

# Lecture 2 - Significant Digits and Rounding

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January 14, 2019

## 1 Rounding

### 1.1 When to Round

- Estimation
- Significant Digits in Measurements
- When it makes sense for units (for instance, in money).

### 1.2 Rounding Method

1. Choose a digit to round to.
2. Look to the digit to the right of this one.
3. If the digit is  $\geq 5$ , add 1 to the digit you are rounding to.
4. The digits to the right of this position become zero.

Examples:

Round the following to the 10's place: (a) 12.5 (b) 17.9 (c) 14.999

Round the following to the 100's place: (a) 125 (b) 170 (c) 14

Round the following to 1/10th's place (a) 12.54555 (b) 12.78 (c) 1.31111

## 2 Accuracy and Precision

- A number by itself is an abstract number.
- A number which quantifies objects or units is a concrete number.
- A measurement is a number observed using some instrument (ruler, scale, etc.).
- Measurements will always contain errors.
- **Accuracy** - The distance between an observed value and the actual value.
- **Precision** - The distance between repeated observations.

### 3 Significant Digits

Significant digits roughly correspond to the precision of the instrument used to take measurements. When performing calculations, your answer cannot be more precise than your measurements!



#### 3.1 Significant Digit Rules

1. All non-zero digits are significant.
2. Any zero digits between significant digits are significant.
3. A trailing zero is significant only if it appears to the right of the decimal point.

Example: How many significant digits are in each of the following?

(a) 1 (b) 10 (c) 1.0 (d) 10.0 (e) 0.000312 (f) 0.00300

#### 3.2 Addition with Significant Digits

1. Count the number of significant digits to the right of the decimal place in each of the numbers you are adding. This is the number of significant digits that your answer can have to the right of the decimal place.
2. Add as normal.
3. Round the sum to the correct number of significant digits.

#### 3.3 Multiplication with Significant Digits

1. Count the number of significant digits in each number you are multiplying. This is the number of significant digits that can be in your answer.
2. Multiply as normal.
3. Round the product to the correct number of significant digits.

Examples:

- (a)  $10\text{in} + 11\text{in} = ?$  (b)  $1\text{mm} + 2.0\text{mm} = ?$  (c)  $1.125\text{kg} + 0.1\text{g} = ?$  (d)  $1.5\text{in} \times 2.125\text{in} = ?$   
(e)  $10.0\text{mm} \times 2\text{mm} = ?$  (f) Compute the Perimeter of your student ID.  
(g) Compute the area of your student ID.

#### 3.4 Significant Digits and Scientific Notation

When using scientific notation, only write significant digits.

#### 3.5 When to Use Significant Digits

Significant digit considerations only apply to values observed via measurement. They do not apply to counting, abstract numbers, or theoretical values!