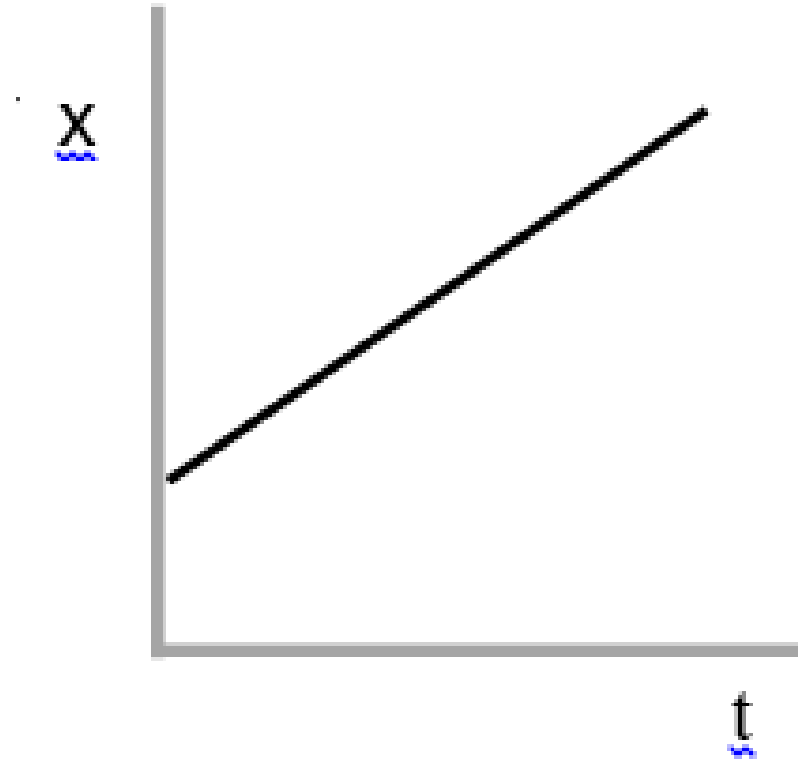


What is the equation for this line?

$$x = \bar{v} t + x_0$$



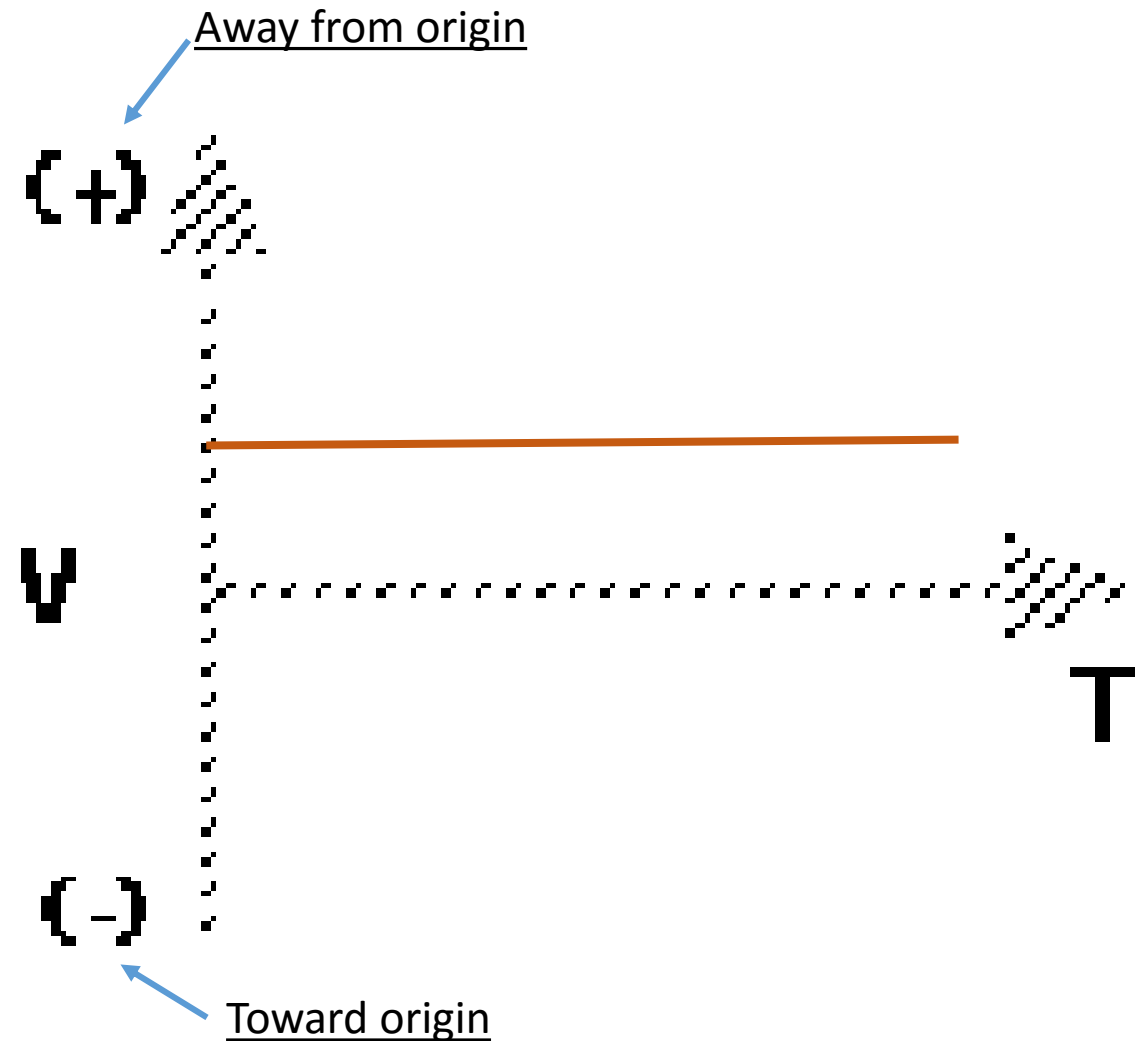
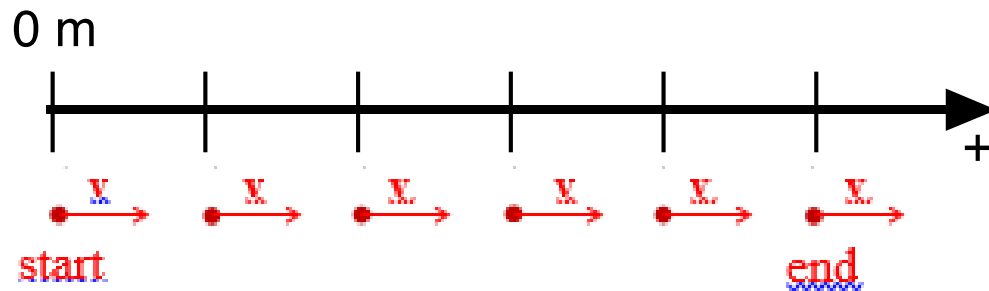
# Velocity vs. Time Graphs

*Be able to create velocity vs. time graphs if given the motion of the object.*

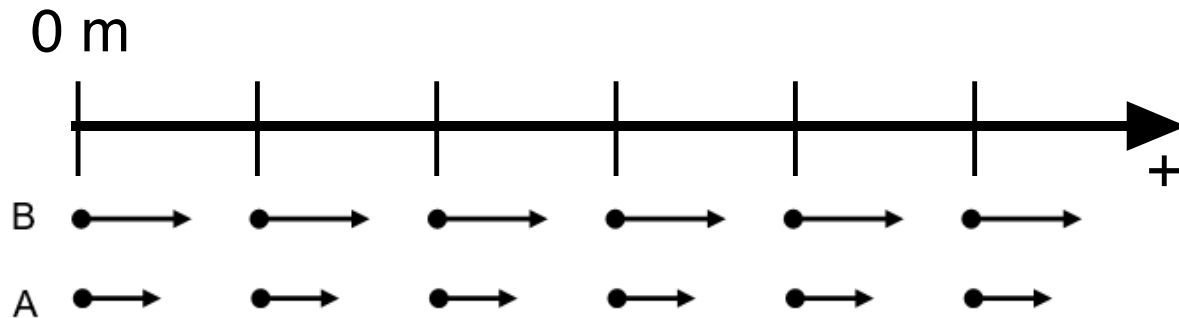
Sketch velocity vs time graphs corresponding to the following descriptions of the motion of an object.

1. The object is moving in the positive direction at a constant (steady) speed.

- *Not changing speed = flat line*
- *Same Velocity #*
- ***No Acceleration***



# Motion map common mistake

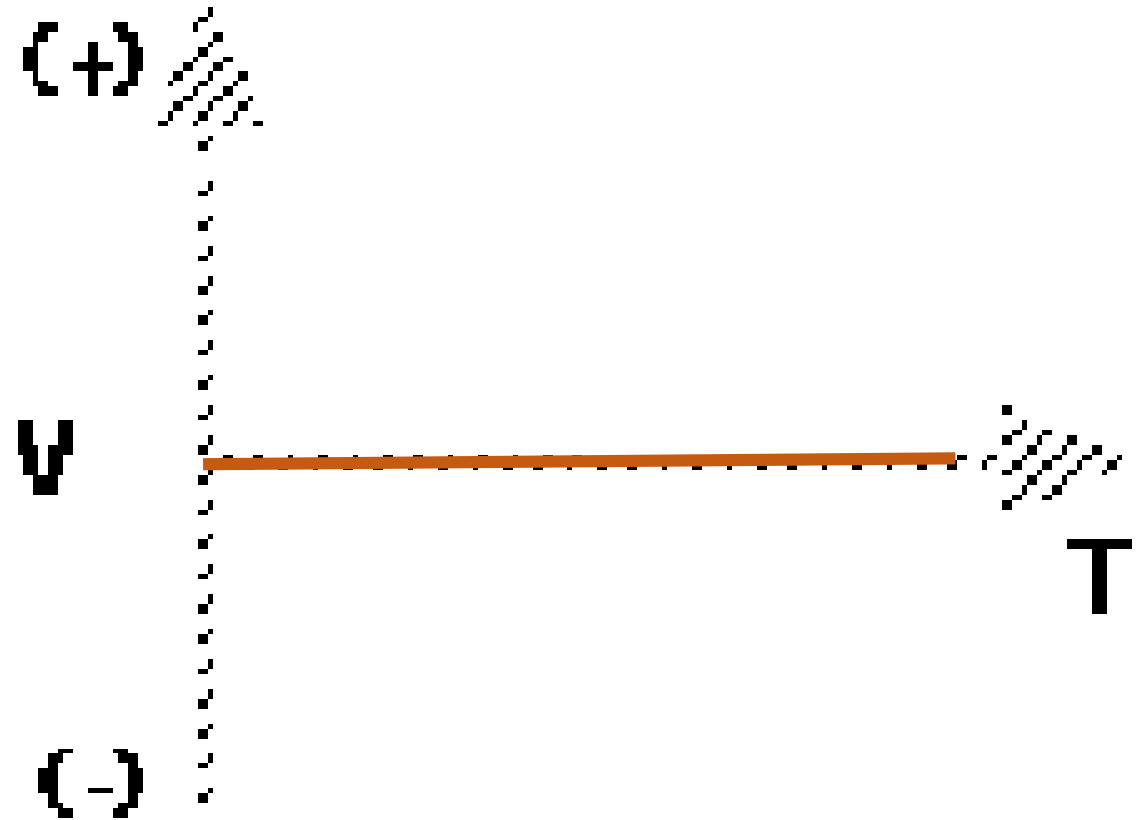
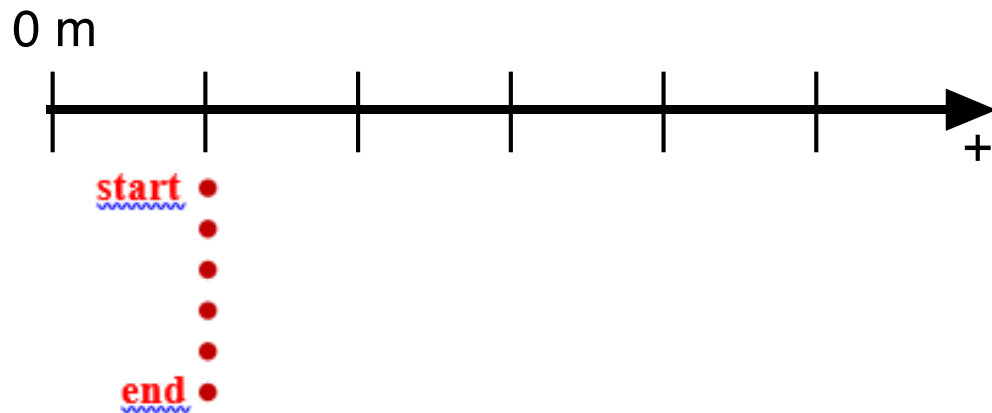


- Students have been known to draw the motion map and state that B was moving faster than A because the velocity vectors were longer, despite the fact that the positions of A and B are the same at each instant.

Sketch velocity vs time graphs corresponding to the following descriptions of the motion of an object.

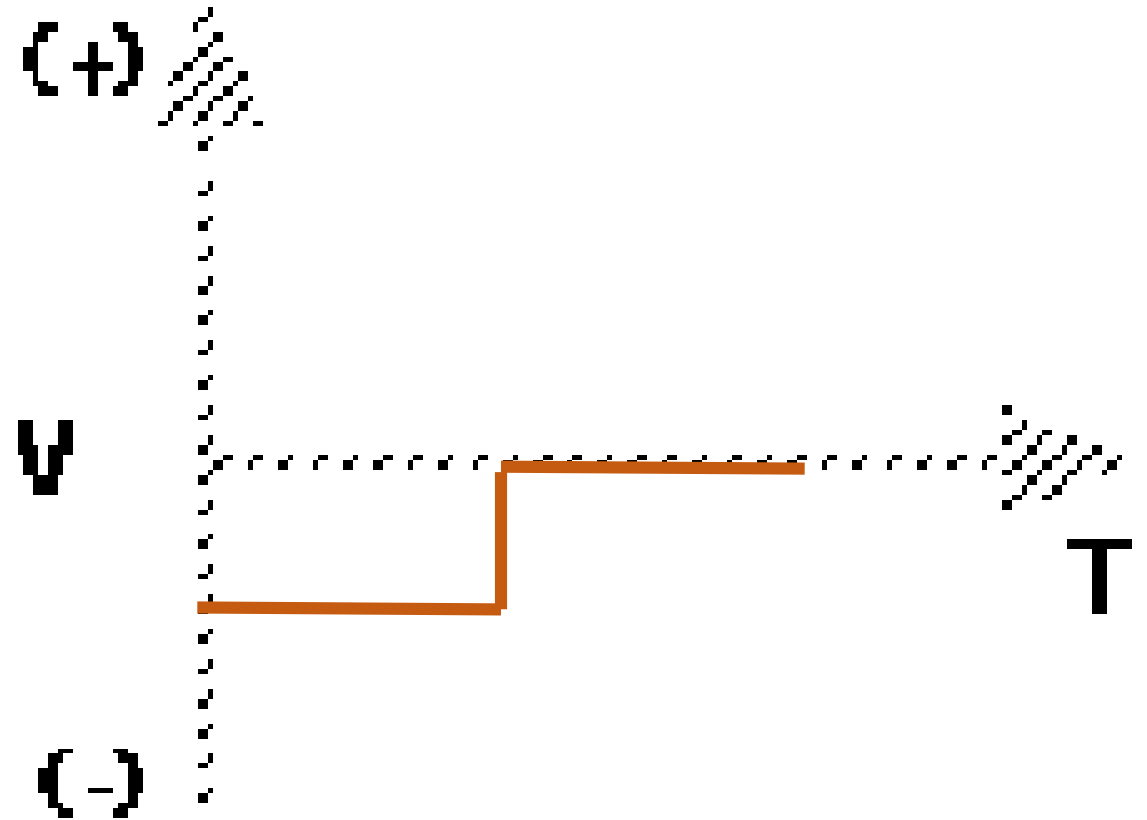
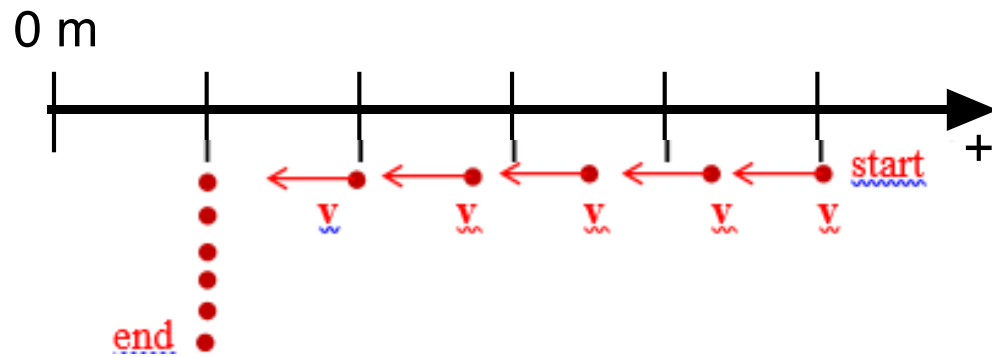
2. The object is standing still.

- Not moving
- 0 m/s
- **No** Acceleration



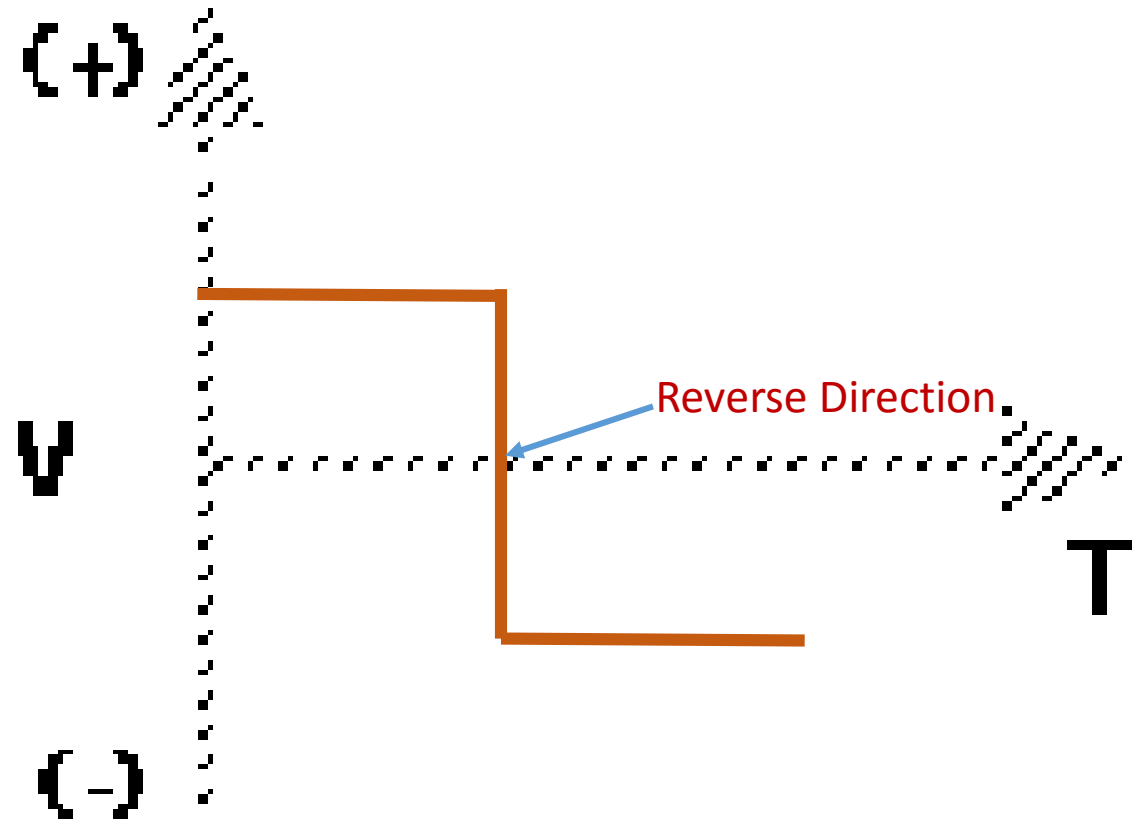
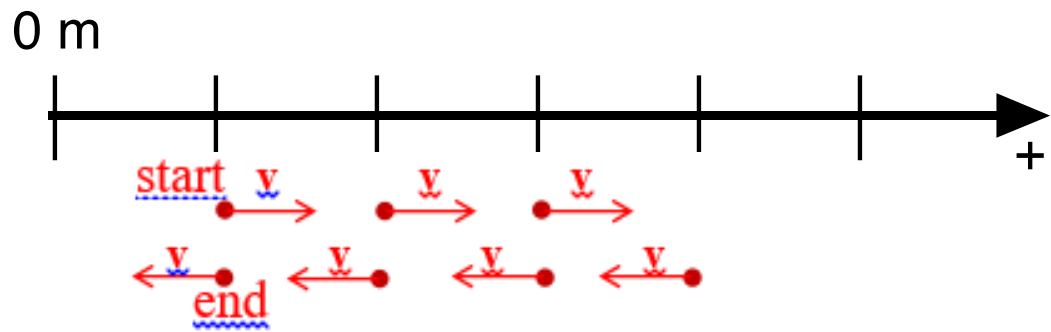
3) The object moves in the negative direction at a steady speed for 10s, then stands still for 10s.

- Toward the origin = (-)Velocity
  - Speed not changing = flat line
- Stop 0 m/s
  - If velocity and acceleration have same sign (+ or -) the object is speeding up
  - If velocity and acceleration have opposite signs the object is slowing down.



4. The object moves in the positive direction at a steady speed for 10s, reverses direction and moves back toward the negative direction at the same speed.

- Moves away from the origin = (+)  $V$ 
  - Steady or constant speed = flat line
- Moves toward origin = (-) Velocity
  - Steady speed = flat line

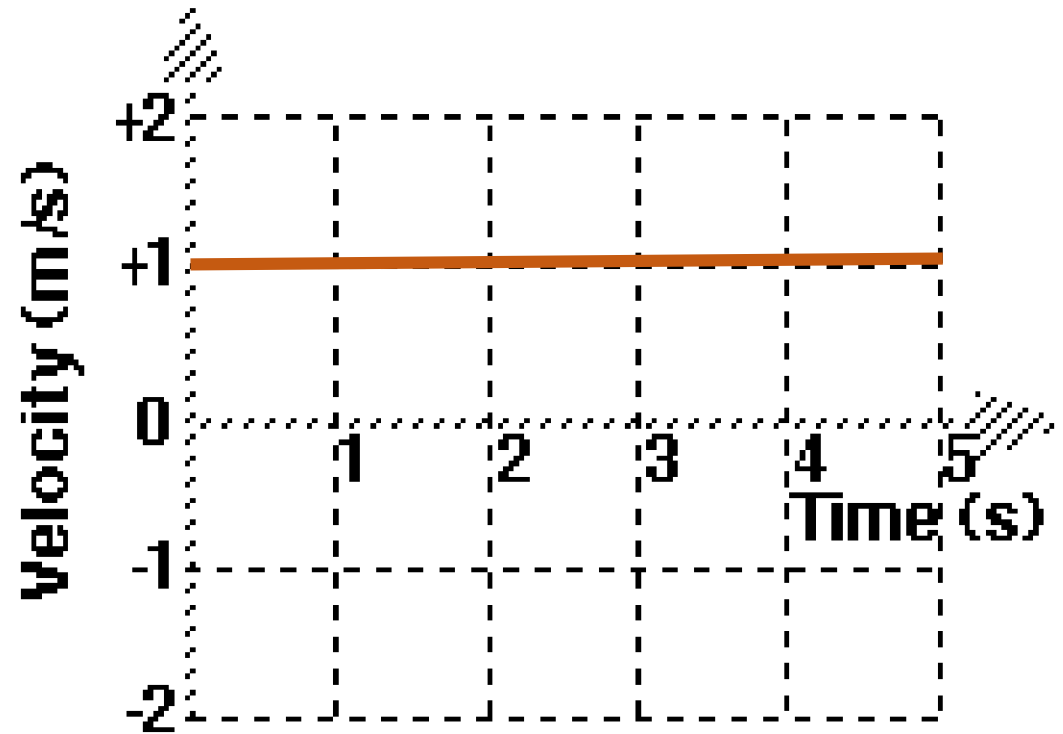
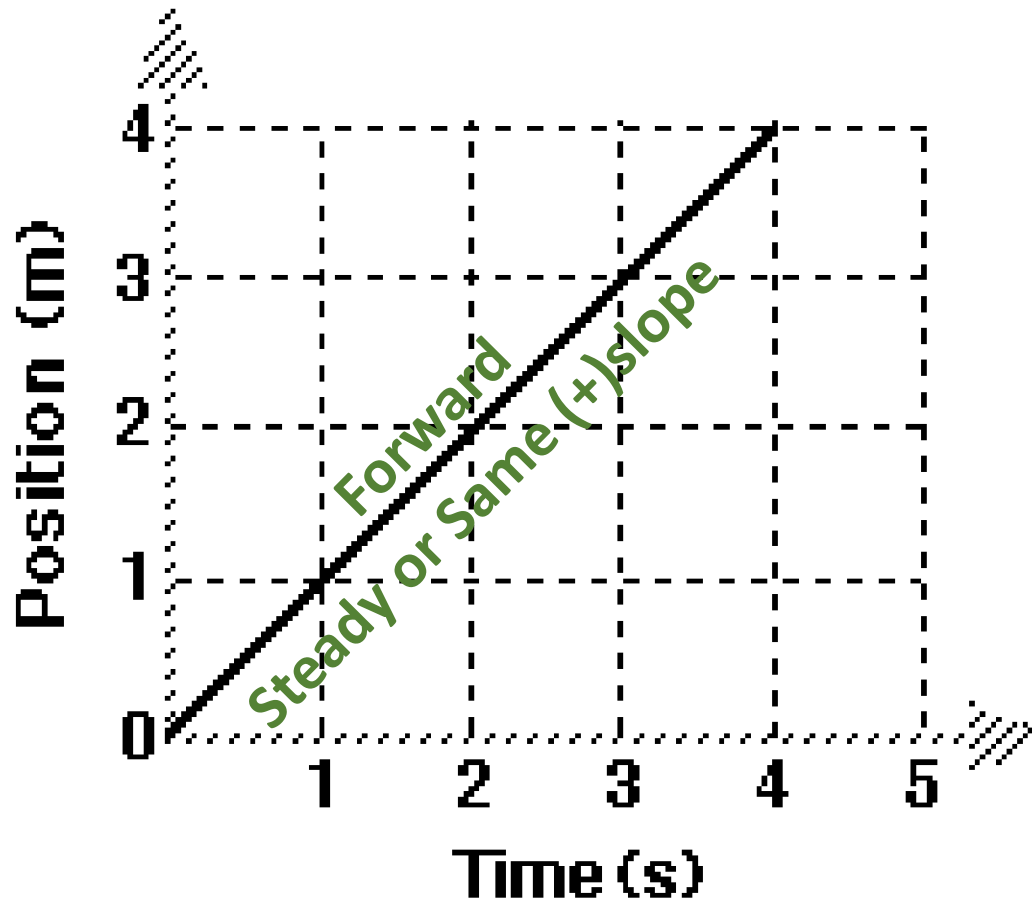


Draw the velocity vs time graphs for an object whose motion produced the position vs time graphs shown below at left.

5. Slope =  $\frac{\Delta Y}{\Delta X} =$

- $4/4 = (+)1\text{m/s}$

- Flat line = no acceleration, same speed.
- (+) Velocity = moving away



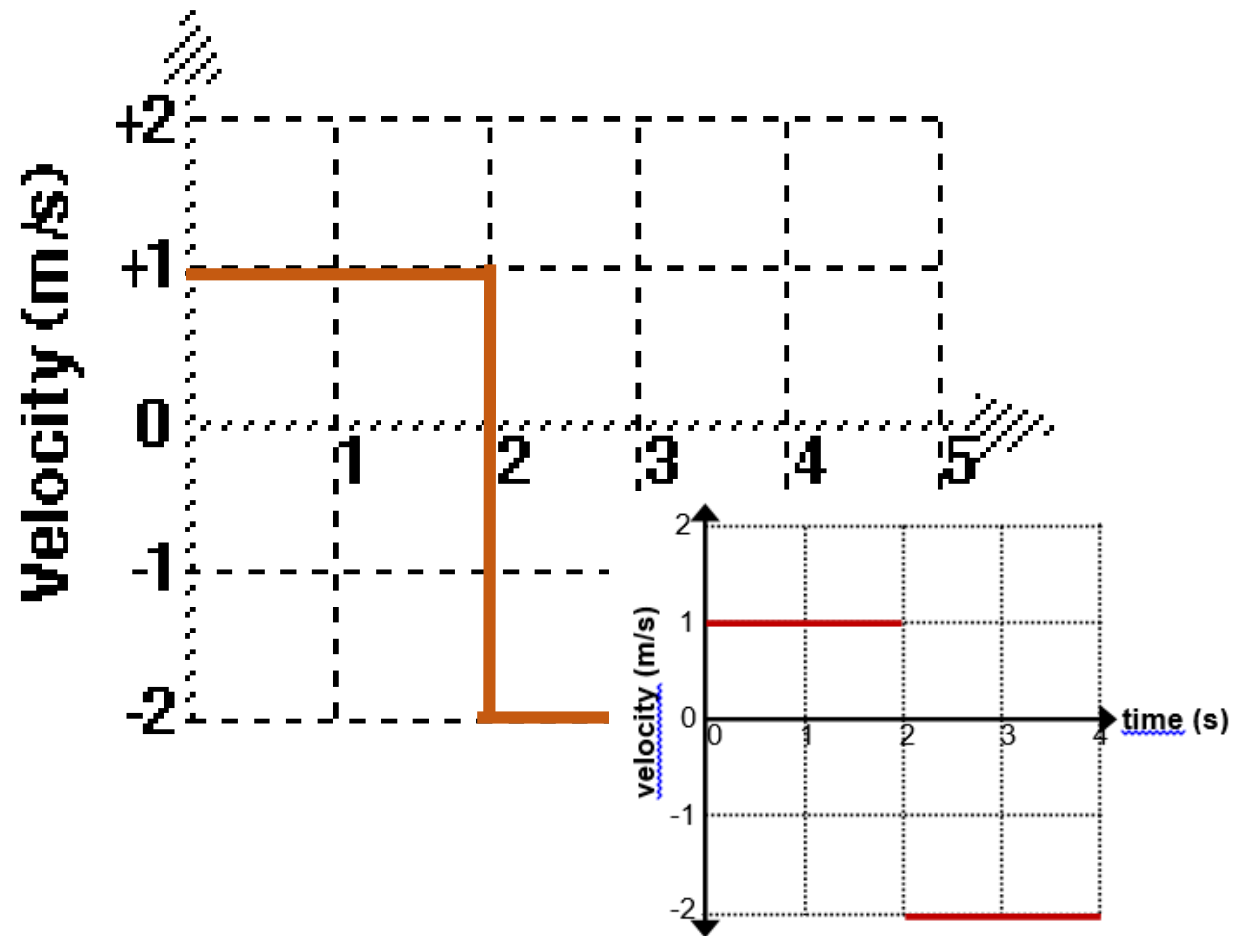
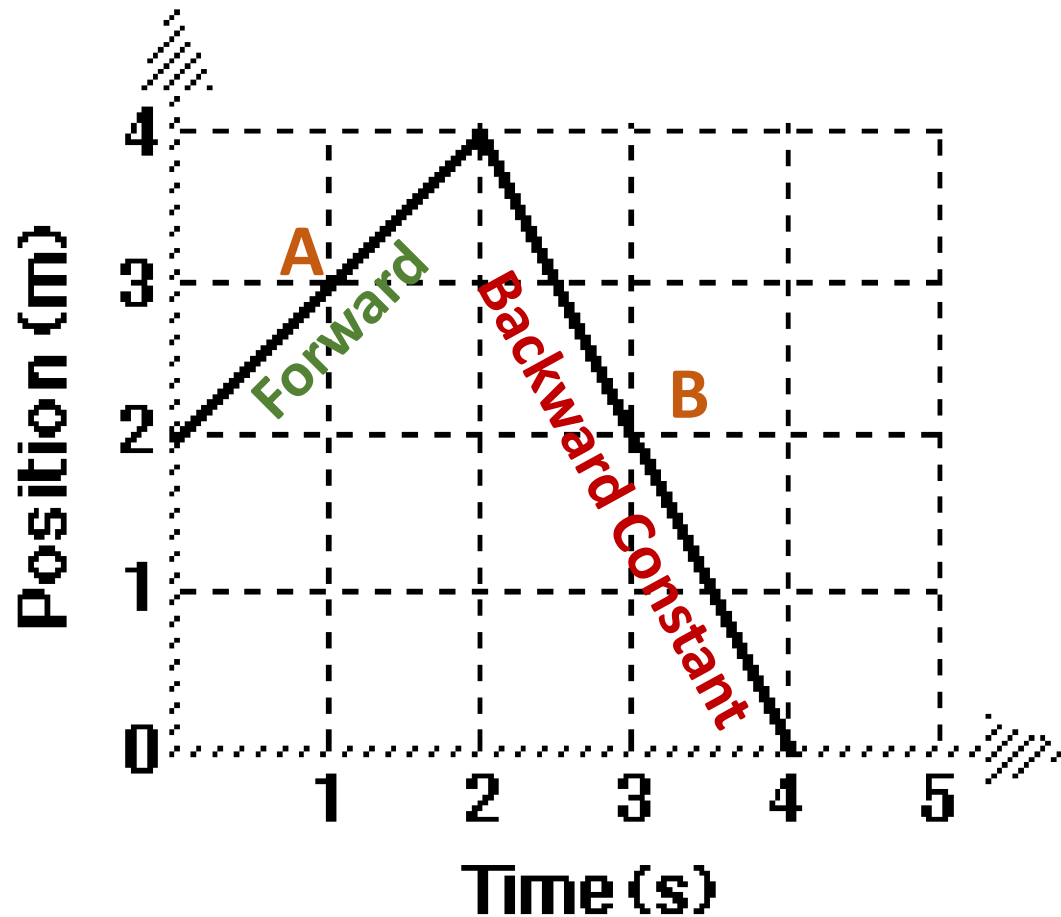


Draw the velocity vs time graphs for an object whose motion produced the position vs time graphs shown below at left.

6. Slope =  $\frac{\Delta Y}{\Delta X}$

- A =  $2/2 = 1$  m/s
- B =  $-4/2 = -2$  m/s (negative = reverse direction)

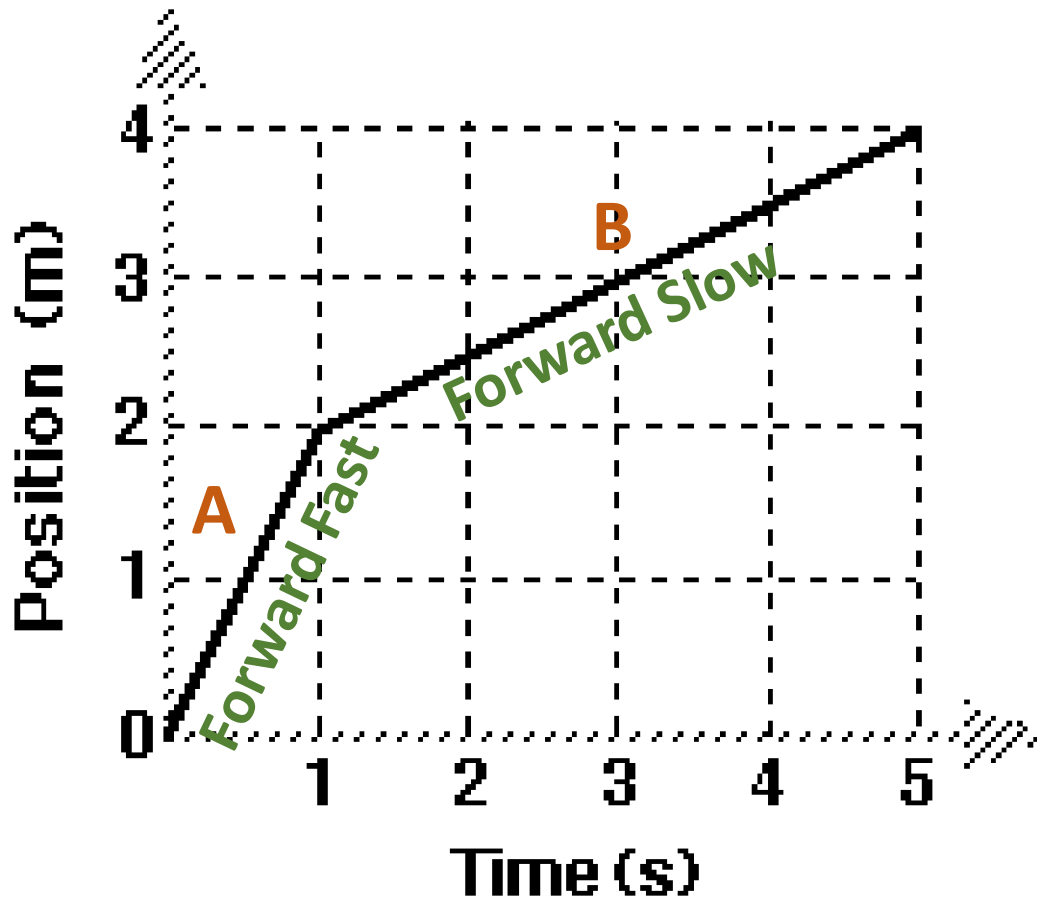
- Constant speed = flat line



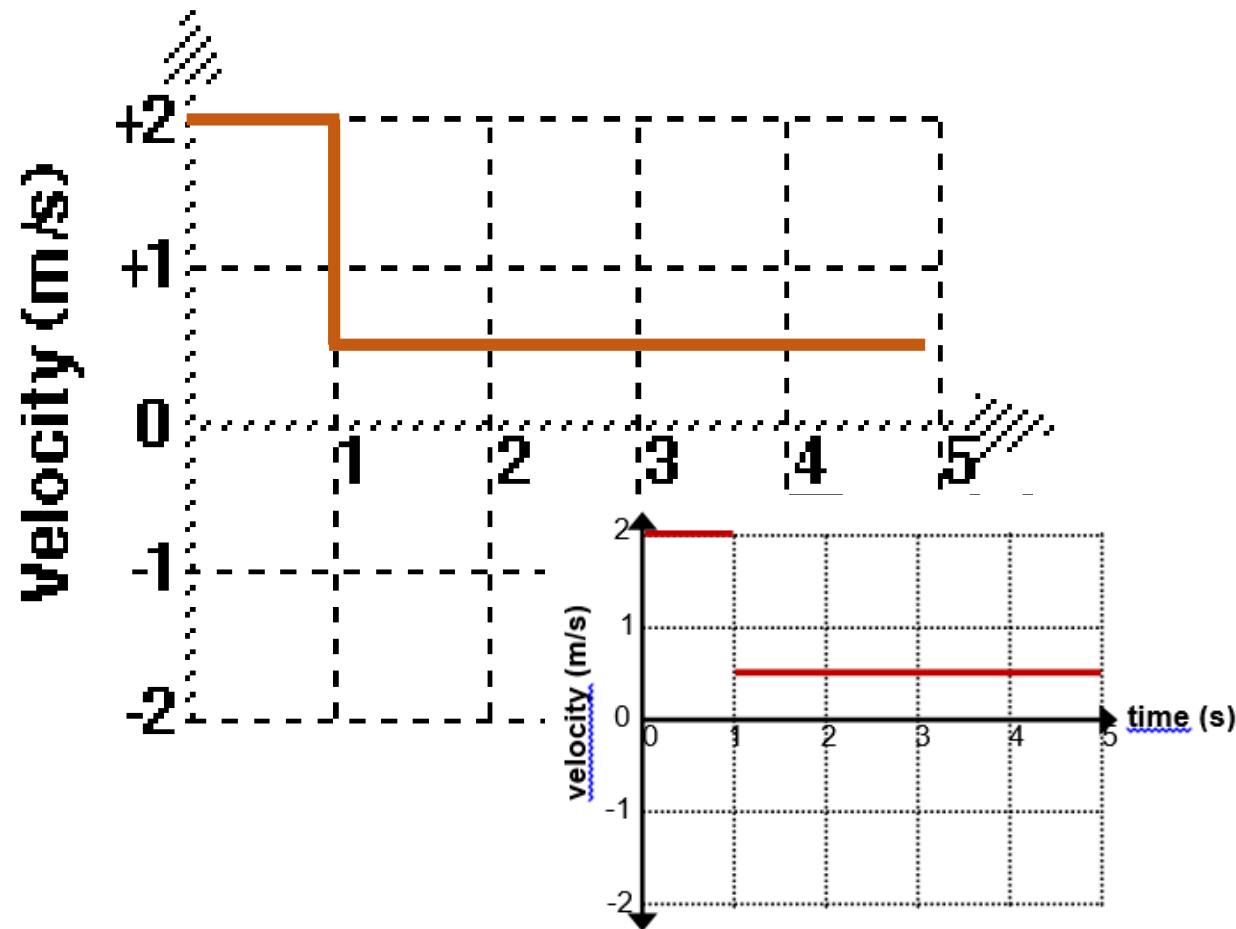
Draw the velocity vs time graphs for an object whose motion produced the position vs time graphs shown below at left.

7. Slope =  $\frac{\Delta Y}{\Delta X}$

- A =  $2/1 = 2$  m/s
- B =  $2/4 = .5$  m/s



- Deceleration or (- acceleration) from 2 m/s to .5 m/s



8. For many graphs, both the **slope** of the line and the **area** between the line and the horizontal axis have physical meanings.

a) What does the slope of a position time graph tell you about the motion of an object?

- *The slope of position vs time graphs gives you average velocity over that time interval.*

b) Looking at the velocity time graphs, determine the units for a square of area on the graph.

- *The units for the area under a velocity vs. time graph are  $(m/s)(s) = m$ .*

c) What does the area "under the velocity-time graph" tell you about the motion of an object?

- *The area under a velocity vs. time graph tells you change in position during that time interval.*

