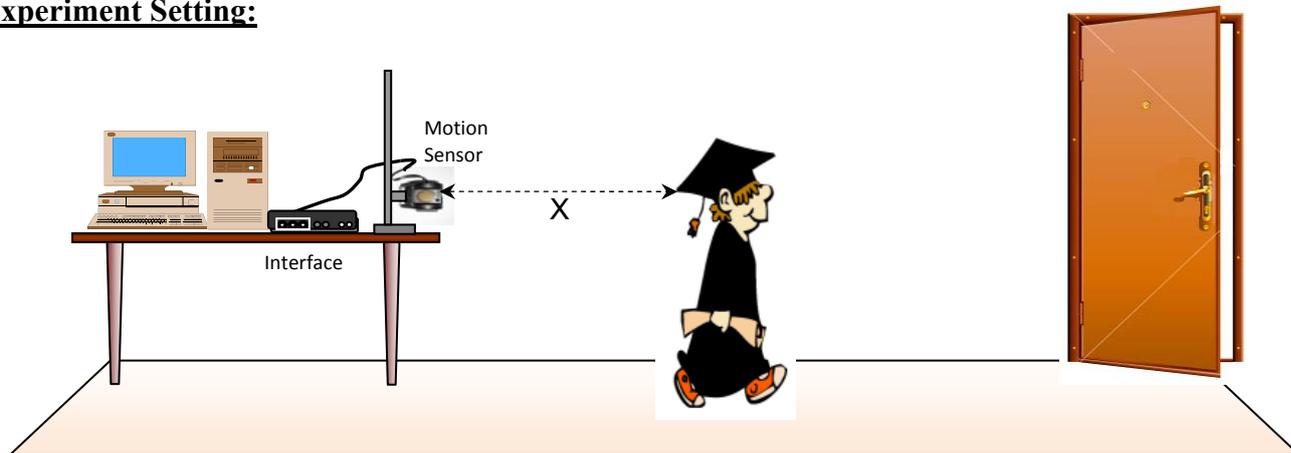


Motion and Graphs

ACTIVITY A:

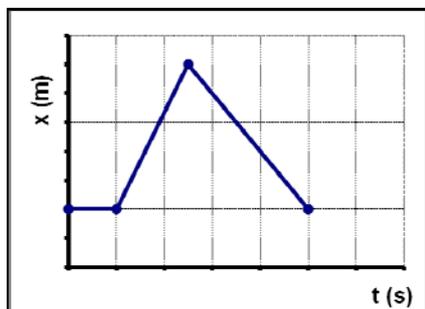
apparatus: Computer, Interface Pasco, Data Studio Software, Motion Sensor.

Experiment Setting:

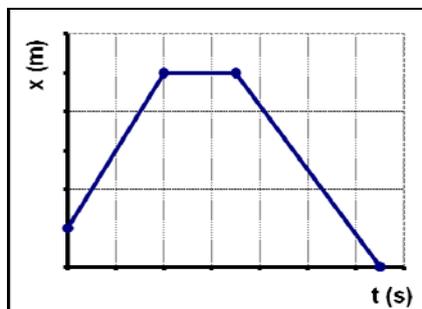


1. A student is standing in front of the motion detector at a distance x .
2. The motion detector is activated. The student remains motionless for a few seconds in front of the motion detector.
He then moves towards the door with constant velocity. He stops for a while in front of the door and then returns back to the motion detector.

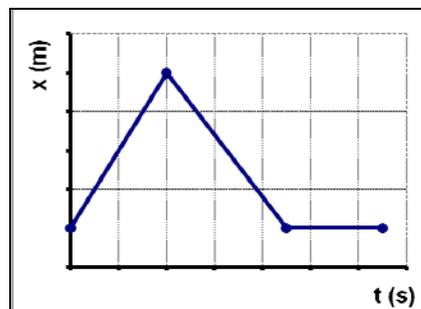
Which graph below, $x=f(t)$, illustrates the motion of the student.



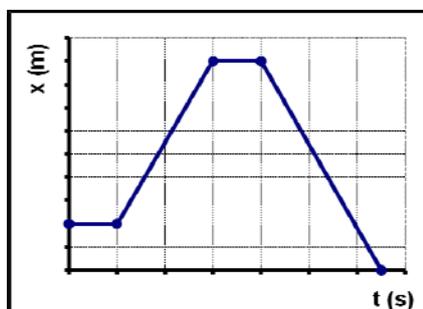
(A)



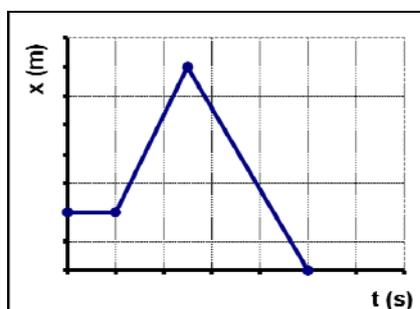
(B)



(Γ)



(Δ)



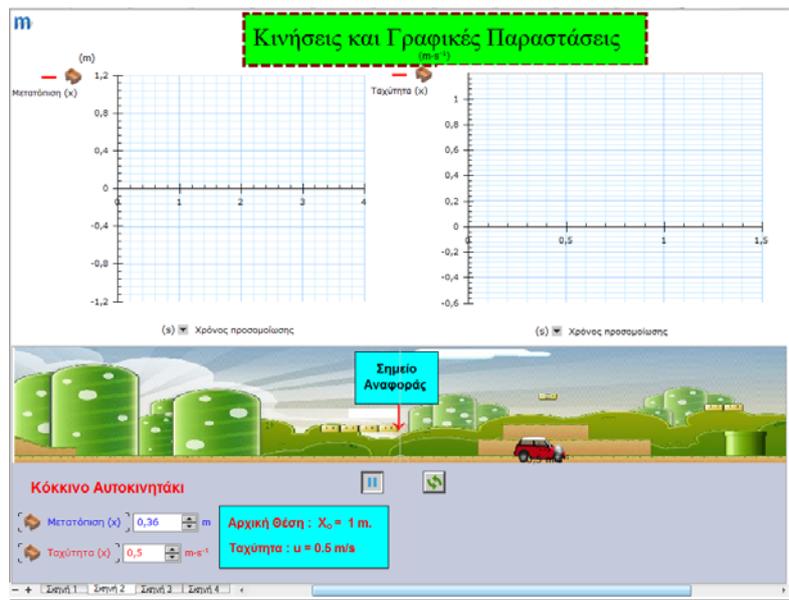
(E)

Is Graph A the wrong answer? Justify your answer.

ACTIVITY B:

apparatus: Computer, Crocodile Physics software (simulations).

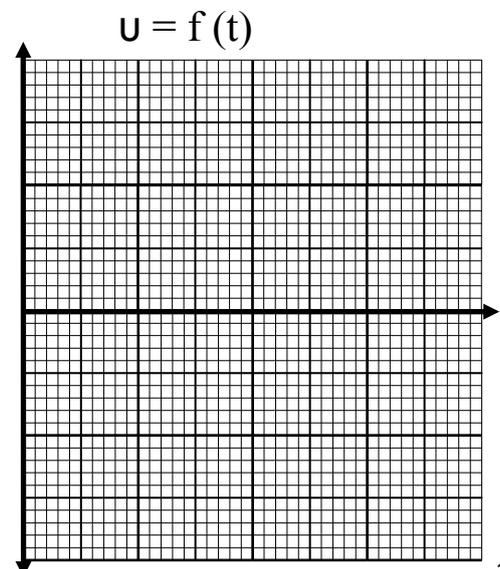
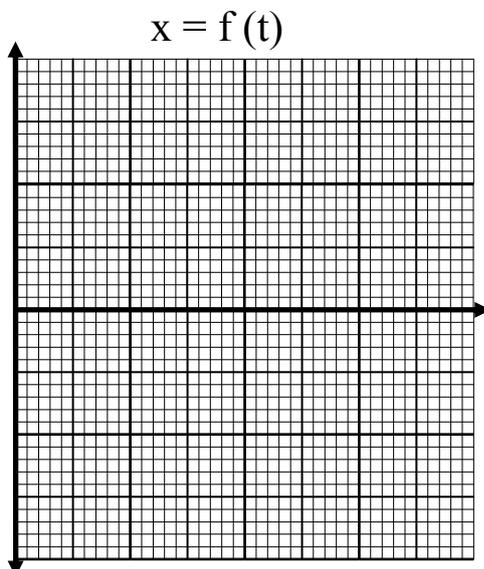
Simulation:



SCENE 1

1. Press button **Scene 1** which is located at the bottom left of the screen.
2. Set the simulation in such a way so that the red car is located at position $x = -1$ m and moves with a constant velocity $u = 0.5$ m/s.
3. Activate the simulation at **Scene 1** by pressing 
4. Observe the car's motion.
5. Stop the simulation when the car reaches position $x = 0.8$ m. 
6. What type of motion does the car perform? Justify your answer.

7. Draw the following graphs:
 - α. Distance x versus time t , $x = f(t)$.
 - β. Velocity u versus time, $u = f(t)$.



SCENE 2

1. Press button *Scene 2* which is located at the bottom left corner of the screen.
2. Set the simulation, in the same way you set it in the previous scene, so that the car is located at position $x = -1$ m and moves with a constant velocity $u = 0.5$ m/s.
3. Activate the simulation of *Scene 2* by pressing 
4. Observe the graphs that illustrate the type of motion performed by the car.
5. **Stop** the simulation when the little car reaches position $x = 0.8$ m. 
6. Compare the graphs you have drawn earlier with those produced by the simulation.
Are the graphs similar or different? In what way?

Comment on Graph $x = f(t)$: _____

Comment on graph $u = f(t)$: _____

7. What is the point of intersection of the line of the graph with the axis position (vertical axis); Does this point remind you of something?

8. Using the Graph of the Distance x versus Time t , $x = f(t)$, calculate the slope of the line.

9. Compare the slope of the line you have calculated in **step 7** to the velocity of the vehicle.

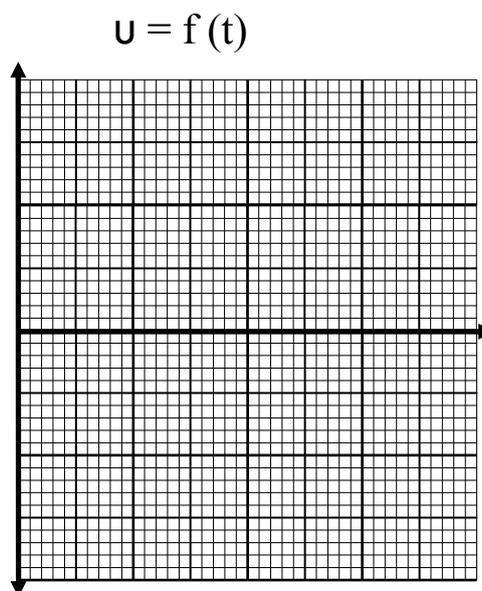
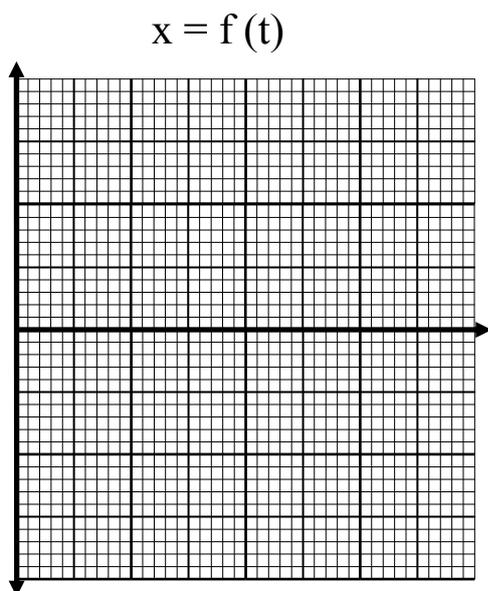
CONCLUSION:

At Graph _____ the slope is equal to the _____ of the vehicle.

ACTIVITY C:

SCENE 3

1. Press button *Scene 3* which is located at the bottom left corner of the screen.
2. Adjust the simulation in such a way so that:
 - a. The red car is located at position $x = -1$ m and moves with a constant velocity $u = 1.5$ m/s.
 - b. The yellow car is located at position $x = 1$ m and moves with a constant velocity $u = -0.5$ m/s.
3. Activate the simulation of *Scene 3* by pressing. 
4. Observe the type of motion performed by each car.
5. Stop the simulation **just before** the two cars hit each other. 
6. Draw on the same diagram below, for both cars, the following graphs:
 - a. Distance x versus Time t , $x = f(t)$.
 - b. Velocity u versus Time t , $u = f(t)$.



SCENE 4

1. Press button *Scene 4* which is located at the bottom left corner of the screen.
2. Adjust the simulation like you have done in the previous scene so that:
 - a. The red car is located at position $x = -1$ m and moves with a constant velocity $u = 1.5$ m/s.
 - b. The yellow car is located at position $x = 1$ m and moves with a constant velocity $u = -0.5$ m/s.
3. Activate the simulation of *Scene 4* by pressing 
4. Stop the simulation **just before** the two cars collide. 

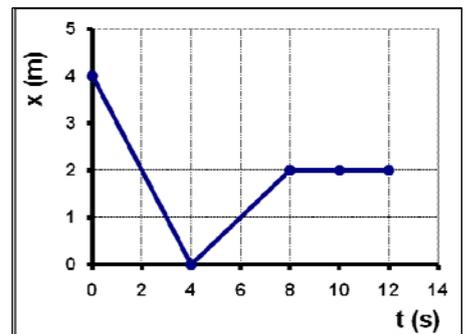
5. Compare the graphs you have drawn earlier with those produced by the simulation. Are the graphs similar or different? In what way?

Comment on Graph $x = f(t)$: _____

Comment on Graph $u = f(t)$: _____

ACTIVITY D: (Homework)

1. a. Describe in detail the motion of the student as it appears in the following graph.



- b. Using the graph above, calculate the velocity of the student during the following time intervals:

0-4s: _____

4s-8s: _____

8s-12s: _____

2. Which physical quantity does the area under the graph represent in the graphs of velocity versus time, $u = f(t)$?
