Flipping Physics Lecture Notes:
Understanding Instantaneous and Average Velocity using a Graph

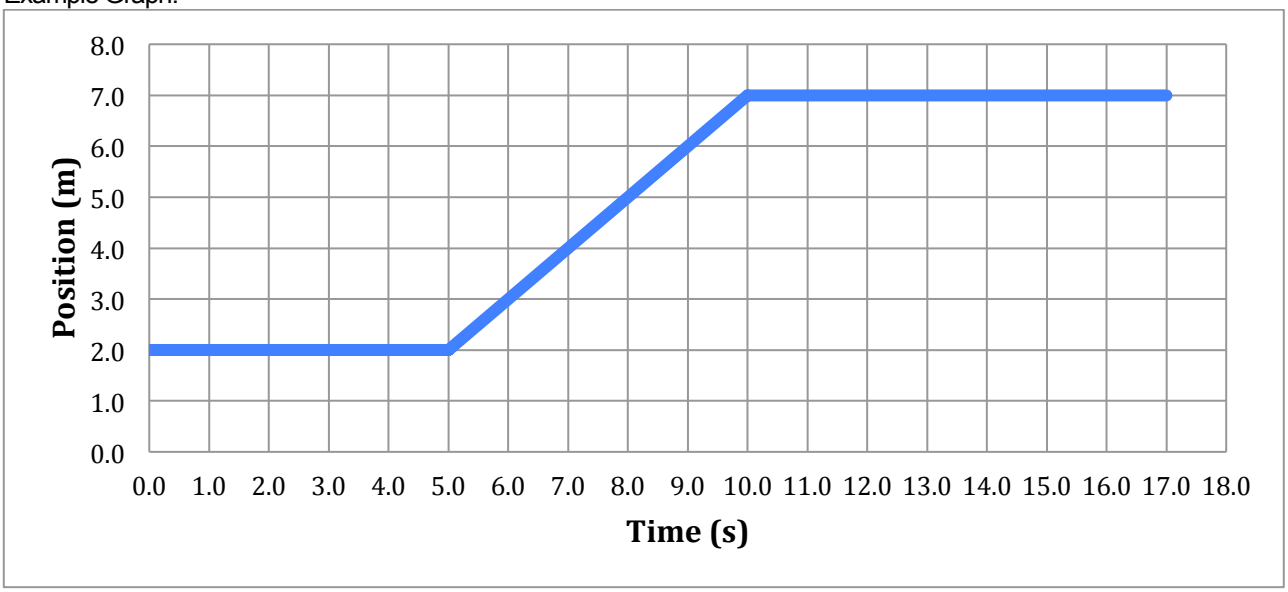
Instantaneous Velocity: The velocity at a specific point in time.

- The UAM variables Velocity Final and Velocity initial are instantaneous velocities because they are at specific points in time.

Average Velocity: The velocity over a time period.

- $v = \frac{\Delta x}{\Delta t}$ is an average velocity because Δt is the time period over which the velocity occurs.

Example Graph:



$$v = \frac{\Delta x}{\Delta t} \Rightarrow v_{(0-5\,\text{sec})} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} = \frac{x_5 - x_0}{t_5 - t_0} = \frac{2-2}{5-0} = \frac{0}{5} = \boxed{0}$$

$V_{(0-5\,\text{sec})}$ => An *average* velocity because it is a time period from 0 to 5 seconds.

$$v_{(5-10\,\text{sec})} = \frac{\Delta x}{\Delta t} = \frac{x_{10} - x_5}{t_{10} - t_5} = \frac{7-2}{10-5} = \frac{5}{5} = \boxed{1.0\,\frac{m}{s}}$$ (again, an average velocity)

Velocity at 6 seconds, at 7 seconds, at 9.85342 seconds are all equal to 1.0 m/s. All are at a specific point in time and therefore *instantaneous* velocities. Note: It's the slope of the line, which we have shown to be velocity.

$$v_{(0-17\,\text{sec})} = \frac{\Delta x}{\Delta t} = \frac{x_{17} - x_0}{t_{17} - t_0} = \frac{7-2}{17-0} = \frac{5}{17} = 0.29412 \approx \boxed{0.29\,\frac{m}{s}}$$