

**Physics: Class Examples**  
**Kinematics in One-Dimension**

**Sections Covered:**  
 Chapter 2: pages 10 - 24

**Topics Covered:**

- Position and time
- Displacement and Distance
- Average speed and average velocity
- Average acceleration
- Kinematic formulas and problem solving
- Graphical analysis
- Free fall and acceleration of gravity

**\*Conversions Needed - Please memorize the following**

- |                       |                 |
|-----------------------|-----------------|
| 1 year = 365 days     | 1 km = 1000 m   |
| 1 day = 24 hours      | 1 m = 100 cm    |
| 1 hour = 3600 seconds | 1 mile ≈ 1600 m |

**Average Speed, Velocity, and Acceleration**

**Example 1:**

Mrs. Whittaker ran for 4 hours 45 minutes and 21 seconds (and was super tired at the end!) through a displacement of 87.54 kilometers. What was her average velocity in m/s?

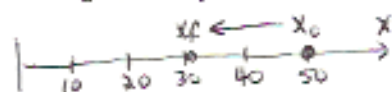
$$\bar{v} = \frac{\text{Displacement } (\Delta x)}{\text{Time } (\Delta t)} = \frac{\Delta x}{\Delta t}$$

$$\bar{v} = \frac{87.54 \text{ km} \left| \frac{1000 \text{ m}}{1 \text{ km}} \right|}{\left( \frac{4 \text{ hours} \left| \frac{3600 \text{ s}}{1 \text{ h}} \right| + 45 \text{ minutes} \left| \frac{60 \text{ s}}{1 \text{ min}} \right| + 21 \text{ s}}{14,400 \text{ s} + 2700 \text{ s} + 21 \text{ s}} \right)}$$

$$\bar{v} = 5.11 \text{ m/s}$$

**Example 2:**

The position of a runner is plotted as a function of time, moving along the x-axis. He moves from an initial position  $x_0 = 50.0 \text{ m}$  to a position  $x_f = 30.5 \text{ m}$  in a time of 3.00 s. What is his average velocity?



$$\bar{v} = \frac{\text{displacement } (\Delta x)}{\text{time } (\Delta t)} = \frac{x_f - x_0}{t_f - t_0}$$

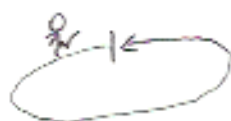
$$\bar{v} = \frac{30.5 - 50}{3.00 - 0}$$

$$\bar{v} = -6.50 \text{ m/s} \text{ or } 6.50 \text{ m/s in a negative direction}$$

**Example 3:**

A person jogs eight complete laps around a quarter mile track in a total of 12.5 minutes. Calculate:

- A. The average speed (in SI Units)
- B. The average velocity (in SI Units)



8 laps on a quarter mile track = 2 miles

$$\frac{2 \text{ miles} \left| \frac{1600 \text{ m}}{1 \text{ mile}} \right|}{12.5 \text{ minutes} \left| \frac{60 \text{ s}}{1 \text{ minute}} \right|} = 3200 \text{ m}$$

$$\frac{3200 \text{ m}}{750 \text{ s}} = 4.27 \text{ m/s}$$

A.) Average Speed =  $\frac{\text{distance } (\Delta x)}{\text{time}}$

$$\text{Average Speed} = \frac{3200}{750}$$

$$\text{Average Speed} = 4.27 \text{ m/s}$$

B.)  $\bar{v} = \frac{\text{displacement } (\Delta x)}{\text{time}} = \frac{0}{750}$

\* Start + ending point are the same

$$\bar{v} = 0 \text{ m/s}$$