# Constant Velocity Practice #1

1. Define constant velocity motion and describe its characteristics and representations

a) What is the definition of velocity (x-scalar component)? $v_x = \dfrac{\Delta x}{\Delta t}$

b) An object can be modeled as having constant velocity if it can be modeled as a __Point particle__ and it has the same __displacement__ in every unit of time.

c) A toy train travels at a constant speed of 0.50 m/s around a circular track. Does it have a constant velocity? Why or why not? No, because its velocity is changing as it changes direction
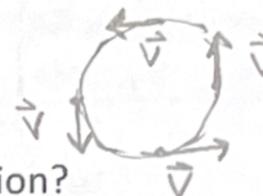
d) What does the magnitude of a velocity vector tell you about the object's motion?
The instantaneous speed

e) Fill in the missing representations for the motion described by the position-time graph:

Graphs	Motion Diagram
Slope $= \dfrac{rise}{run} = \dfrac{-8\,cm}{4s}$ $= -2\dfrac{cm}{s}$ (Position vs Time graph)	(number line, x(cm), marks at -4, -2, 0, 2, 4)
	Mathematical Model $X_f = X_i + V_x \Delta t$ $X_f = 5\,cm + (-2\,cm/s)\Delta t$
(velocity vs Time graph, horizontal at -2)	**Words** The object is at a position of 5 cm at t=0, and it is moving in the negative direction with a speed of 2 cm/s from 0s to 4s. At t=4s, it is at a position of -3 cm.

2. Explain the meaning of specific values for speed or velocity.
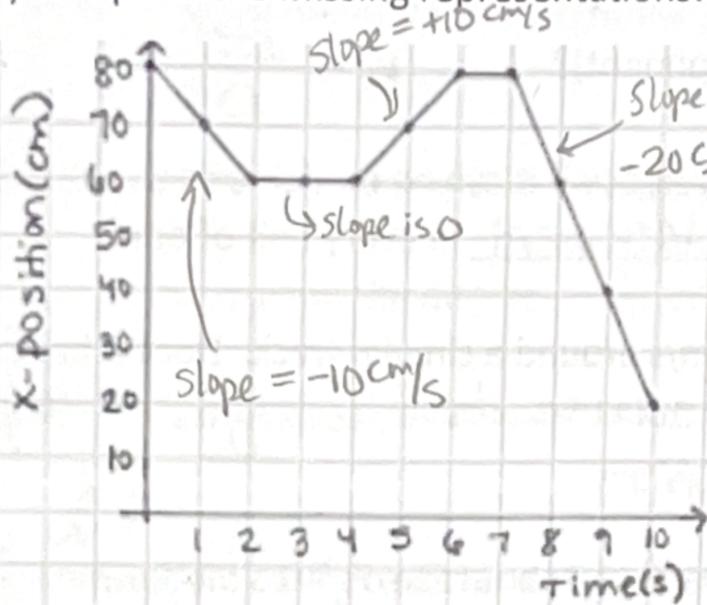*See "Modeling a Motion as Constant Velocity" for the criteria.*

An object is moving with a constant velocity of -9 inches/hour. Explain the meaning of this velocity.
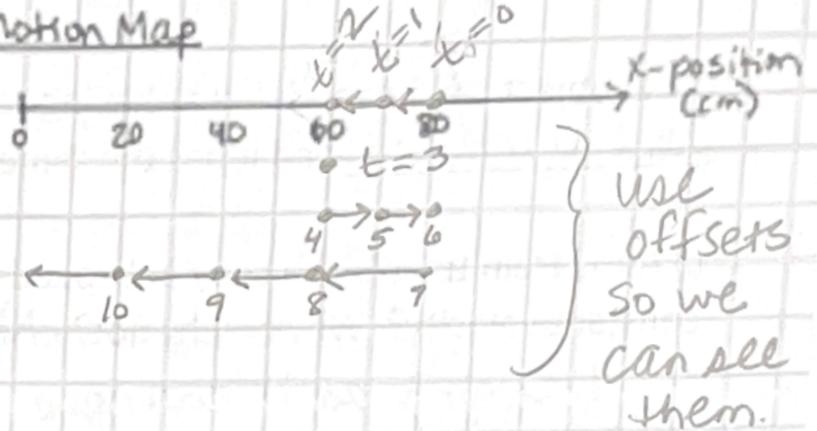
The object's position changes by -9 inches every hour.

3. Create and interpret representations to determine an object's displacement, direction of travel, speed, and velocity. Translate between representations.
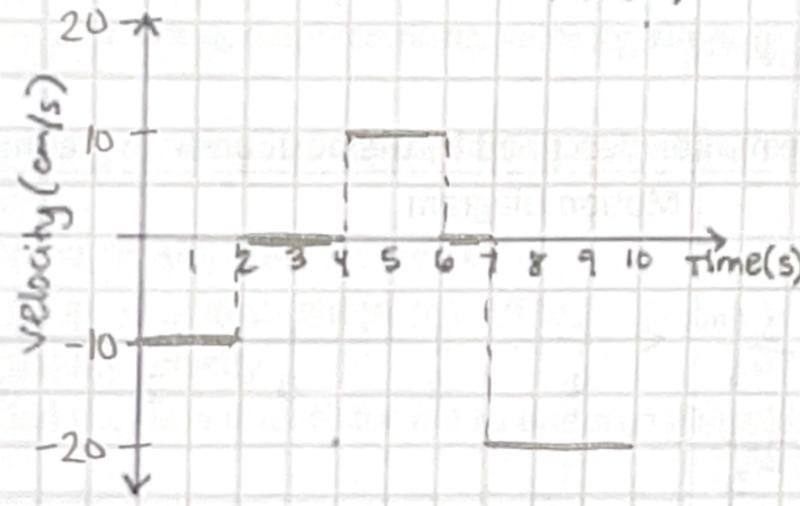4. Draw motion diagrams with correct dot placement and velocity vectors
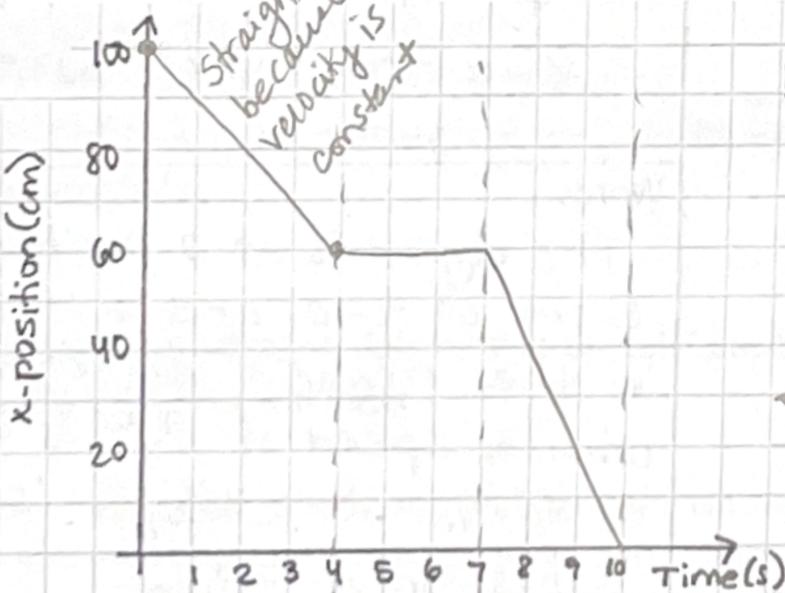
a) Complete the missing representations:

Graph: x-position (cm) vs Time (s)

slope = +10 cm/s
slope = -20 cm/s
slope is 0
slope = -10 cm/s

Motion Map

$x_0^{v=1} \, x_6^{v=1} \, x_5^{v=0}$
0   20   40   60   80   → x-position (cm)
t=3
4 5 6
10   9   8   7

use offsets so we can see them.

Velocity (cm/s) vs Time (s) graph

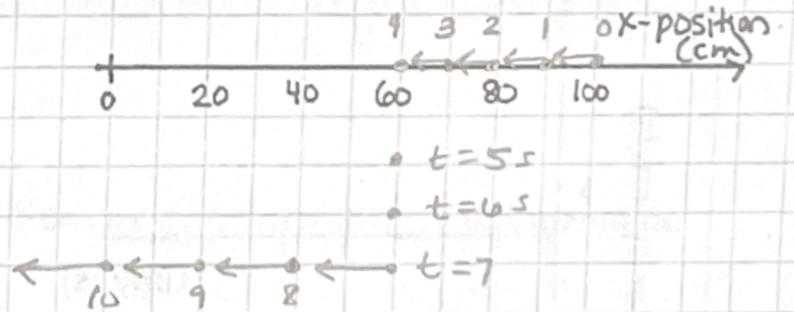**Verbal description:**
- The object starts at x=80cm.
- It moves in the neg. direction at 10 cm/s for 2s. Then it is at rest for 2s.
- Then it moves in the + direction for 2s, and then it rests for 1s.
- Then it moves at 20 cm/s in the negative direction for 3 seconds, ending at x = 20 cm.

b) Complete the missing representations:

x-position (cm) vs Time (s) graph

Straight line because velocity is constant

Motion Map:

4 3 2 1 0 x-position (cm)
0   20   40   60   80   100
t=5s
t=6s
10   9   8   t=7

Verbal description:

The object moves in the negative direction at 10 cm/s for 4 seconds.

area = Δx = 0

Then it stops for 3 seconds

area = (3s)(-20 cm/s) Then it moves in the negative
= -60 cm   direction at 20 cm/s for 3s.

area is Δx
= (4s)(-10 cm/s)
= -40 cm

The total Δx is -100 cm.

It ends up 100 cm in the negative direction from where it started.

I'm starting my position at x=100 cm. But you can choose any initial position.

velocity (cm/s) vs Time (s) graph
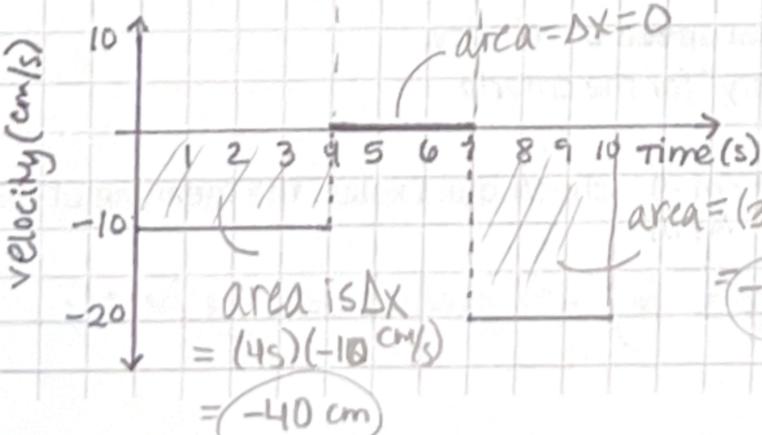
c) Alpha and Beta are driving their cars along the same road. See their position-time graph here:

(i) Compare their speeds

equal at all times

(ii) Compare their positions

B is ahead of A at all times

(iii) Sketch the velocity-time graph

(Same velocity)
A, B
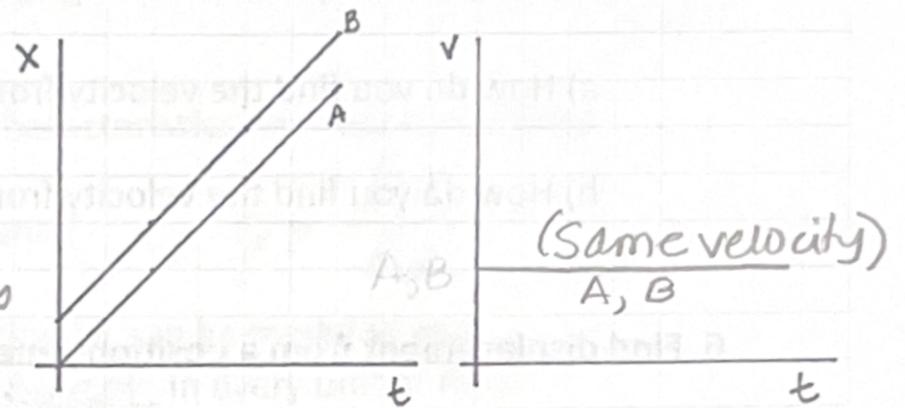
(iv) Label the origin on each axis below, and then sketch the motion diagram for each car:

A ←————————————→

B ←————————————→

Notice the $\vec{v}$ vectors are all the same and B is always ahead of A
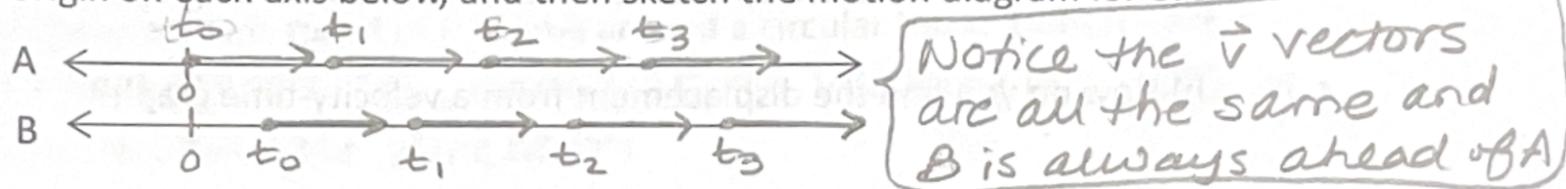
d) Quincy and Webster are driving along the same road. See their position-time graph here:

(i) When, if ever, do they have the same speed?

from $t = 5h$ to $t = 6h$

(ii) When, if ever, do they cross paths? Who passes who?

At $t = 2h$. Q passes W.

(iii) When, if ever, is each car stopped?

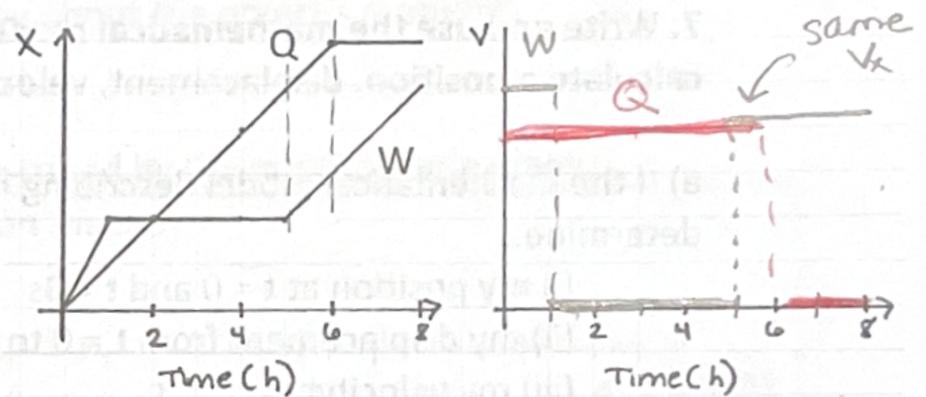Q is stopped from 6h to 8h, W is stopped from 1h to 5h

(iv) When, if ever, does a car change direction?

no cars change direction

(v) Which car has the fastest speed and when?

W has the fastest speed at $t = 0h$ to $t = 1h$

(vi) Sketch the velocity-time graph

same
V_x

e) The origin is in the middle of the street in front of my house. Eastward on the street is the positive direction, and westward on the street is the negative direction. At t = 0, a car moving along the street is 0.25 miles west of my house, and it is moving west at a speed of 20 mi/h.

i) Write the mathematical model for the car's motion

ii) What is the car's displacement in half an hour?

iii) Sketch a p-t graph, v-t graph, and motion diagram for the car's motion.
   (These do not need to be carefully drawn to scale, but they should be qualitatively correct with important values annotated.)