

Significant figures are the digits in a value that are known with some degree of confidence. As the number of significant figures increases, the more certain the measurement. As precision of a measurement increases, so does the number of significant figures.

There are conventions that must be followed for expressing numbers so that their significant figures are properly indicated. These conventions are:

All non zero digits are significant.

- ~ 549 has three significant figures
- ~ 1.892 has four significant figures

Zeros between non zero digits are significant.

- ~ 4023 has four significant figures
- ~ 50014 has five significant figures

Zeros to the left of the first non zero digit are not significant.

- ~ 0.000034 has only two significant figures. (This is more easily seen if it is written as 3.4×10^{-5})
- ~ 0.001111 has four significant figures.

Trailing zeros (the right most zeros) are significant when there is a decimal point in the number. For this reason it is important to give consideration to when a decimal point is used and to keep the trailing zeros to indicate the actual number of significant figures.

- ~ 400. has three significant figures
- ~ 2.00 has three significant figures
- ~ 0.050 has two significant figures

Trailing zeros are not significant in numbers without decimal points.

- ~ 470,000 has two significant figures
- ~ 400 or 4×10^2 indicates only one significant figure. (To indicate that the trailing zeros are significant a decimal point must be added. 400. has three significant digits and is written as 4.00×10^2 in scientific notation.)

Exact numbers have an infinite number of significant digits but they are generally not reported.

- ~ If you count 2 pencils, then the number of pencils is 2.000...

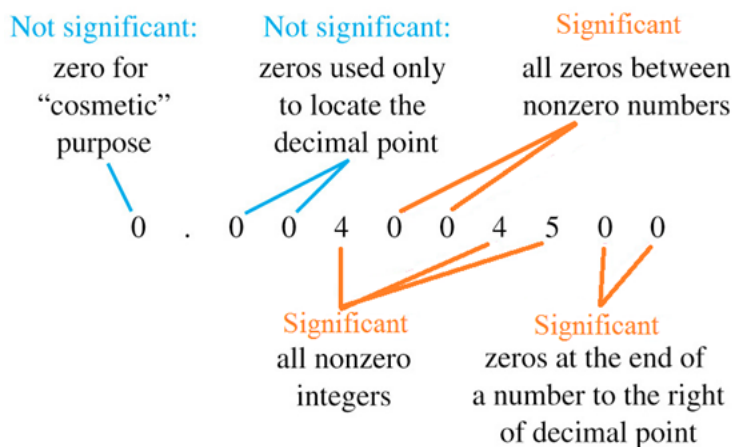
Defined numbers also have an infinite number of significant digits.

- ~ The number of centimeters per inch (2.54) has an infinite number of significant digits, as does the speed of light (299792458 m/s).

RULE(S):

1. ALL non-zero numbers (1,2,3,4,5,6,7,8,9) are ALWAYS significant.
2. ALL zeroes between non-zero numbers are ALWAYS significant.
3. ALL zeroes which are SIMULTANEOUSLY to the right of the decimal point AND at the end of the number are ALWAYS significant.
4. ALL zeroes which are to the left of a written decimal point and are in a number ≥ 10 are ALWAYS significant.

EXAMPLES:



Number	No. of significant figures	Rule(s)
48,923	5	1
3.967	4	1
900.06	5	1,2,4
0.0004 (= 4 E-4)	1	1,4
8.1000	5	1,3
501.040	6	1,2,3,4
3,000,000 (= 3 E+6)	1	1
10.0 (= 1.00 E+1)	3	1,3,4

The rounding process is as follows:

- Decide where you want your rounded value to stop.
- Apply to Rules for Rounding Off .

EXERCISE:

Give the following numbers to **three** significant figures:

- a) 654.389 b) 65.4389 c) 654,389 d) 56.7688 e) 0.03542210 f) 0.0041032 g) 45.989

ANSWERS

a) 654.389 becomes 654 because the first non-significant digit is 3.
 b) 65.4389 becomes 65.4.
 c) 654.389 becomes 654,000 because we need to put the zeros in to hold the place values.
 d) 56.7688 becomes 56.8 because the first non-significant digit is 6.
 e) 0.03542210 becomes 0.0354. Note that three significant figures is not the same as three decimal places, which would give us 0.035.
 f) 0.0041032 becomes 0.00410 because the final zero is a significant figure, being the third in the sequence 4, 1, 0, 3, 2.
 g) 45.989 becomes 46.0 because we round the third significant digit up from 9 to 10. This increases the digit, 5, preceding it to 6 and makes the third digit zero.

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