x, v, & a Express the dimensions of the following variables using the base dimensions of length and time.

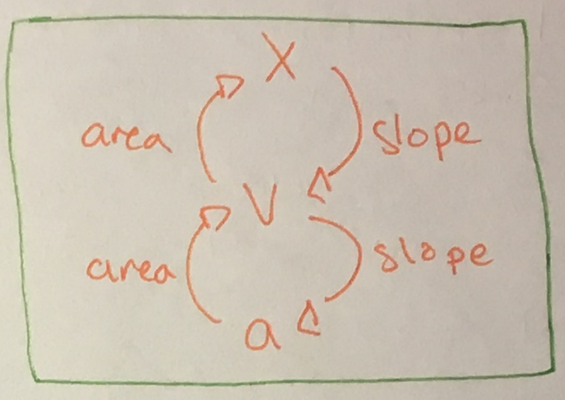
1. position
2. velocity
3. acceleration

Describe how you would find the other 2 variables if given any 1 of the above. Do this for each variable.

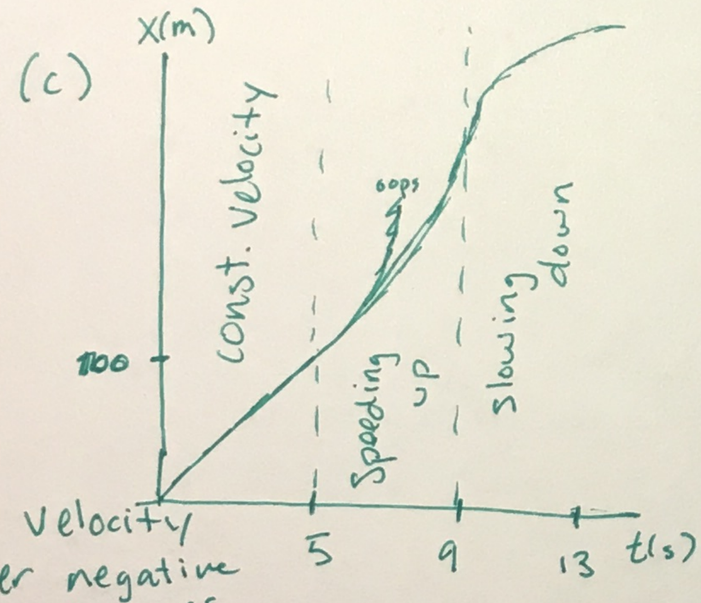
1. position → [length]

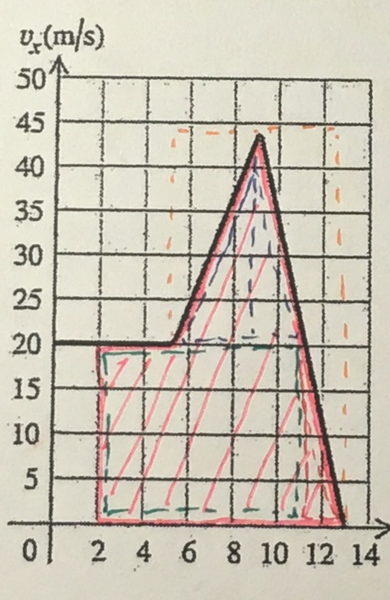
2. velocity → $\frac{[\text{length}]}{[\text{time}]}$

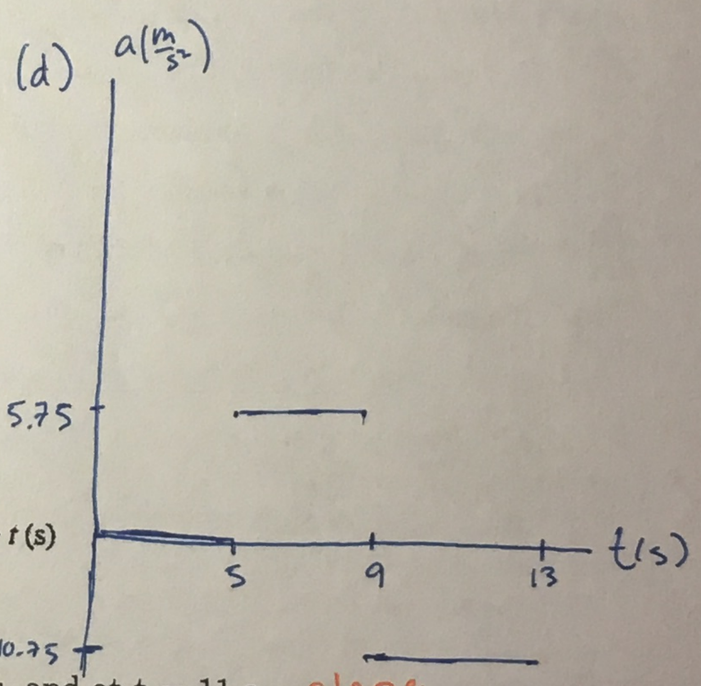
3. acceleration → $\frac{[\text{length}]}{[\text{time}]^2}$



Graphing Motion







Above is a plot of a car's velocity as a function of time.
(a) Find the acceleration of the car at times t = 3 s, at t = 7 s, and at t = 11 s. - slope
(b) How far does the car travel between t = 2 s and t = 13 s? - area
(c) Sketch a plot of the car's position as a function of time.
(d) Sketch a plot of the car's acceleration as a function of time.
Appropriately scale and number the axes in both plots.

(a) $a(t=3s) = \boxed{0\ \frac{m}{s^2}}$

$a(t=7s) = \frac{23\ \frac{m}{s}}{4s} = \boxed{5.75\ \frac{m}{s^2}}$

$a(t=11s) = \frac{-43\ \frac{m}{s}}{4s} = \boxed{-10.75\ \frac{m}{s^2}}$

(b) area under curve
- break into useful shapes and add their areas together

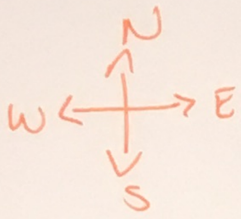
$20\ \frac{m}{s} \cdot 9s = 180\ m$ (length × width)

$23\ \frac{m}{s} \cdot 4s = 92\ m$ (base × height)

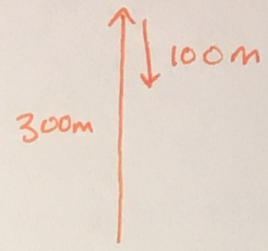
$20\ \frac{m}{s} \cdot 2s = 10m$ (base × height)

$180m + 92m + 10m = \boxed{282m}$

Average Quantities Emily jogs 300 meters north in 10 minutes she then walks 100 meters south in 5 minutes. Find the following:



1. Emily's total distance traveled.
2. Emily's displacement
3. Emily's average speed.
4. Emily's average velocity.



1. $300m + 100m = 400m$
2. $300m - 100m = 200m$
3. $\frac{300m + 100m}{10min. + 5min} = \frac{400m}{15min} \simeq 27 \frac{m}{min.}$
4. $\frac{300m - 100m}{10min. + 5min.} = \frac{200m}{15min.} \simeq 13 \frac{m}{min.}$

Skateboarding Susie Susie is skateboarding on a straight sidewalk.

- She starts at rest at time t = 0 s.
- Over the course of the next two seconds, she accelerates at a constant rate up to 2 m/s north.
- She maintains this velocity for half a second.
- Then, she slows down to 0 m/s over the course of one second.
- She takes a brief pause of half a second.
- Finally, she takes three seconds to accelerate up to a velocity of 2 m/s south.

For the following plots, draw out a grid, scale the axis appropriately, and make sure you label both your horizontal and vertical axes!
Plot Susie's velocity as a function of time.
Plot Susie's acceleration as a function of time.
Plot Susie's position as a function of time.
How would both of these plots respectively relate to the velocity plot above?
Make sure you label your horizontal and vertical axes!

position is area under velocity curve
acceleration is slope of velocity curve