Measurement & Units

Measuring Distance

There are many ways of measuring distance. Here are a few common units of measurement for distance.

- Inches (in)
- Feet (ft)
- Yards (yd)
- Miles (mi)
- Centimeters (cm)
- Meters (m)
- Kilometers (km)

Example 1.1. Give an example of something that can be measured using each of the units above.

Relationships Between Units

- There are 12 inches in 1 foot
- There are 3 feet in 1 yard
- There are 5280 feet in 1 mile
- There are 100 centimeters in 1 meter
- There are 100 meters in 1 kilometer

Example 1.2. Determine an appropriate unit to measure the distance given below.

(a) Distance between Norman and Oklahoma City

(b) Height of a tall building

(c) Diameter of a cookie

(d) Length of a bug

Converting between units is very important to help us conceptualize and compute information.

Example 1.3. If there are 3.28 feet in 1 meter, convert 1 mile to 1 kilometer

Example 1.4. Convert your height from imperial units (feet and inches) to centimeters. Use the fact that there are 2.54 centimeters in 1 inch.

Example 1.5. The average distance between the Earth and the Sun is called an astronomical unit. If there are 149,600,000 km in 1 AU, how many miles is in 1 AU?

Measuring Area

While length measures one dimensional objects, area is a measure of two-dimensional objects.

Area Formulas for Common Shapes

- Rectangles: Length$\cdot$ Width
- Triangles: $\frac{1}{2}\cdot$ Length $\cdot$ Width
- Circles: $\pi\cdot$Radius^2

The units of area are similar to the units of length; we find the units for area by squaring the component length unit. Some common area units are:

- square inches (in^2)
- square miles (mi^2)
- square meters (m^2)

Example 1.6. Give an example of something that could be measured using each of the units above

Example 1.7. A new house has a 2.5 acre lot. What is the square footage of the lot? Use the fact that there are 3 feet in 1 yard, and 4,840 square yards in 1 acre.

Measuring Volume

Volume is a measure of three-dimensional objects, the three-dimensional analogue of area.

Volume Formulas for Common Shapes

- Rectangular prism: Length·Width·Height
- Sphere: $\frac{4\pi}{3}$·Radius^3

Example 1.8. A new piece of luggage has a carrying capacity of 5.2 cubic feet of storage space. How many cubic inches of space is there?

Liquid volume is often measured with special units. Some of these are:

- Milliliters (mL)
- Liters (L)
- Fluid Ounces (oz)
- Cups (c)
- Quarts (qt)
- Gallons (gal)

Relationships Between Units

- There are 1000 milliliters in 1 liter
- There are 8 fluid ounces in 1 cup
- There are 4 cups in 1 quart
- There are 4 quarts in 1 gallon

Example 1.9. How many fluid ounces are in 2 gallons?

Measuring Temperature

There are two primary units used to measure temperature: Fahrenheit and Celsius

Converting Between Fahrenheit and Celsius

To convert from Fahrenheit to Celsius, use the formula

$$^\circ C = (^\circ F - 32) \cdot \frac{5}{9}$$

To convert from Celsius to Fahrenheit, use the formula

$$^\circ F =^\circ C \cdot \frac{9}{5} + 32$$

A decent estimate to go from Celsius to Fahrenheit is to double the Celsius temperature, then add 32.

Example 1.10. The average high in Norman in October is $75^\circ F$. How high is that in Celsius?

Example 1.11. The 2022 Men's World Cup was moved from Summer 2022 to Winter 2022 because the average temperature in Qatar is about $41^\circ C$. About how hot is that in Fahrenheit?