Measurement – 1.1 – Referents and SI Units

In this unit we will:

- Solve problems that involve linear measurement using:
  - SI and imperial units
  - Estimation strategies
  - Measurement strategies
- Apply proportional reasoning to problems that involve conversion between SI and imperial units of measure.
- Solve problems, using SI and imperial units, that involve the surface area and volume of 3D objects, including:
  - Right cones
  - Right cylinders
  - Right prisms
  - Right pyramids
  - Spheres
- Develop and apply the primary trigonometric ratios (sine, cosine, tangent) to solve problems that involve right triangles.

Referent:

- An item that an individual uses as a measurement unit for estimating.
- Examples:
  - Centimeter
  - Millimeter
  - Meter
  - Kilometer

Example: Using a referent of your choice, measure the length and width of your desk.

The referent I selected was  

**finger width** cm

**pencil lead**

**finger nail thickness**

**desk, arm length, big steps**

**couple blocks, 15 min walk, JP → paws mall**

The length of my desk is __________ cm.

The width of my desk is __________ cm.

The slant of my desk is __________ cm.
Is using a referent standardized enough? How could it cause problems?

NO, too much variation!

SI Units (Systeme International d’Unites):

- System of units where all units are based on multiples of 10
- The meter is the basic unit of length.
- Often called the metric system.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Abbreviation</th>
<th>Multiplying Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilometer</td>
<td>km</td>
<td>1000</td>
</tr>
<tr>
<td>Hectometer</td>
<td>hm</td>
<td>100</td>
</tr>
<tr>
<td>Decameter</td>
<td>dam</td>
<td>10</td>
</tr>
<tr>
<td>Meter</td>
<td>m</td>
<td>1</td>
</tr>
<tr>
<td>Decimeter</td>
<td>dm</td>
<td>0.1</td>
</tr>
<tr>
<td>Centimeter</td>
<td>cm</td>
<td>0.01</td>
</tr>
<tr>
<td>Millimeter</td>
<td>mm</td>
<td>0.001</td>
</tr>
</tbody>
</table>

3.6m $\rightarrow$ 360cm
Practice: Convert the following:

\[
\begin{align*}
3.6 \text{ m} &= \frac{360 \text{ cm}}{100} = 3.6 \text{ m} \\
3.84 \text{ mm} &= \frac{0.0038}{10^{-3}} = 3.84 \text{ mm} \\
2160 \text{ m} &= 2160 \cdot \frac{1000 \text{ cm}}{10 \cdot 10} = 216 \text{ m} \\
4 \text{ m} &= 4 \cdot \frac{1000 \text{ cm}}{10 \cdot 10} = 400 \text{ cm}
\end{align*}
\]

Practice: Convert each measurement to a more appropriate SI unit:

a) A tube of toothpaste is 205 mm long →

\[205 \div 10 = 20.5 \text{ cm} \]

b) The circumference of a highlighter measures 0.06 m →

\[0.06 \times 10 \times 10 = 6 \text{ cm} \times 10 = 60 \text{ mm} \]

c) You travel 526 000 m from Edmonton to Saskatoon →

\[526 000 \div 1000 = 526 \text{ km} \]

d) The top of the door is 2110 mm high →

\[2110 \div 10 = 211 \text{ cm} \div 10 = 21.1 \text{ m} \]

Example: Ms. Carlson buys a wooden barrel that she cuts in half so she is able to use it as a big flower planter. She needs to put a metal band around the planter, 4 cm from the top, to hold the planter together.

a) We know that circumference = \(2\pi r\). If the radius 4 cm from the top of the planter is 0.6 m, what is the length of the metal band Ms. Carlson will need? Express your answer in centimeters.

\[
\begin{align*}
C &= 2\pi r \\
r &= 0.6 \text{ m} \times 10 \times 10 = 60 \text{ cm} \\
C &= 2\pi \times (60) = 377 \text{ cm}
\end{align*}
\]

b) There is a second metal band at the bottom of the barrel that is 1 m shorter than the top band. What is the radius of the planter at the bottom? Express your answer in centimeters.

2nd band: 377 cm - 1 m

\[377 \text{ cm} - 100 \text{ cm} = 277 \text{ cm} \]

\[
\begin{align*}
C &= 2\pi r \\
277 &= 2\pi r \\
\frac{277}{2\pi} &= r \\
r &= 44.1 \text{ cm}
\end{align*}
\]