

Understanding Garbage In, Garbage Out

Humans tend to have unwarranted faith in numbers that are generated by calculators or by computers. When stating a number as an answer to a question, you should remember that the accuracy of the output is only as good as the accuracy of the input.

Study Tip

The best way to communicate measurements is to tell the reader how you obtained your numbers and to give some indication of the accuracy of the measurements.

Significant Digit Rule

A general rule for writing numbers is to not list more **significant digits** in the output than you can guarantee in the input.

Examples: The number 1.26 has 3 significant digits. The number 0.034 has 2 significant digits. The number 25,400 has 3 significant digits.

EXAMPLE 5 Estimating the Accuracy of Measurements

Rewrite each statement using the number of significant digits that seems appropriate in the context of the statement. Explain your reasoning.

- In 2009, the population of Florida was 18,537,969 people.
- The total amount of a loan is \$3,546.28.
- The area of an apartment is 1891 square feet.

SOLUTION

- Taking a population census of a large region has many difficulties. Moreover, with 2009 being 9 years after an official census, this statement would be better phrased as, “In 2009, the population of Florida was about 18.5 million people.” This number has 3 significant digits.
- It is fair to assume that numbers dealing with banking or payroll are exact. So, this statement can remain as it is. All of the digits are significant.
- Without knowing who is making this statement, it is difficult to determine the accuracy. Even so, specifying the area of an apartment exactly within 1 square foot seems unrealistic. Suppose the apartment was measured to be a rectangle that is 31 feet by 61 feet. This would yield an area of $31 \times 61 = 1891$ square feet. If the measurements were off by only 0.1 foot, the actual area could range between

$$30.9 \times 60.9 = 1881.81 \quad \text{and} \quad 31.1 \times 61.1 = 1900.21.$$

It would be better to say that the area of the apartment is about 1900 square feet. This number has 2 significant digits.

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Rewrite each statement using the number of significant digits that seems appropriate in the context of the statement. Explain your reasoning.

- The weight of an athlete is 213.6 pounds.
- The record time for a 100-meter dash is 9.58 seconds.
- The distance between Earth and the Sun is 92,955,819 miles.