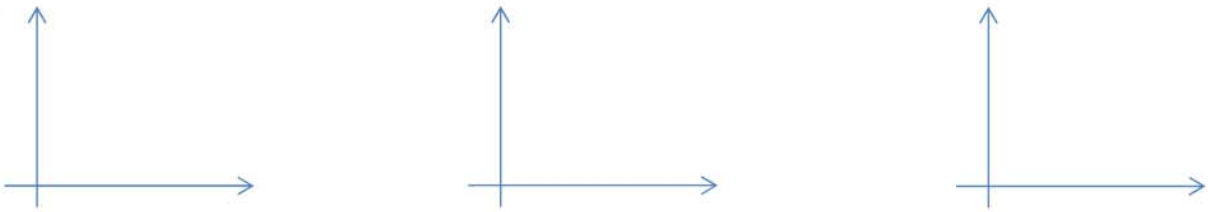
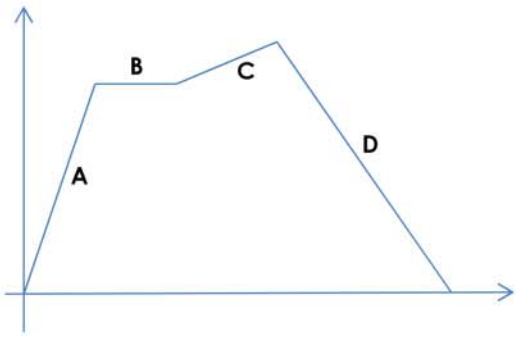
A linear (straight line) graph of d vs t will show a constant speed/velocity.



Example 4: Given the following displacement vs time graph, describe the object's motion.



C. Non-Uniform (changing) Velocity - Graphing d vs t

Acceleration is the rate of change of velocity.

- A **vector** quantity because it has magnitude and direction
- Represented by $\vec{a}$
- Typically measured in m/s^2

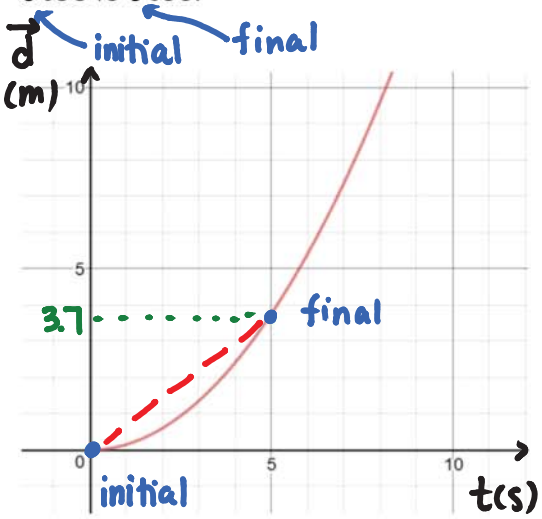
$$\vec{a} = \frac{\vec{V}}{t} \quad \text{or} \quad \vec{a} = \frac{\Delta \vec{V}}{\Delta t}$$

An object that accelerates will result in a **curved** displacement vs time graph.

Average Velocity (V_{avg}) velocity measured over a specific time interval. We only care about the start (initial) and end (final) points; not what is happening in between.

To find V_{avg}: find the slope of a line between the initial and final points on a $\vec{d}$ vs t graph.

Example 5: Consider the following displacement vs time graph. Determine the average velocity from 0 sec to 5 sec.



$\vec{V}_{avg}$ = slope of red line

$= \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{3.7 - 0}{5 - 0}$

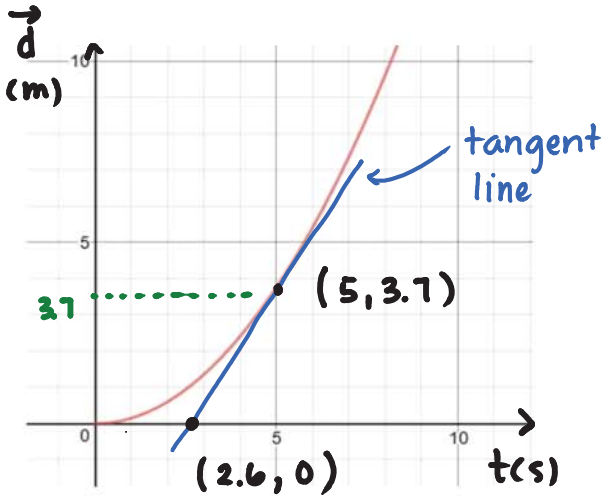
$\vec{V}_{avg} = 0.74\ m/s$

Instantaneous Velocity ($V_{instant}$) the velocity of an object at one specific instant in time.

To find instantaneous velocity:

1) locate the exact time on your graph
2) draw a straight line at that point (known as the tangent line)
   - Line does not intersect your graph
   - Just skims the point
3) find the slope of the tangent line

Example 6: Consider the following displacement vs time graph. Determine the instantaneous velocity at exactly 5 seconds.



$\vec{v}_{instant}$ = slope of tangent line

$= \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{3.7 - 0}{5 - 2.6}$

$= \frac{3.7}{2.4}$

$\vec{v}_{instant} = 1.54 \text{ m/s}$ or 1.5 m/s

D. Non-Uniform Velocity - Graphing d vs t and v vs t

Remember that acceleration is the rate of change of velocity.

The slope of a velocity vs time graph gives us acceleration.

Objects which are **accelerating** (increasing their velocity/speeding up) will have curved graphs that get steeper on a d vs t graph.

Object moving **forward – Accelerating**