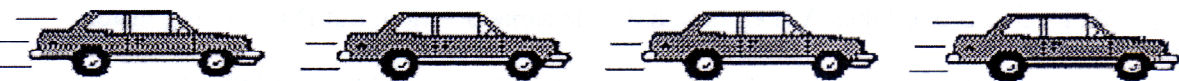


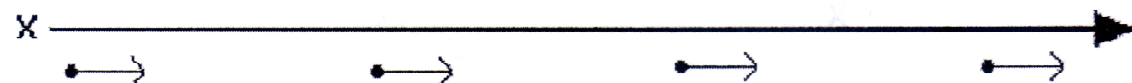
UNIT II READING: MOTION MAPS

A motion map represents the position, velocity, and acceleration of an object at various clock readings. (At this stage of the class, you will be representing position and velocity only.)

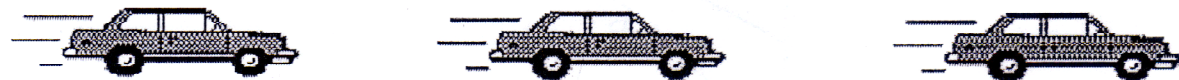
Suppose that you took a stroboscopic picture of a car moving to the right at constant velocity where each image revealed the position of the car at one-second intervals.



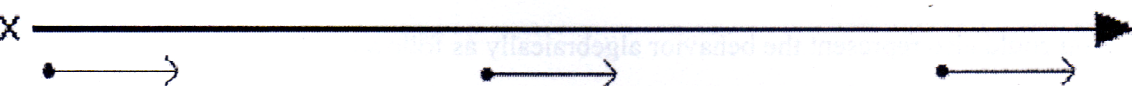
This is the motion map that represents the car. We model the position of the object with a small point. At each position, the object's velocity is represented by a vector.



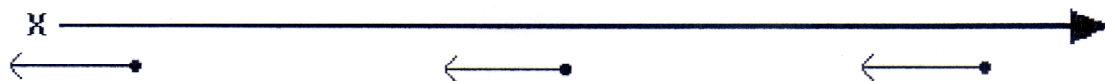
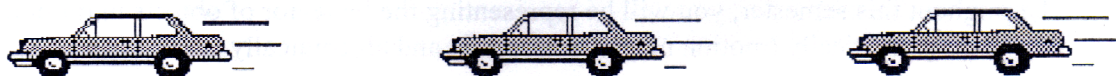
If the car were traveling at greater velocity, the strobe photo might look like this:



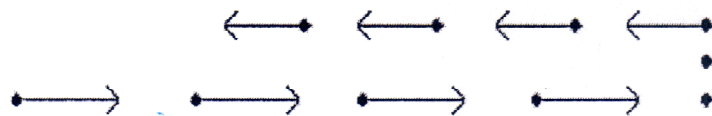
The corresponding motion map has the points spaced farther apart, and the velocity vectors are longer, implying that the car is moving faster.



If the car were moving to the left at constant velocity, the photo and motion map might look like this:

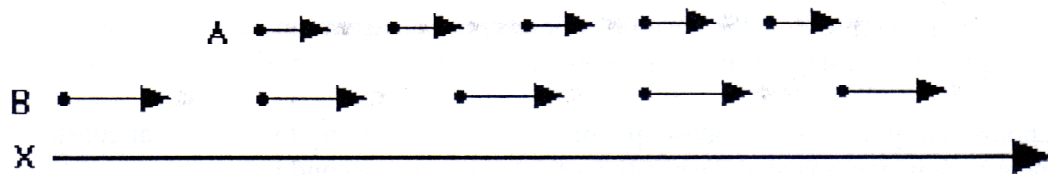


More complicated motion can be represented as well.



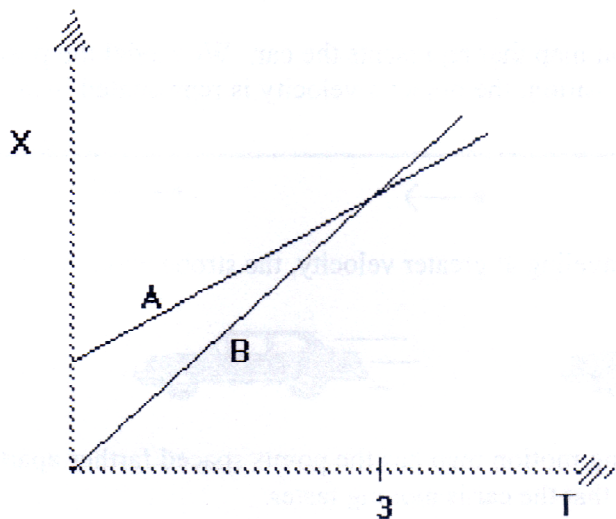
Here, an object moves to the right at constant velocity, stops and remains in place for two seconds, then moves to the left at a slower constant velocity.

Consider the interpretation of the motion map below. At time $t = 0$, cyclist A starts moving to the right at constant velocity, at some position to the right of the origin.



Cyclist B starts at the origin and travels to the right at a constant, though greater velocity. At $t = 3$ s, B overtakes A (i.e., both have the same position, but B is moving faster).

A graphical representation of the behavior of cyclists A and B would like this:



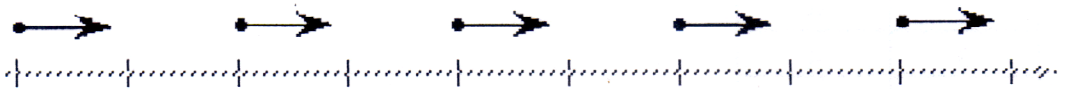
You could also represent the behavior algebraically as follows:

$$x = v_A t + x_0, \text{ for A}$$

$$x = v_B t, \text{ for B} \quad \text{where } v_B > v_A$$

Throughout this semester, you will be representing the behavior of objects in motion in multiple ways: diagrammatically (motion maps), graphically and algebraically.

UNIT II: Worksheet 4



1. From the motion map above, answer the following:

- What can you conclude about the motion of the object?
- Draw a qualitative graphical representation of x vs t (see below).
- Draw a qualitative graphical representation of v vs t (see below).

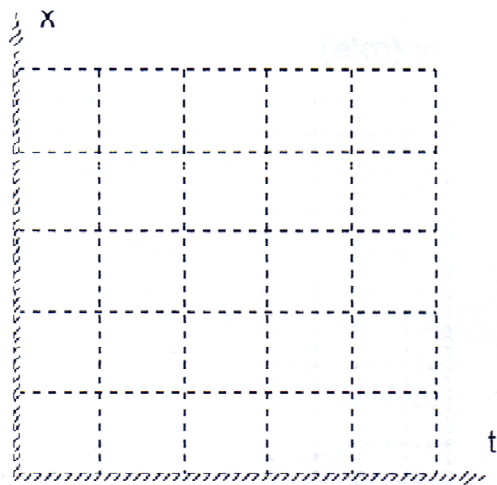


fig. 1

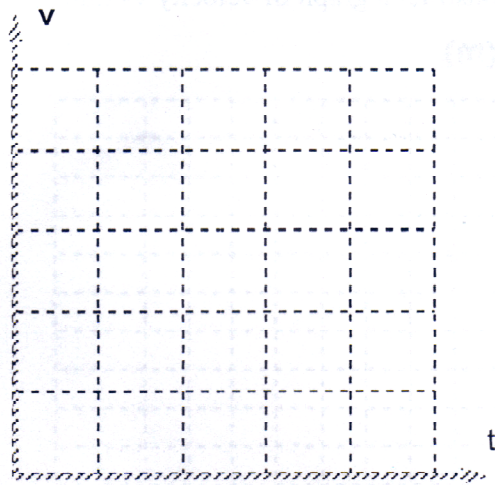


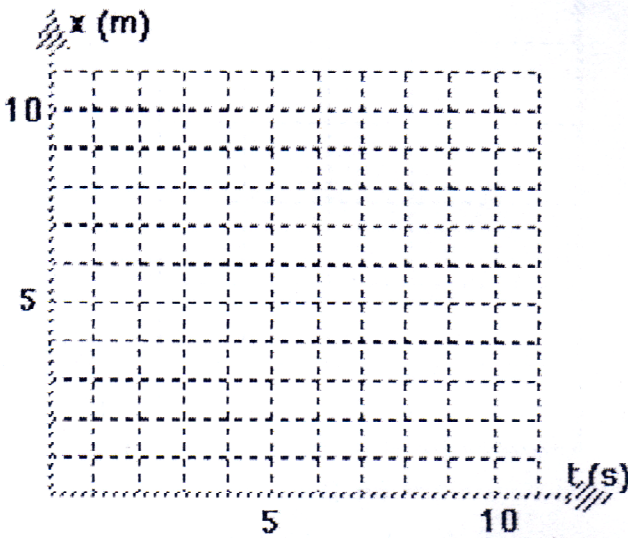
fig. 2

- Write a mathematical expression that represents the relationship between x and t , from fig. 1.
- Write a mathematical expression that represents the relationship between v and t , from fig. 2.
- Describe what the area under the curve in fig. 2 represents. Cross hatch this area.

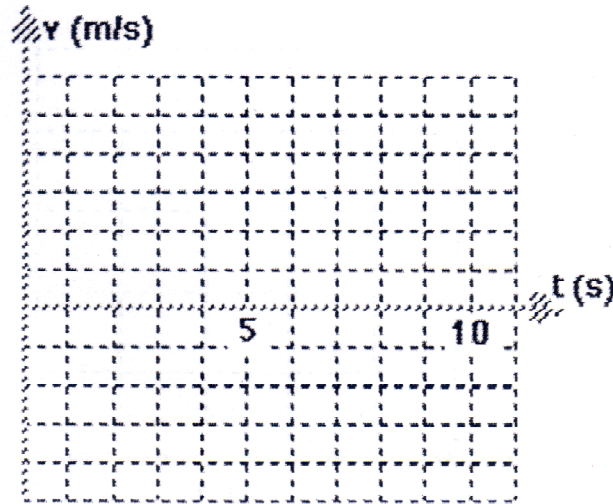
2. From the position vs time data below, answer the following questions.

| t (s) | x (m) |
|-------|-------|
| 0 | 0 |
| 1 | 2 |
| 2 | 4 |
| 3 | 4 |
| 4 | 7 |
| 5 | 10 |
| 6 | 10 |
| 7 | 10 |
| 8 | 5 |
| 9 | 0 |

- Construct a graph of position vs time.
- Construct a graph of velocity vs time.



(A)



(B)

- Draw a motion map for the object.

- Determine the displacement from $t = 3.0\text{s}$ to 5.0s using graph B.

- Determine the displacement from $t = 7.0\text{ s}$ to 9.0 s using graph B.