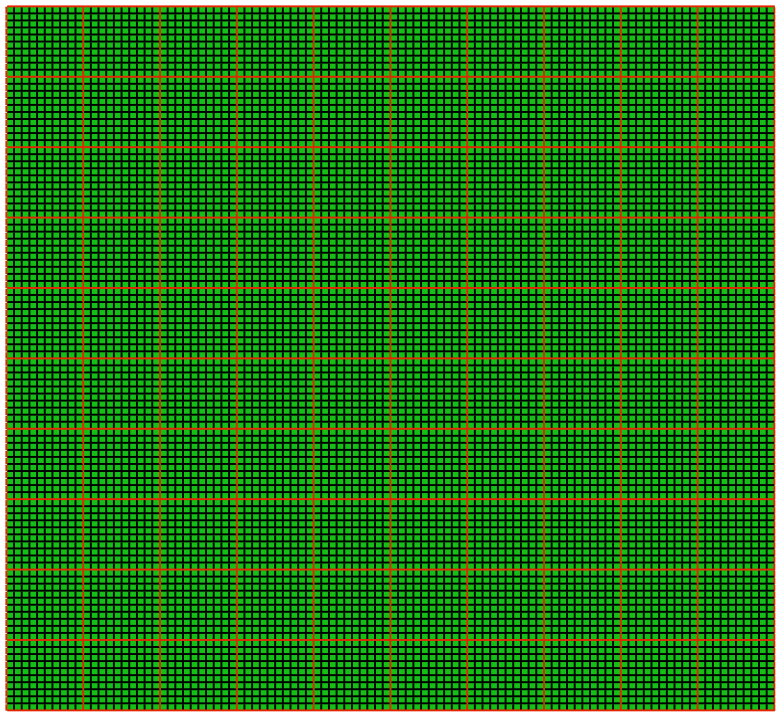
Going back to the laminated model. If 1 billion cells is over a mile long, 1 trillion cells is over 1,000 miles long and 1 quadrillion cells is over a million miles (to the moon and back and to the moon and back and 1 quintillion cells is over 1 billion miles (more than 10 times as far away as the sun).

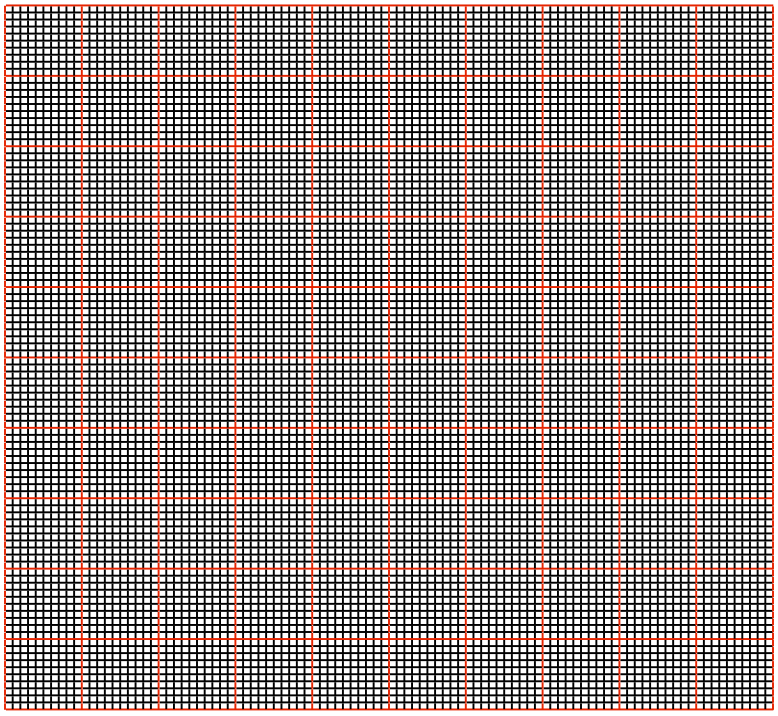
There is nothing in the known universe of which there are 1 googol of. If you divide the volume of the universe by the amount of space that the smallest subatomic particle (a quark) takes up, the quotient is less than 1 googol. The estimate of the diameter of a quark is thought to be about .0000000000000000000000000000000000016 meters or 1.6 x 10 to the negative 35th power. The diameter of the observable universe is thought to be about 93.2 billion light years.

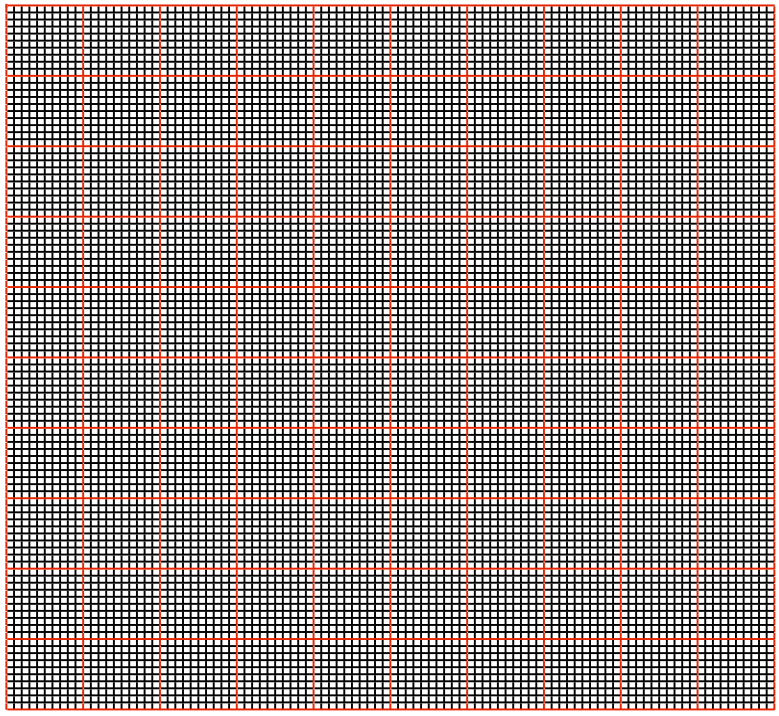
1 light year is 9.461 x 10 to the 15th meters.
The diameter of the observable universe is 9.32 x 10 to the 10 meters.
The observable universe is 8.817652 x 10 to the 26th power.
8.817652 x 10^26 ÷ 1.6 x 10^-35 = 5.5110325 x 10 ^61 which is only 55 novemdecillion, 110 octodecillion, 032 septemdecillion, 500 sexdecillion "quark spaces." It would take over a duodecillion universes the same size as ours to have a googol of quark spaces.

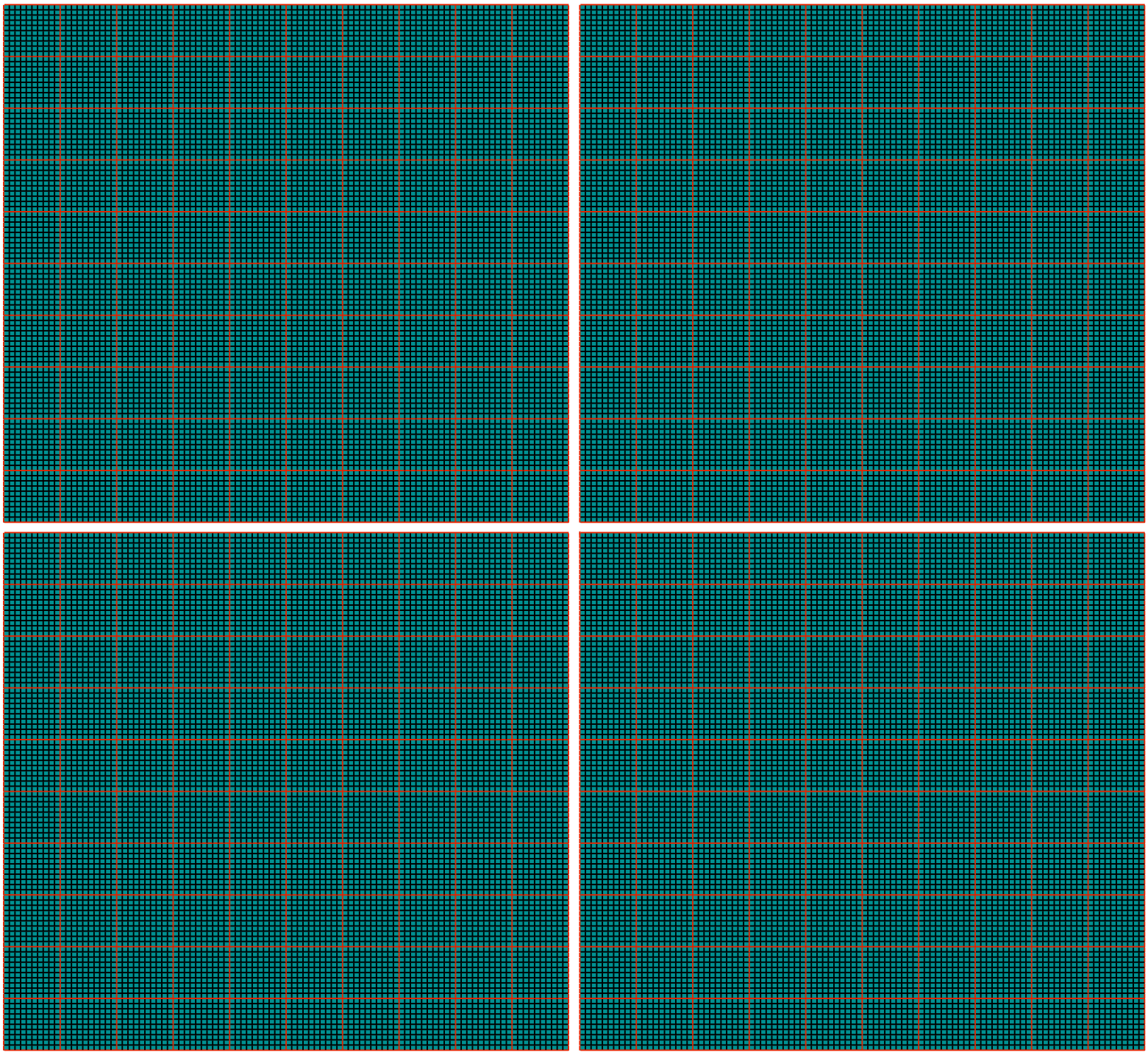
Robert van Deusen, Lecturer
UI College of Education
Department of Teaching & Learning
N250LC
robert-vandeusen@uiowa.edu
319-330-8379

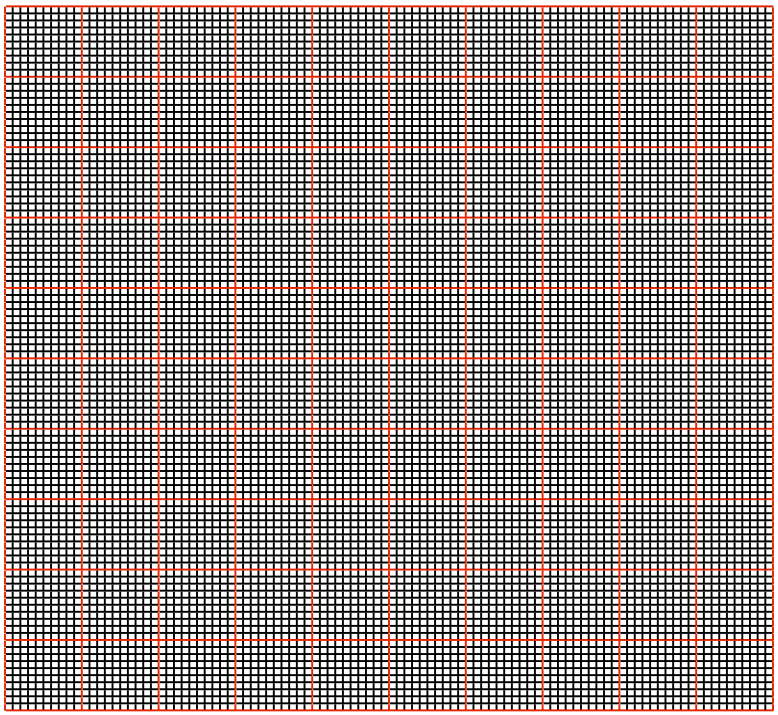
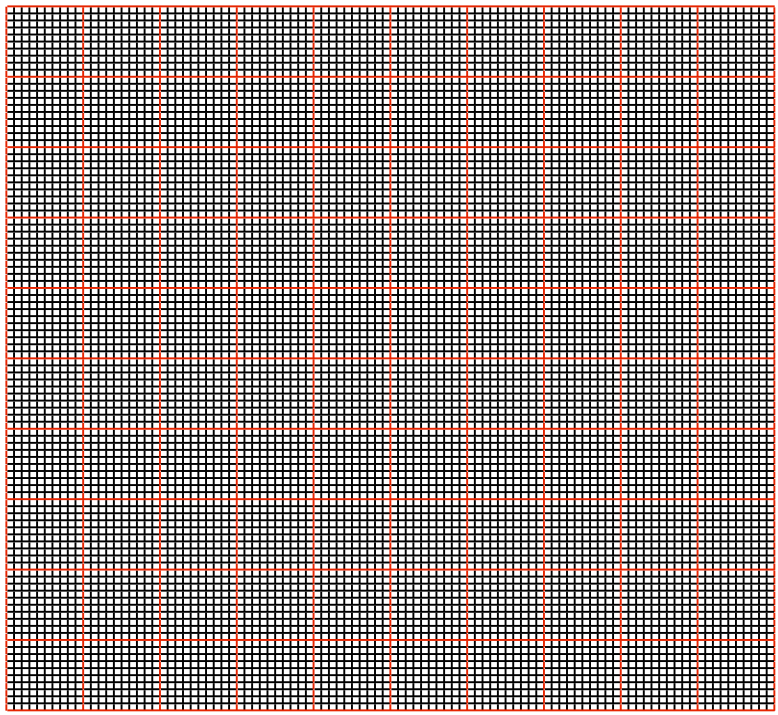
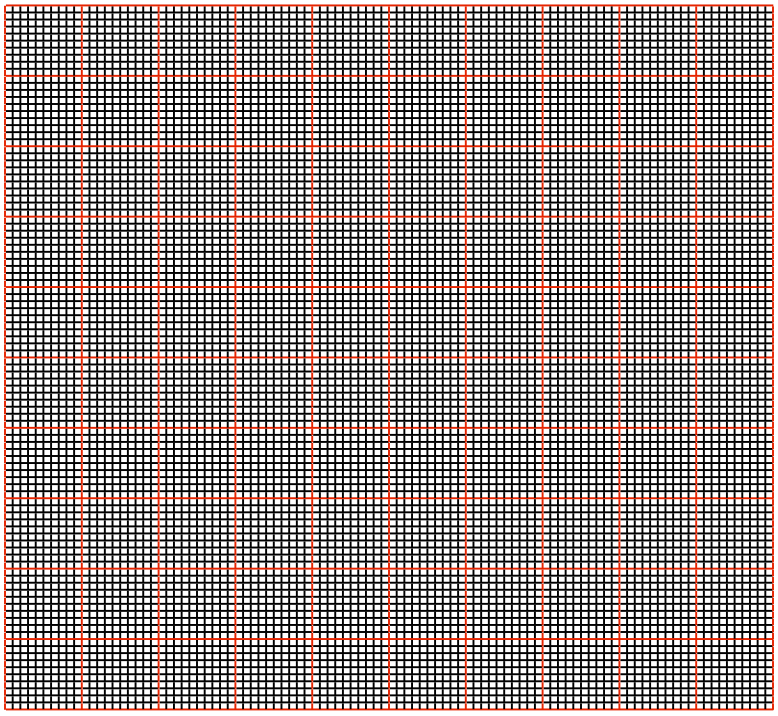
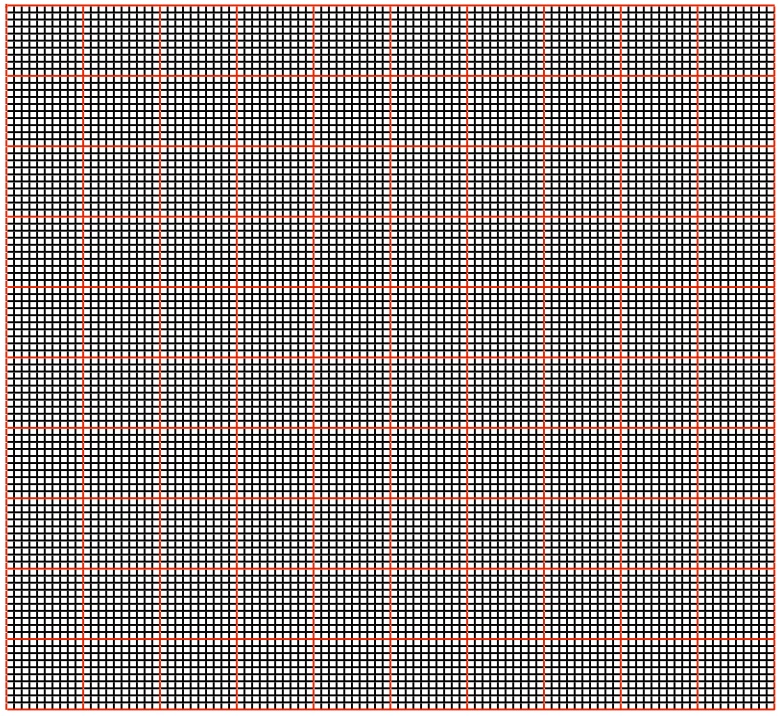










Number Names

(number of zeros after the 1)

by

Dr. Robert M. van Deusen

one (0)
1

one thousand (3)
1,000

one million (6)
1,000,000

one billion (9)
1,000,000,000

one trillion (12)
1,000,000,000,000

one quadrillion (15)
1,000,000,000,000,000

one quintillion (18)
1,000,000,000,000,000,000

one sextillion (21)
1,000,000,000,000,000,000,000

one septillion (24)
1,000,000,000,000,000,000,000,000

one octillion (27)
1,000,000,000,000,000,000,000,000,000

one nonillion (30)
1,000,000,000,000,000,000,000,000,000,000

one decillion (33)
1,000,000,000,000,000,000,000,000,000,000,000

one undecillion (36)
1,000,000,000,000,000,000,000,000,000,000,000,000

one duodecillion (39)
1,000,000,000,000,000,000,000,000,000,000,000,000,000

one tredecillion (42)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000

one quattuordecillion (45)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000

one quindecillion (48)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000

one sexdecillion (51)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000

one septendecillion (54)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,
000

one octodecillion (57)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
,000,000

one novemdecillion (60)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
,000,000,000

one vigintillion (63)
1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
,000,000,000,000

one googol (100)
10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000

one googolplex (1 followed by a googol of zeros)
Just to **WRITE** the number you would need:

1<u>00,000</u> (shows five zeros to the inch) &

5 X 12 (inches in a foot) = 60 zeros to the foot

60 x 5280 (feet in a mile) = 316,000 zeros to the mile

316,000 x 93,000,000 (miles from the earth to the sun) =
29,462,400,000,000,000 zeros this size that could be written on a sheet of paper from here to the sun.

If each of the 5,000,000,000 people on earth old enough to write wrote zeros from here to the sun, we would have a total of 147,312,000,000,000,000,000
000,000 zeros printed on the pages.

60x60x24x365x100= 3,153,600,000 seconds in one hundred years.

In fact, if all those people wrote enough zeros to go from the earth to the sun each second for 100 years, we would not yet even come close to writing the number one googolplex.

In fact, we would have written only 460,456,312,320,000,000,000,000,000,000,000,000 zeros so far, that is 460 decillion, 456 nonillion, 312 octillion, 320 septillion zeros. If all those people wrote a page of zeros from here to the sun every second since the world began (about 5 1/2 billion years ago), our list of zeros would be only 25,325,097,178,000,000,000,000,000,000,000,000,000,000 long.

In other words, if we wanted just to **write** the number googolplex, there is no way it could ever be done. In fact, there are no uses for the number googolplex other than for boggling the mind. When you think of the concept of infinity, imagine it to be so much larger than a googolplex that a googolplex would be as a grain of sand compared to the earth.

Names of Big Numbers

Name	# of zeroes	
one	0	1
thousand	3	1,000
million	6	1,000,000
billion	9	1,000,000,000
trillion	12	1,000,000,000,000
quadrillion	15	1,000,000,000,000,000
quintillion	18	1,000,000,000,000,000,000
sextillion	21	1,000,000,000,000,000,000,000
septillion	24	1,000,000,000,000,000,000,000,000
octillion	27	1,000,000,000,000,000,000,000,000,000
nonillion	30	1,000,000,000,000,000,000,000,000,000,000
decillion	33	1,000,000,000,000,000,000,000,000,000,000,000
undecillion	36	1,000,000,000,000,000,000,000,000,000,000,000,000
duodecillion	39	1,000,000,000,000,000,000,000,000,000,000,000,000,000
tredecillion	42	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000
quattuordecillion	45	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
quindecillion	48	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
sexdecillion	51	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
septendecillion	54	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
octodecillion	57	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
novemdecillion	60	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
vigintillion	63	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
unvigintillion	66	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
duovigintillion	69	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
trevigintillion	72	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
quattuorvigintillion	75	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
quinvigintillion	78	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
sexvigintillion	81	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
septenvigintillion	84	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
octovigintillion	87	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
novemvigintillion	90	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
thousand novemvigintillion	93	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
million novemvigintillion	96	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
billion novemvigintillion	99	1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
10 billion novemvigintillion or 1 googol	100	10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000