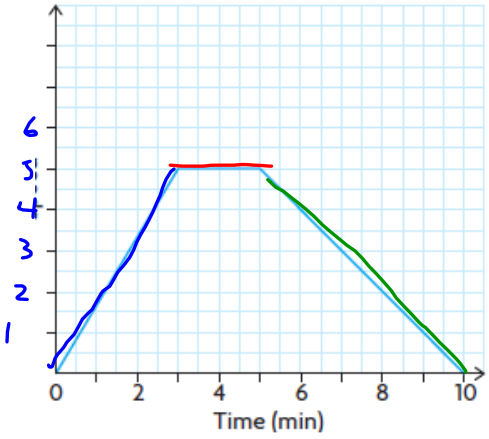
Walk this way...



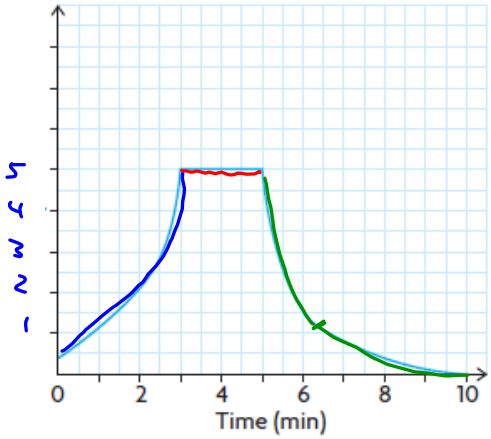
Describe a person's walk if this graph is

(a) a displacement vs time graph

- a snail slimes away from the origin 5 m, stops for 2 minutes, returns at a slower rate.

(b) a speed vs time graph

→ v ↑ constantly (accel)
→ constant v
→ v constantly decreasing until a stop



Describe a person's walk if this graph is

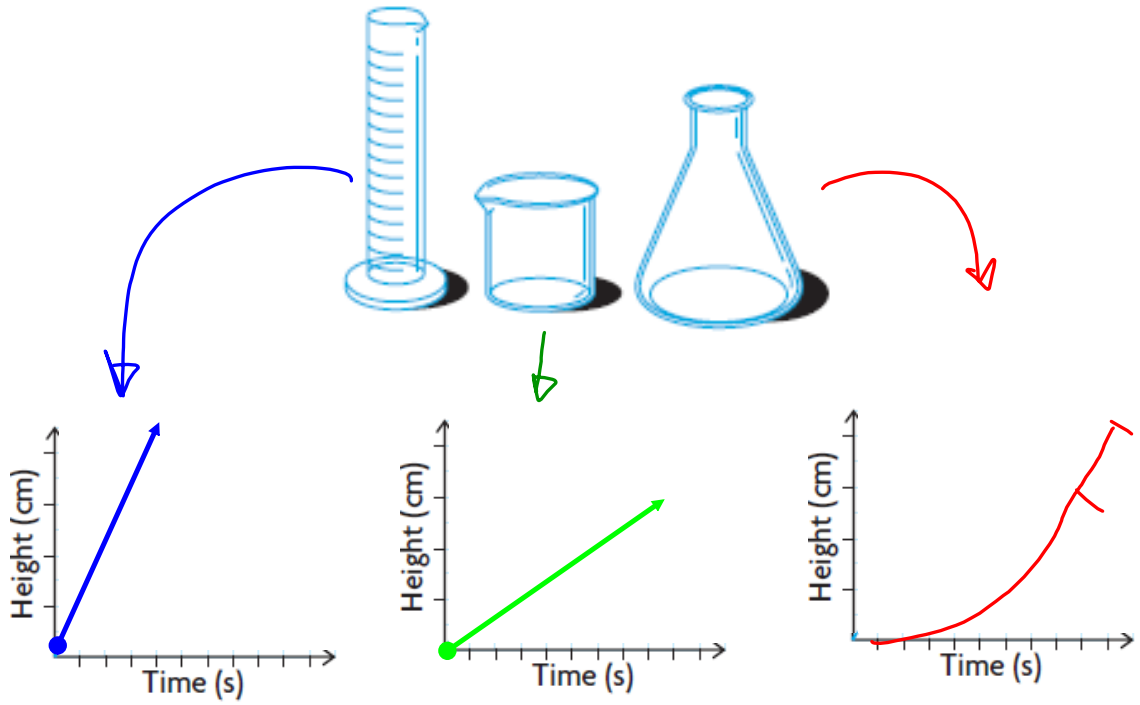
(a) a displacement vs time graph

- ROC of displacement (v) ↑
- v = 0 not moving accelerating
→ returning to origin

(b) a speed vs time graph → decelerating

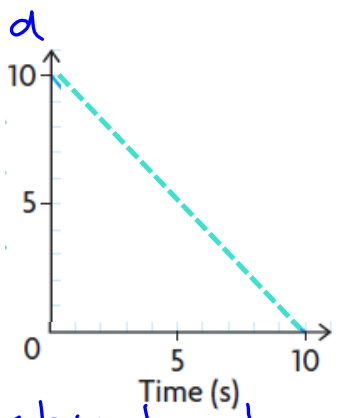
- v ↑, accel ↑
- constant velocity
- decelerating to a stop

A flask, a beaker, and a graduated cylinder are being filled with water. The rate at which the water flows from the tap is the same when filling all three containers. Draw possible water level versus time graphs for the three containers.

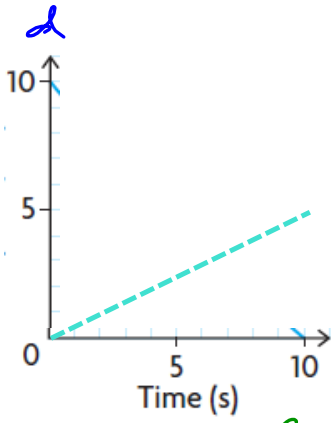


2.4 Graphical Models

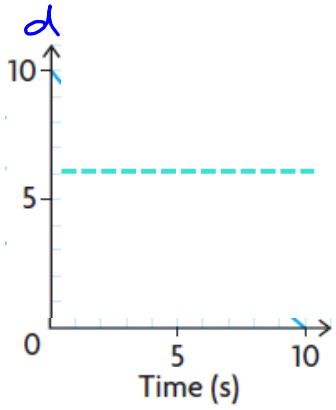
Displacement vs time - shows us how far from a "zero" position (origin) an object is (over some interval of time)



- object returns to origin with constant $\vec{v}$

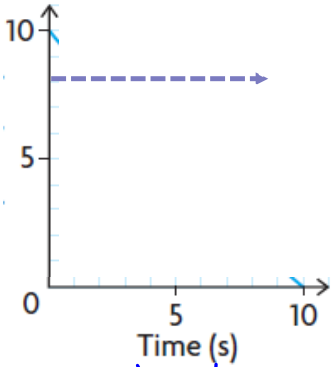


- away from origin ... constant $\vec{v}$

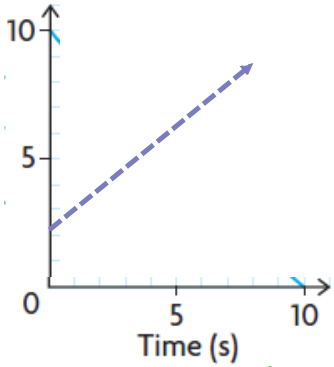


- object is stationary

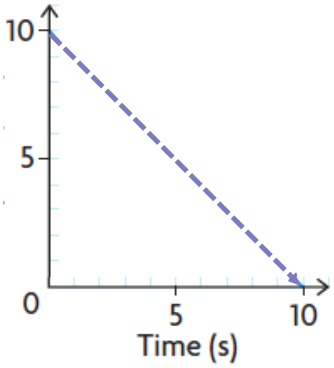
Speed vs time -



- constant speed



- increasing speed
- constant accel.

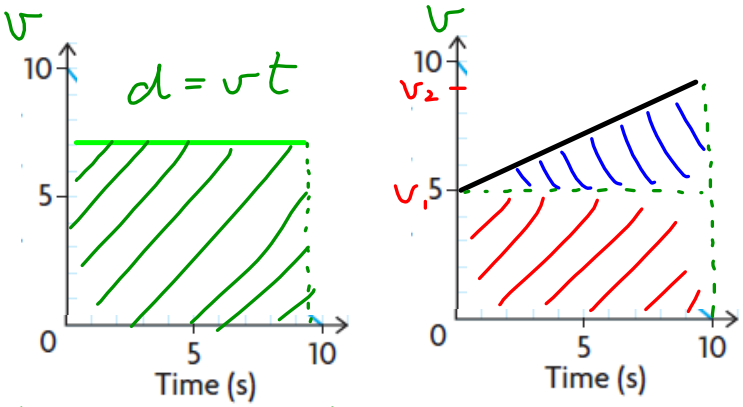


- decreasing speed
- constant negative accel.

The Link Between Displacement and Speed

graph

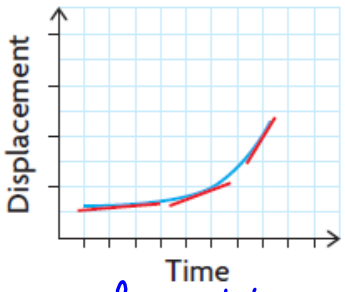
* The slope on a dt gives speed.
* The slope on a vt graph gives acceleration



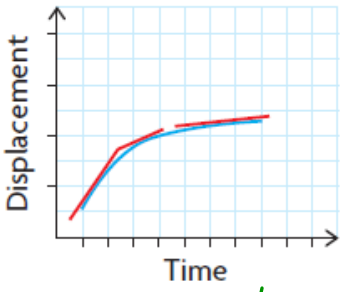
d = area under a vt graph

$d = v_1 t + \frac{1}{2}(v_2 - v_1)t$

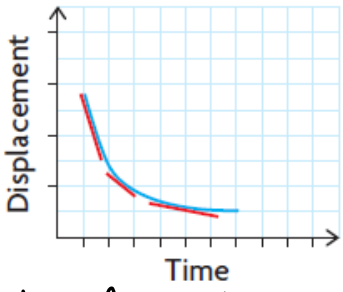
What about curves on these graphs?



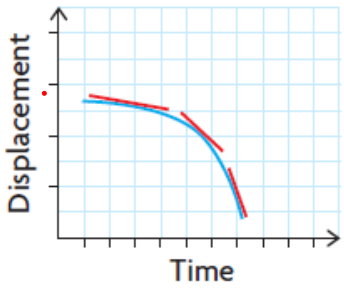
- accelerating away from origin



- decelerating away from the origin



- decelerating as it moves toward origin.



- accelerating toward the origin

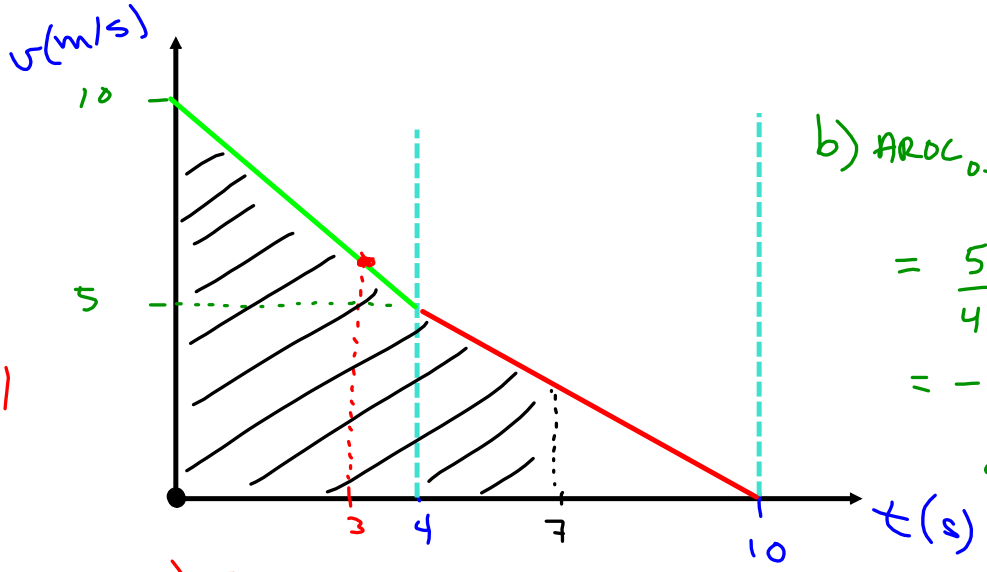
Example 1:

A cyclist is observed moving at a speed of 10 m/s. She begins to slow down at a constant rate and, 4 s later, is at a speed of 5 m/s. She continues to slow down at a different constant rate and finally comes to a stop 6 s later.

a) Sketch a graph of speed versus time.

b) What is the average rate of change of the cyclist's speed in the first 4 s?

c) Estimate the instantaneous rate of change in speed at 3 s.



b) $AROC_{0-4} = \frac{v_2 - v_1}{t_2 - t_1}$

$= \frac{5-10}{4-0} = \frac{-5}{4}$

$= -1.25 \frac{m/s}{s}$

or $-1.25\ m/s^2$

c) $IROC_{t=3} = -1.25\ m/s^2$

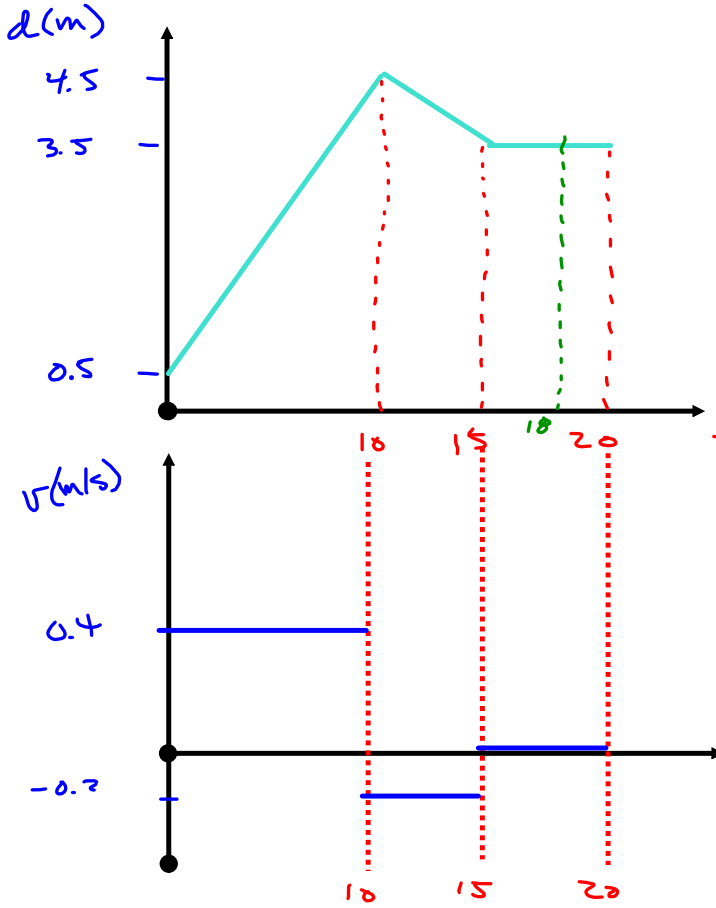
because it's linear !!

d) If I wanted d(7), I could calculate the area under the vt graph

Example 2:

Adam and his friend are testing a motion sensor. Adam stands 0.5 m in front of the sensor and then walks 4 m away from it at a constant rate for 10 s. Next, Adam walks 1 m toward the sensor for 5 s and then waits there for another 5 s.

a) Draw a distance versus time graph for Adam's motion sensor walk.
b) What is the average rate of change in his distance in the first 10 s?
c) What are the instantaneous rates of change at $t = 1$ s and $t = 7$ s?
d) What is the average rate of change in the next 5 s?
e) What are the instantaneous rates of change at $t = 12$ s and $t = 14$ s?
f) What is the instantaneous rate of change at $t = 18$ s?
g) Draw a speed versus time graph for Adam's motion sensor walk.



b) $AROC_{0\to10} = \frac{d_2 - d_1}{t_2 - t_1}$

$= \frac{4.5 - 0.5}{10 - 0} = 0.4$ m/s

c) $IROC_{t=1} = 0.4$ m/s

$= IROC_{t=7}$

d) $AROC_{10\to15}$

$= \frac{3.5 - 4.5}{15 - 10} = -\frac{1}{5}$ m/s

$= -0.2$ m/s

e) $IROC_{12} = IROC_{14} = -0.2$ m/s

f) $IROC_{18} = 0$ m/s

Homefun:

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Review:

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