2.3 Speed and Velocity

2.1 I can interpret and analyze the motion of an object moving with constant velocity.

2.3 I can interpret, analyze, and create velocity vs. time graphs for objects moving with constant velocity.

Chapter In Review

Distance = Total Length of Travel

Displacement = Change in position
\[ \Delta x = x_f - x_o \]

Average Velocity = \( \frac{\text{displacement}}{\text{time}} \)

Average Speed = \( \frac{\text{distance}}{\text{time}} \)

Velocity

\[ \bar{v} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} \]

\[ t = \frac{x_f - x_o}{\bar{v}} \]

\[ \bar{v} \cdot t + x_o = x_f \]

Example Problem

A kingfisher is a bird that catches a fish by plunging into water from a height of several meters. If a kingfisher dives from a height of 7.0 m with an average speed of 4.00 m/s, how long does it take for it to reach the water?

\[ x_f = 7.0 \, \text{m} \]
\[ x_o = 0 \]
\[ v = 4.00 \, \text{m/s} \]

\[ t = ? \]

\[ t = \frac{x_f - x_o}{v} = \frac{7.0 - 0}{4.00} \]

\[ t = 1.75 \, \text{s} \]
2.3 Speed and Velocity

**Conceptual Checkpoint**
You drive 4.00 mi at 30.0 mi/h and then another 4.00 mi at 50.0 mi/h. What is your average speed for the 8.00 mi trip?

\[ \text{speed} = \frac{\text{distance}}{\text{time}} \]

\[ \text{time} = \frac{\text{distance}}{\text{speed}} \]

\[ \begin{align*}
\text{time} &= \frac{4.00 \text{ mi}}{30.0 \text{ mi/h}} \\
\text{time} &= 0.133 \text{ hr} \\
\text{time} &= \frac{4.00 \text{ mi}}{50.0 \text{ mi/h}} \\
\text{time} &= 0.0800 \text{ hr}
\end{align*} \]

\[ \text{speed} = \frac{8.00 \text{ mi}}{0.213 \text{ hr}} = 37.6 \text{ mi/h} \]

**Example**
An athlete sprints 50.0 m in 8.00 s, stops, and then walks slowly back to the starting line in 40.0 s. The "sprint direction" is taken to be positive.

\[ \mathbf{v} = \frac{x_f - x_i}{t} = \frac{50.0 \text{ m} - 0}{8.00 \text{ s}} = 6.25 \text{ m/s} \]

What is the average velocity for the complete round trip?

\[ \mathbf{v} = \frac{x_f - x_i}{t} = \frac{0 - 0}{48 \text{ s}} = 0 \text{ m/s} \]

**Example**
Create a position-time graph and a velocity-time graph that represents the motion of the person for the entire 48 seconds.
Graphing Motion With Constant Velocity

PRACTICE
UNIT 2 PROBLEMS
(15-17)