Unit 1.6

We will continue:

– collecting data by hand
– developing our spreadsheet skills (tables, graphs)

+ start looking at how objects move

→ develop precise language to describe motion
   (Unit 5: start looking at what causes objects to change motion)
Unit 1.6
General motion of an object can be quite complicated.

Ex: tossing a hammer → 3D translational motion (horiz. & vert.)

→ rotational motion

We will start simply and add complexity as we go along

⇒ 1D horizontal motion of a ball

⇒ Remove/greatly reduce outside influences and interactions

Experimental design question: Why are we using a bowling ball?
Again:  We are **not** measuring speed.

We are measuring:
- positions, $x$
- times, $t$

We are calculating:
- distance, $\Delta x = x_2 - x_1$
- time interval, $\Delta t = t_2 - t_1$
- speed, $v$
Unit 1.6 (continued)

First motion definitions:

Distance, \( \Delta x \equiv x_2 - x_1 \)

Average speed, \( < v > \equiv \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1} \)

- \( x_1 = \) position of object at instant of time \( t_1 \)
- \( x_2 = \) position of object at instant of time \( t_2 \)

(This is not quite the same as speed = distance/time, which is not correct)

Example, \( < v > = \frac{x_2 - x_1}{t_2 - t_1} = \frac{8.0 \text{ m} - 0.0 \text{ m}}{4.0 \text{ s} - 0.0 \text{ s}} = 2.0 \text{ m/s} \)
Unit 1.7
Here, we will learn to graph our data:
- by hand
- by computer (spreadsheet)

Guidelines:
- title the graph, label the axes, and include units
- use the full axes
- use scale increments of multiples of 1, 2, or 5
- do not connect the data points with lines

Appendix A walks you through how to make a graph using Excel.
- select/highlight time and position data before using Chart Wizard
Unit 1.8

Our data:

- position, \( x \), increases as time, \( t \), increases
- increases linearly
- passes through \((0 \text{ s}, 0 \text{ m})\) \(\Rightarrow\) proportional

Slope, \( m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}} = \frac{x_2 - x_1}{t_2 - t_1} \)
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<th>$x$ (m)</th>
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Bowling Data