Lab 1: Distance, Velocity, Acceleration

Apparatus

- Motion detector
- Vernier LabQuest
- Logger Pro software
- Cart
- Basketball
- Foam Board
- Meter stick
- Colored pencils

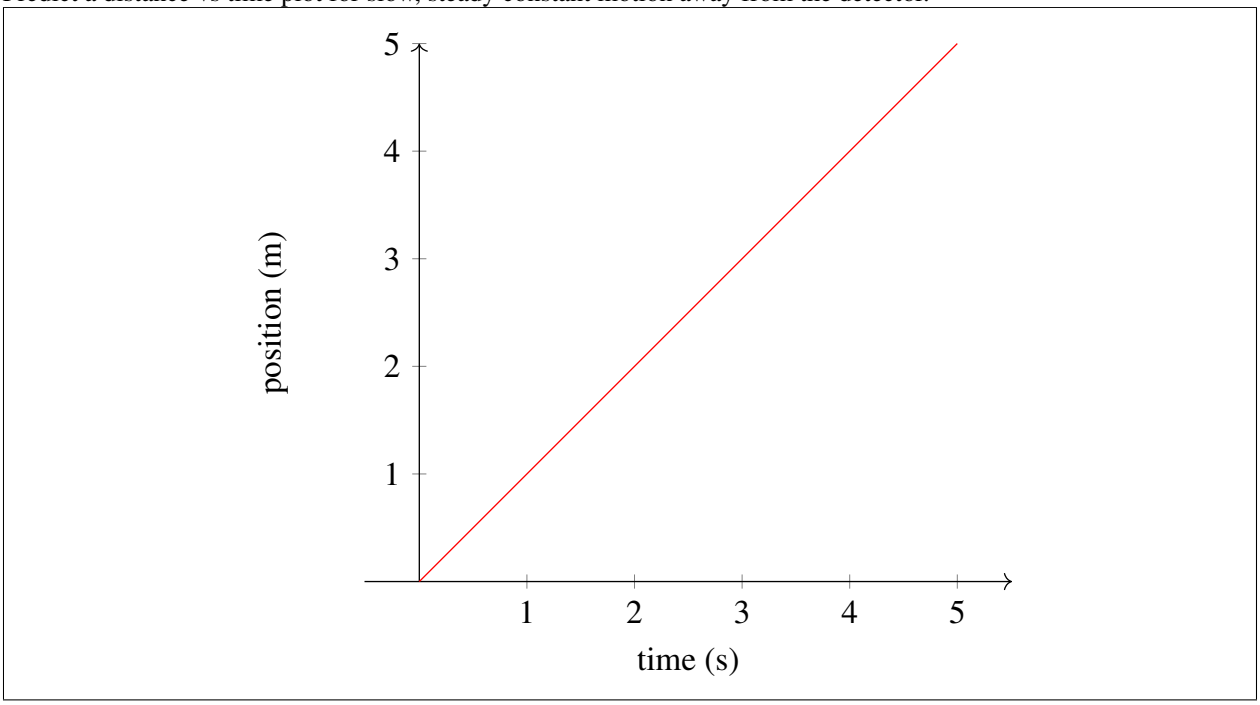
Objective

- Examine the relationship between distance, velocity and acceleration
- Attempt to duplicate given graphs with your own body's motion, or by moving a cart back and forth, quantitatively
- Consider what positive and negative values mean when applied to distance, velocity, and acceleration measurements

Part I: Distance vs Time

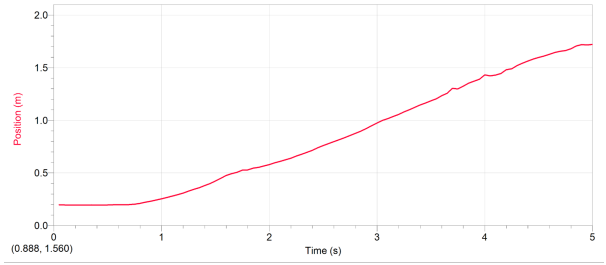
1.

Predict a distance vs time plot for slow, steady constant motion away from the detector.



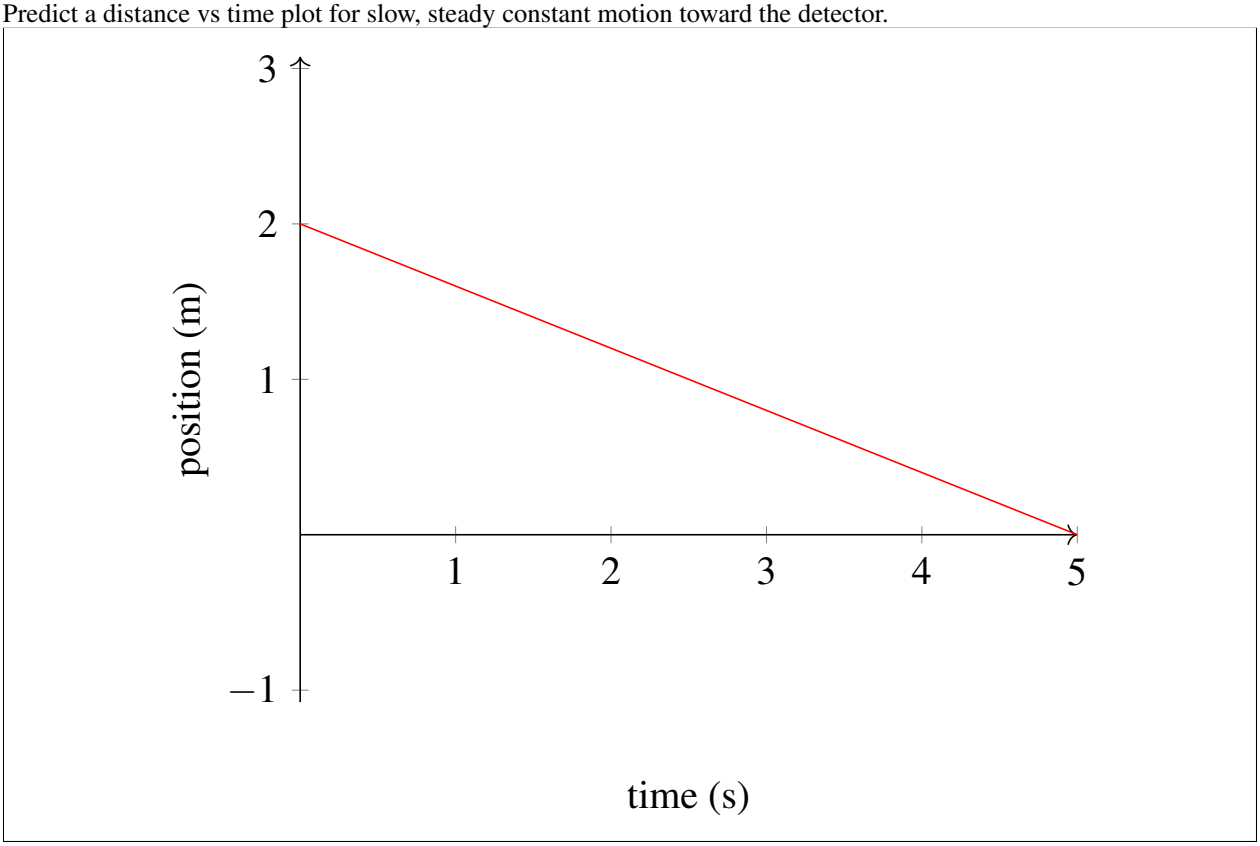
2.

Now test your prediction: Collect data for slow, steady motion away from the detector. When you click the "Collect" button (Logger Pro) it will collect and plot data for 10 seconds. Either walk back and forth with the foam board or move the cart back and forth in front of the motion detector.



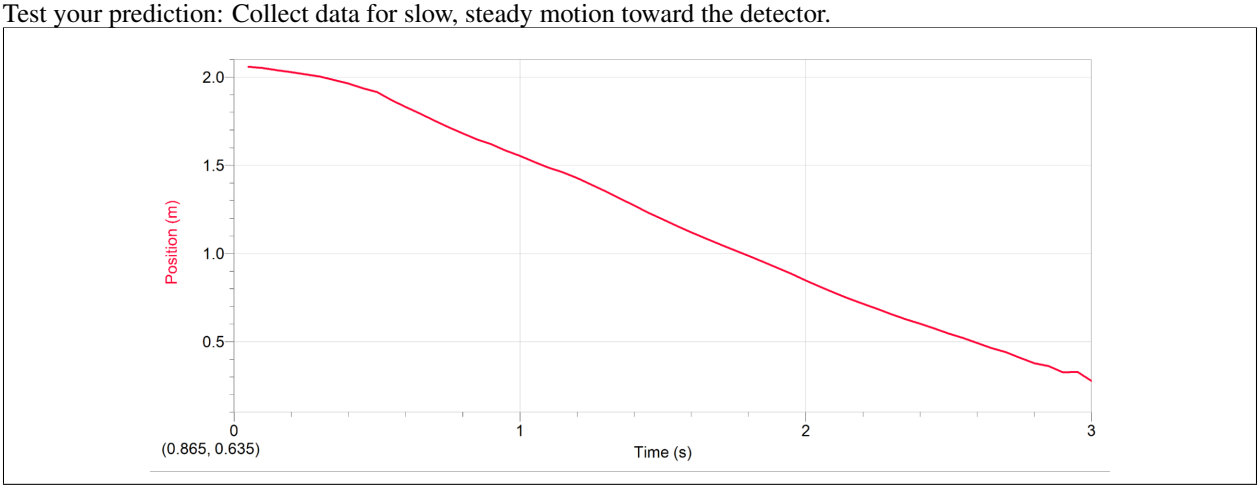
3.

Predict a distance vs time plot for slow, steady constant motion toward the detector.



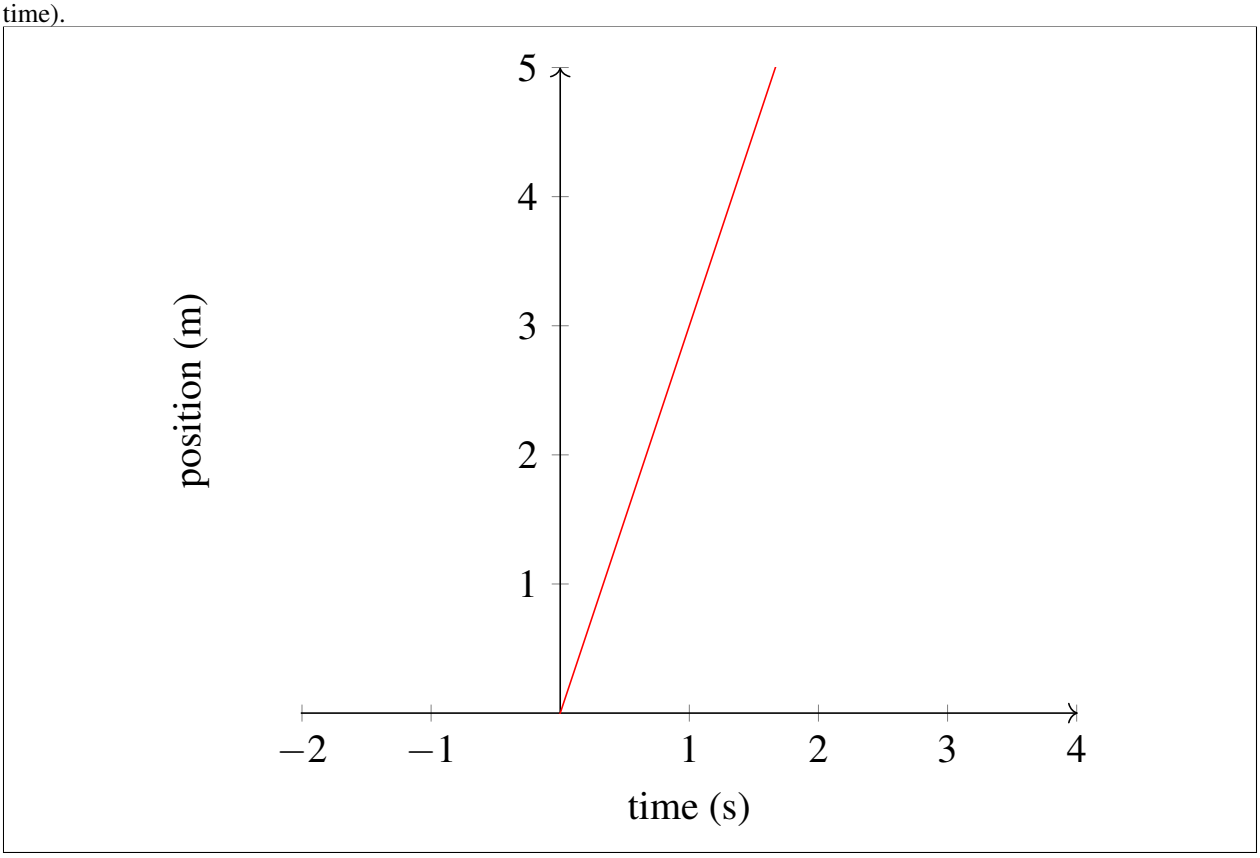
4.

Test your prediction: Collect data for slow, steady motion toward the detector.



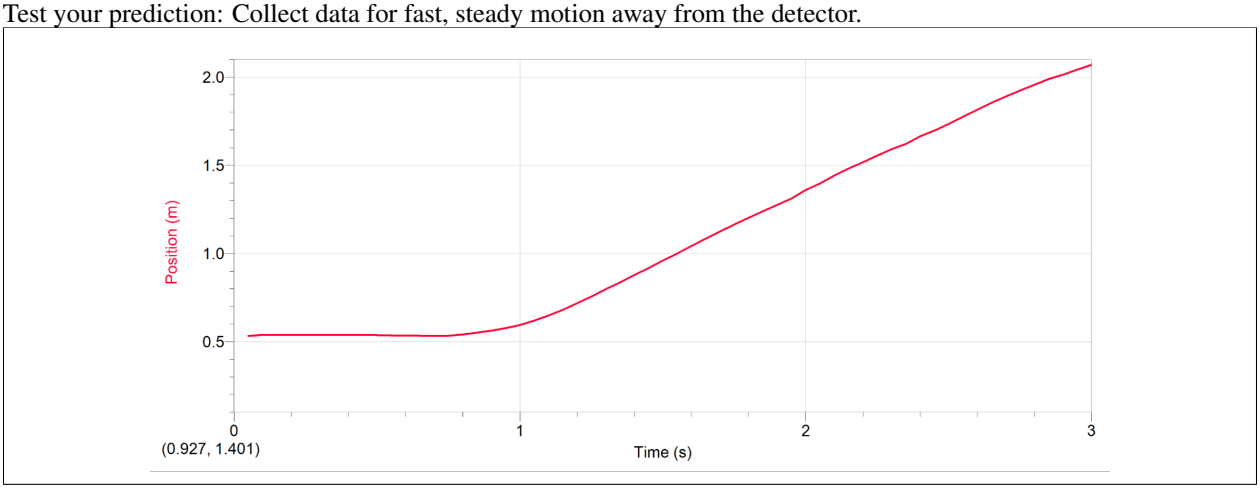
5.

Predict a distance vs. time plot for fast steady motion away from the detector (not speeding up, but faster than last time).



6.

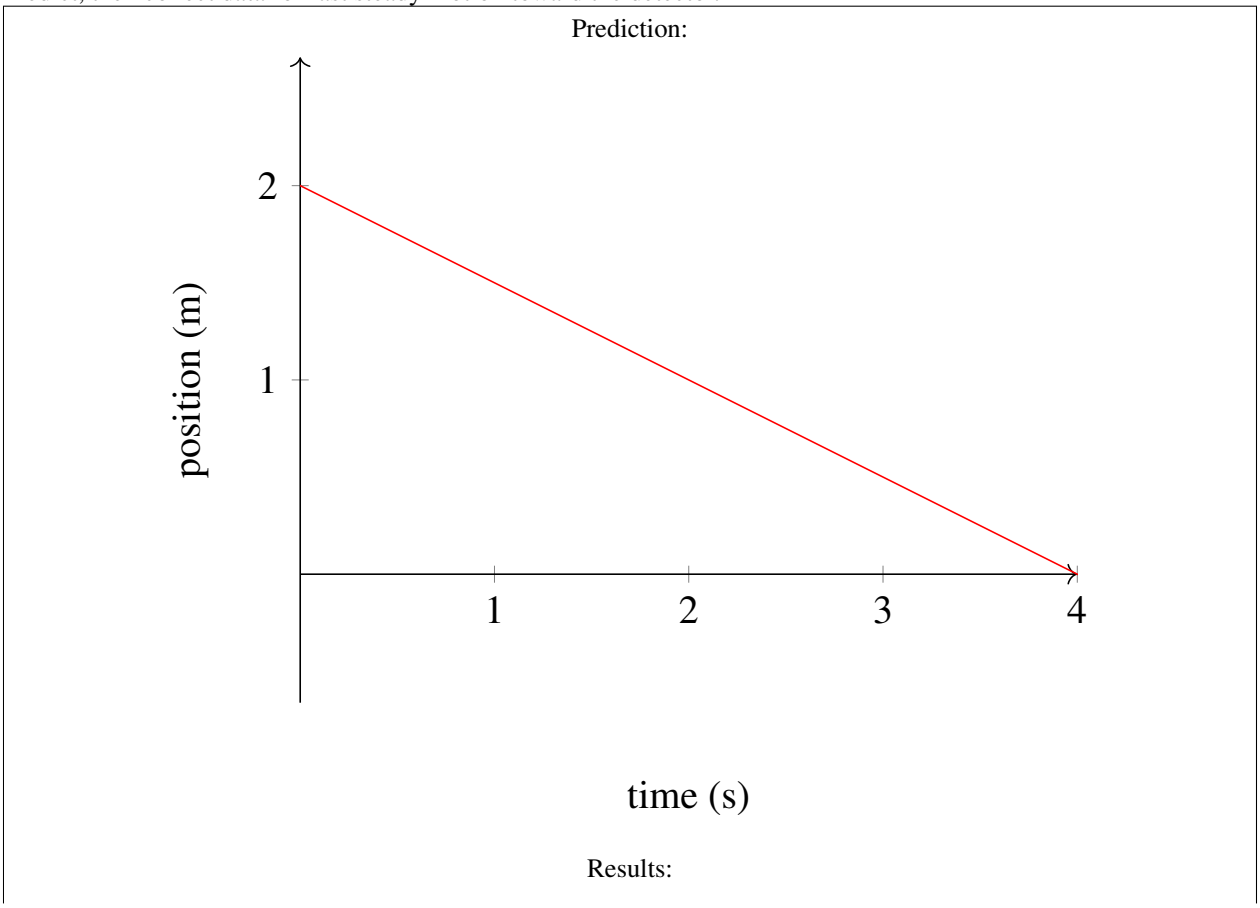
Test your prediction: Collect data for fast, steady motion away from the detector.



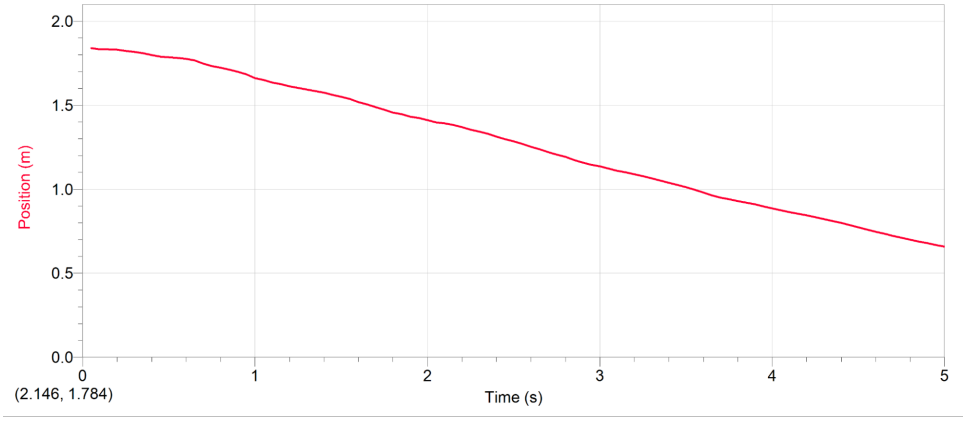
7,8.

Predict, then collect data for fast steady motion toward the detector.

Prediction:



Results:



9.

Summarize the results of your observations using words such as: moving towards, moving away, fast, slow, positive slope, negative slope, steep, less steep.

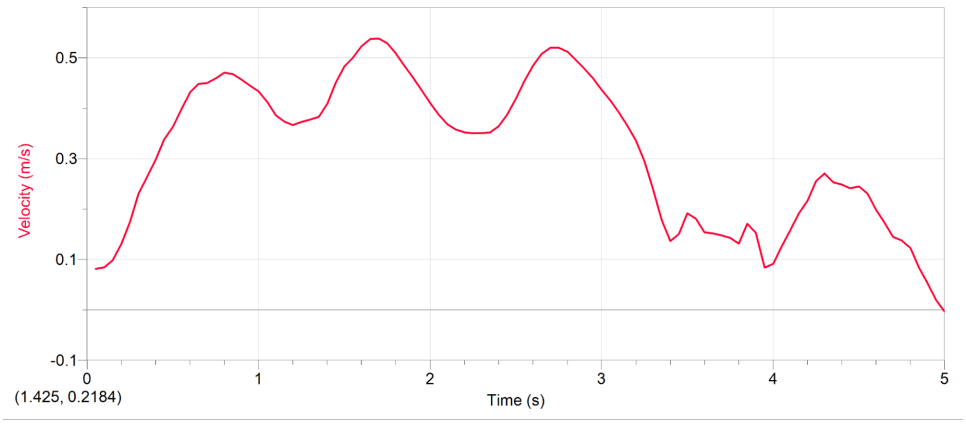
Part II

10.

Predict a velocity vs time plot for slow, steady constant motion away from the detector.

11.

Now test your prediction: Collect data for slow, steady motion away from the detector.

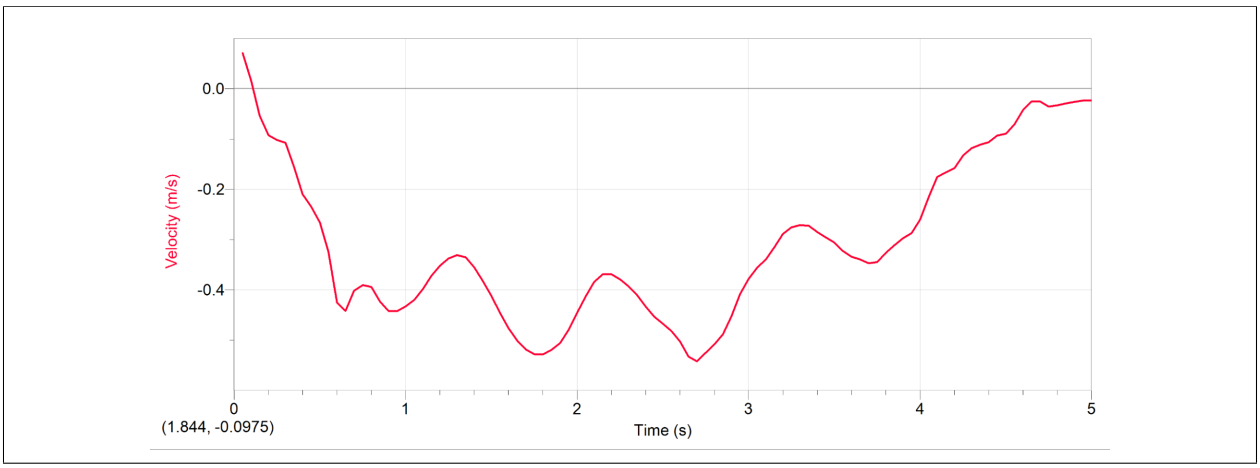


12.

Predict a velocity vs time plot for slow, steady constant motion toward from the detector.

13.

Now test your prediction: Collect data for slow, steady motion toward from the detector.

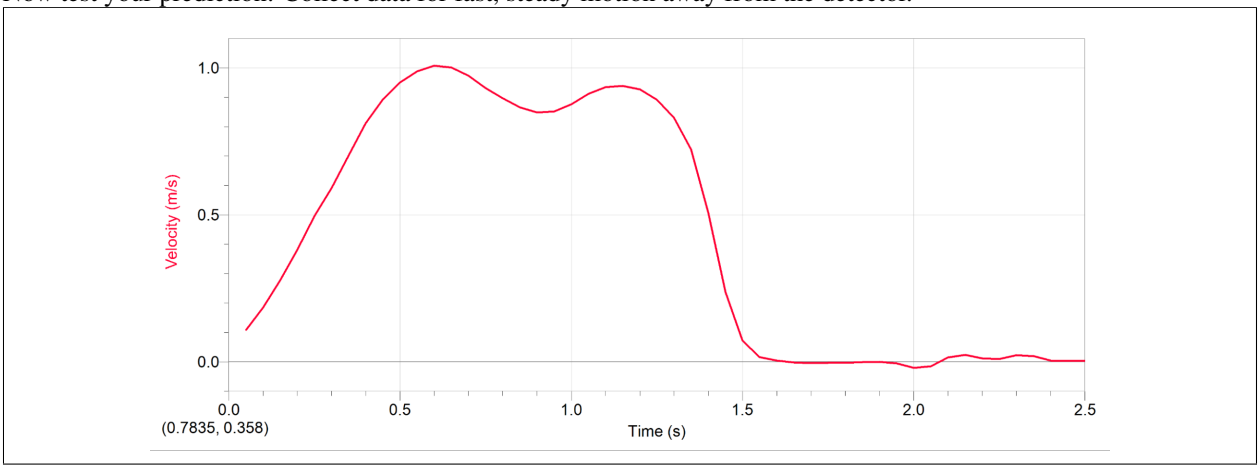


14.

Predict a velocity vs time plot for fast, steady constant motion away from the detector.

15.

Now test your prediction: Collect data for fast, steady motion away from the detector.

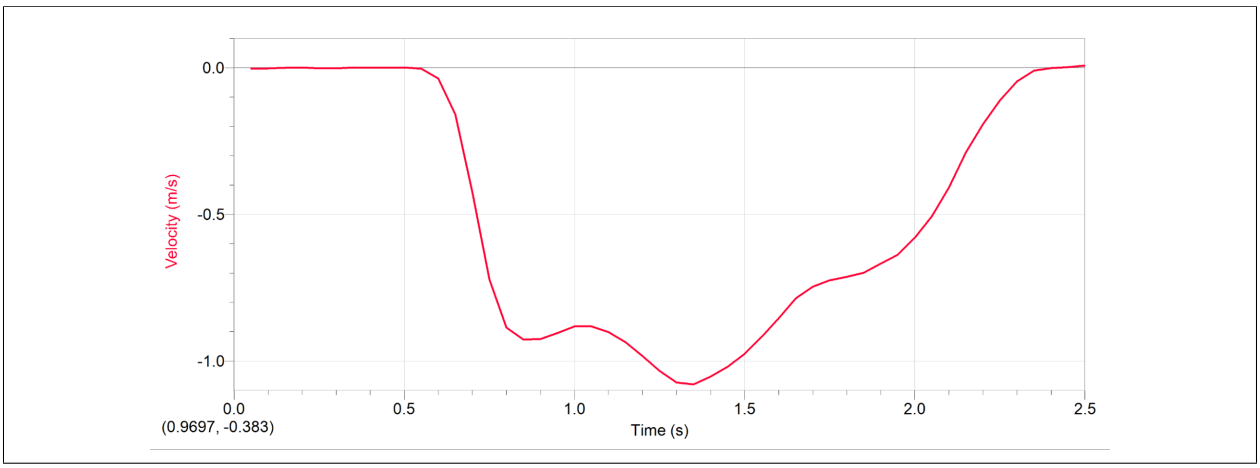


16.

Predict a velocity vs time plot for fast, steady constant motion away from the detector.

17.

Now test your prediction: Collect data for fast, steady motion away from the detector.

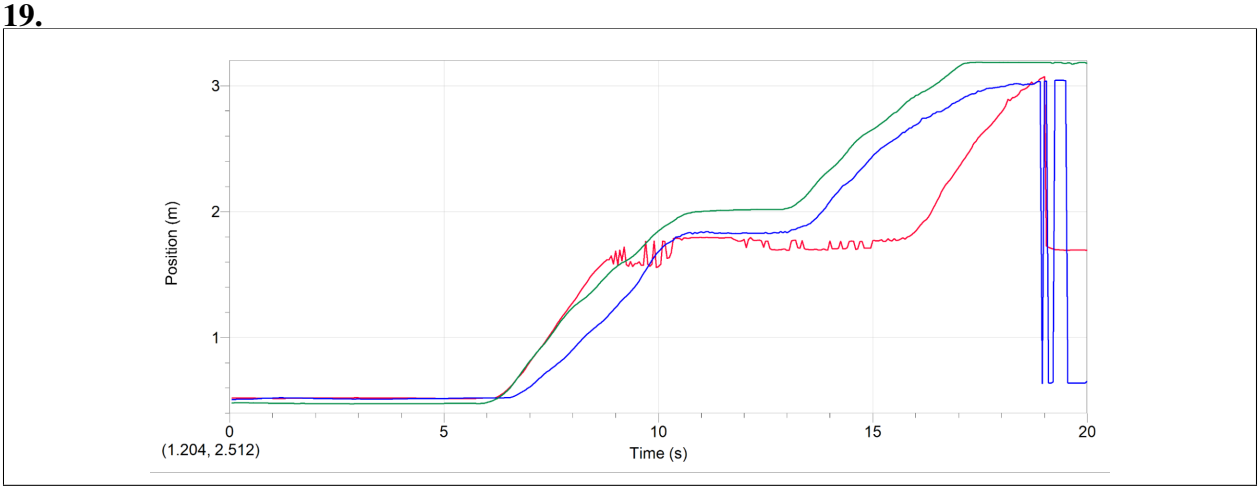


18.

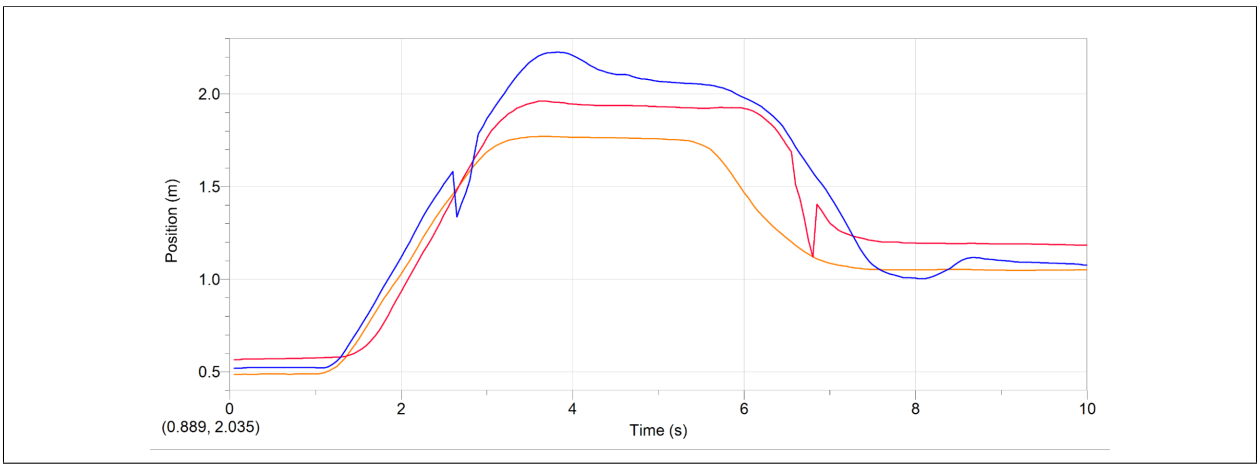
Summarize the results of your observations using words such as: moving towards, moving away, fast, slow, positive value, negative value, far from the time axis, close to the time axis.

Part III

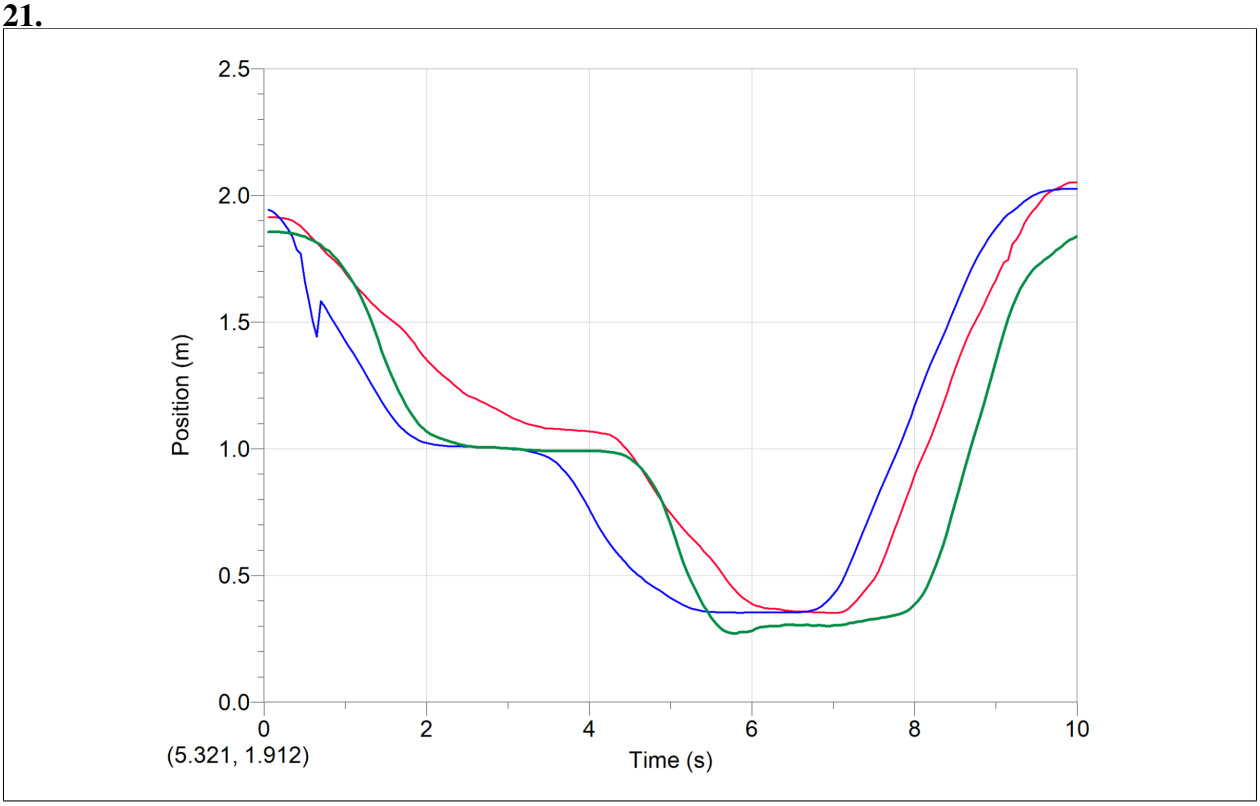
19.



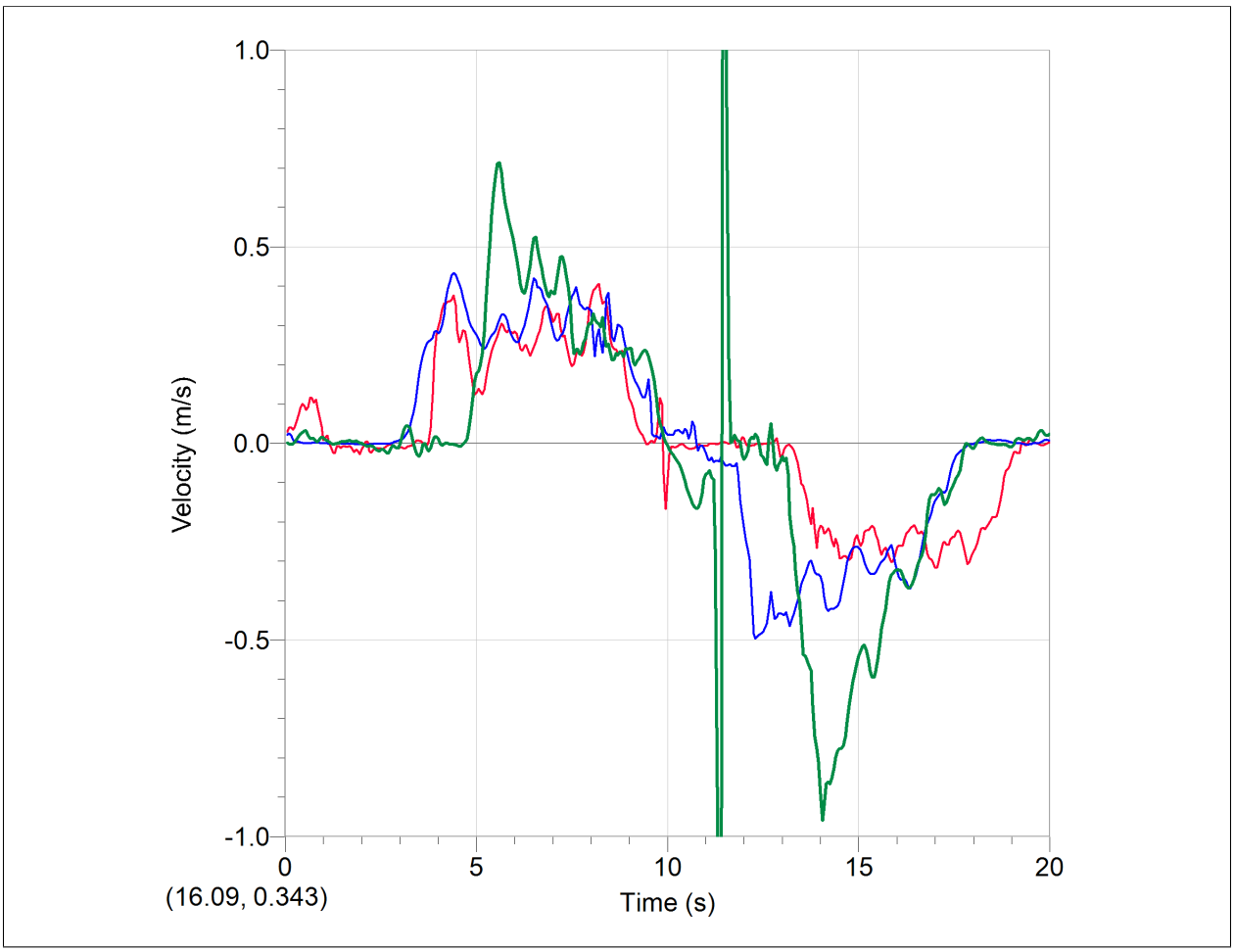
20.


Position (m)
2.0
1.5
1.0
0.5
0
2
4
6
8
10
(0.889, 2.035)
Time (s)

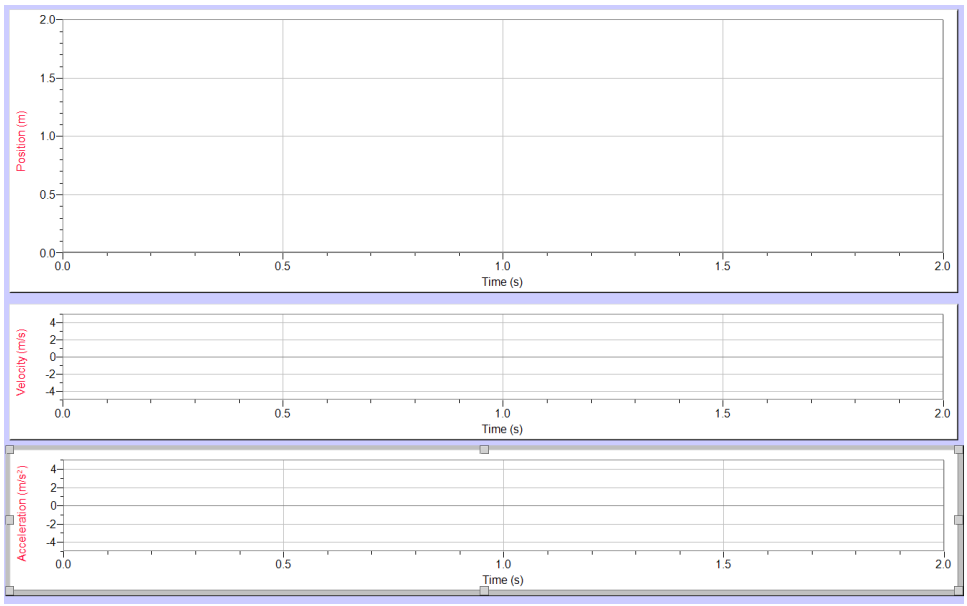
21.


Position (m)
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
(5.321, 1.912)
Time (s)

22.


1.0
0.5
0.0
-0.5
-1.0
Velocity (m/s)
0
5
10
15
20
(16.09, 0.343)
Time (s)

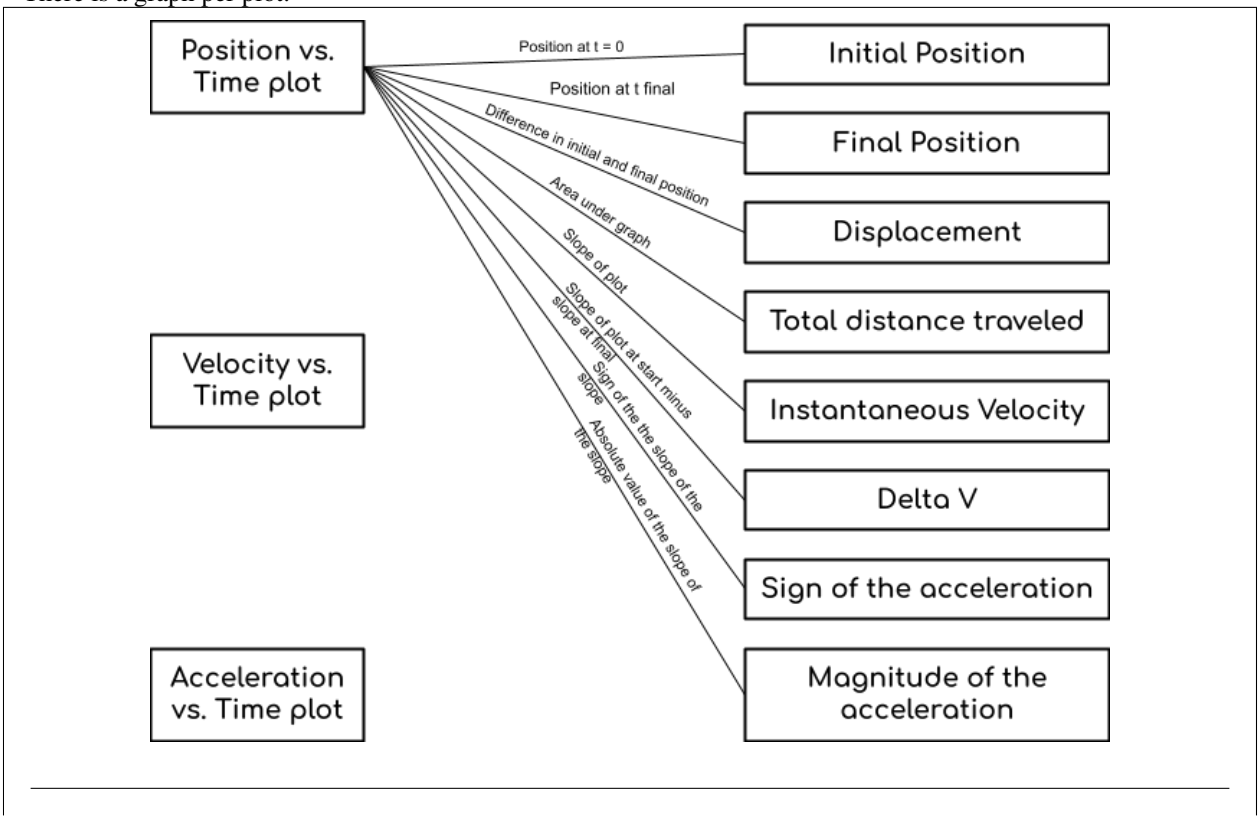
23.

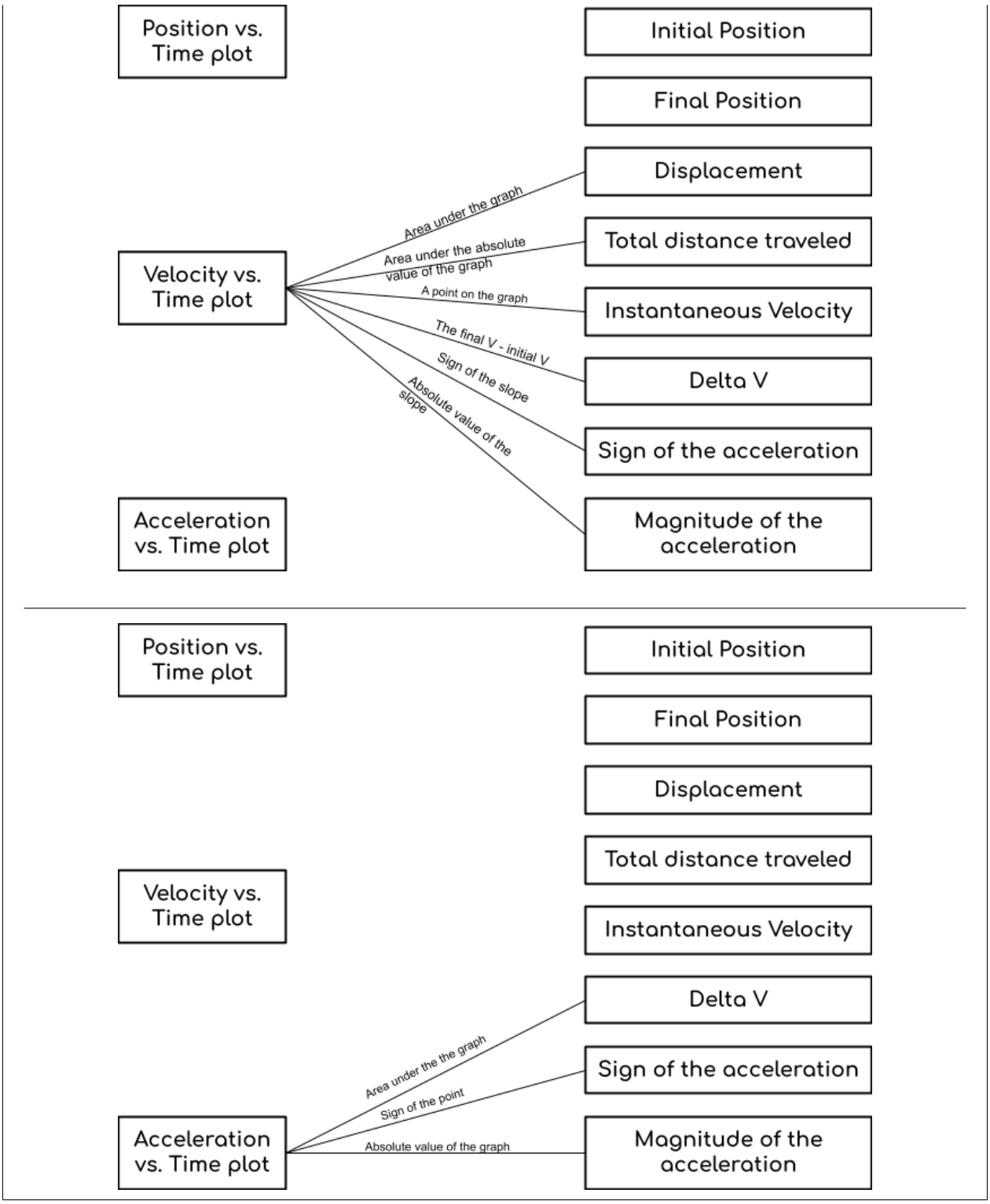

Position (m)
Time (s)
Velocity (m/s)
Time (s)
Acceleration (m/s²)
Time (s)

34.

What information can and can't be determined from a different plot? Please draw lines to match appropriately. To be thorough, you should write a few words on each line describing how one would obtain such information from that plot. For example, the initial position can be found from a position/time plot from something described as the "y-value", "vertical value", "height" or "value":

* There is a graph per plot.




Position vs. Time plot
Velocity vs. Time plot
Acceleration vs. Time plot
Initial Position
Final Position
Displacement
Total distance traveled
Instantaneous Velocity
Delta V
Sign of the acceleration
Magnitude of the acceleration
Area under the graph
Area under the absolute value of the graph
A point on the graph
The final V - initial V
Sign of the slope
Absolute value of the slope
Position vs. Time plot
Velocity vs. Time plot
Acceleration vs. Time plot
Initial Position
Final Position
Displacement
Total distance traveled
Instantaneous Velocity
Delta V
Sign of the acceleration
Magnitude of the acceleration
Area under the the graph
Sign of the point
Absolute value of the graph