

# Lab 1

## Motion diagrams

**Rectangle Repulsed Researchers**

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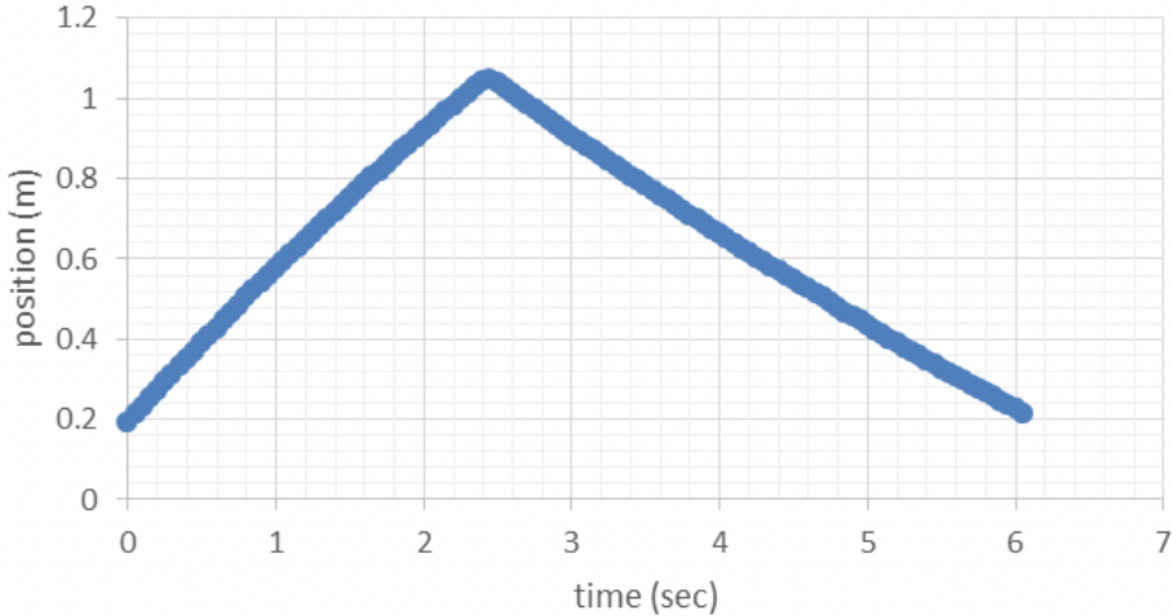
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### 3 Matching Position vs. Time and Velocity vs. Time Graphs

#### 3.1 Graph 1



##### 3.1.1 Graph analysis

Graph one describes the position vs. time graph of a collision. The graph itself directly depicts that the object's position from the sensor increases, then at  $t \approx 2.4s$  it's position begins decreasing. The derivative of a position vs. time graph gives the velocity. From the slope of the graph, one can conclude that the velocity over the interval  $t \in [0s, 2.4s)$  is constant and positive. Then from  $t \in (2.4s, 6s]$  the velocity becomes negative. With this information, one can deduce the object of interest was given an initial velocity and began moving in the positive direction, then it encountered a barricade and reversed direction, continuing the same magnitude of velocity.

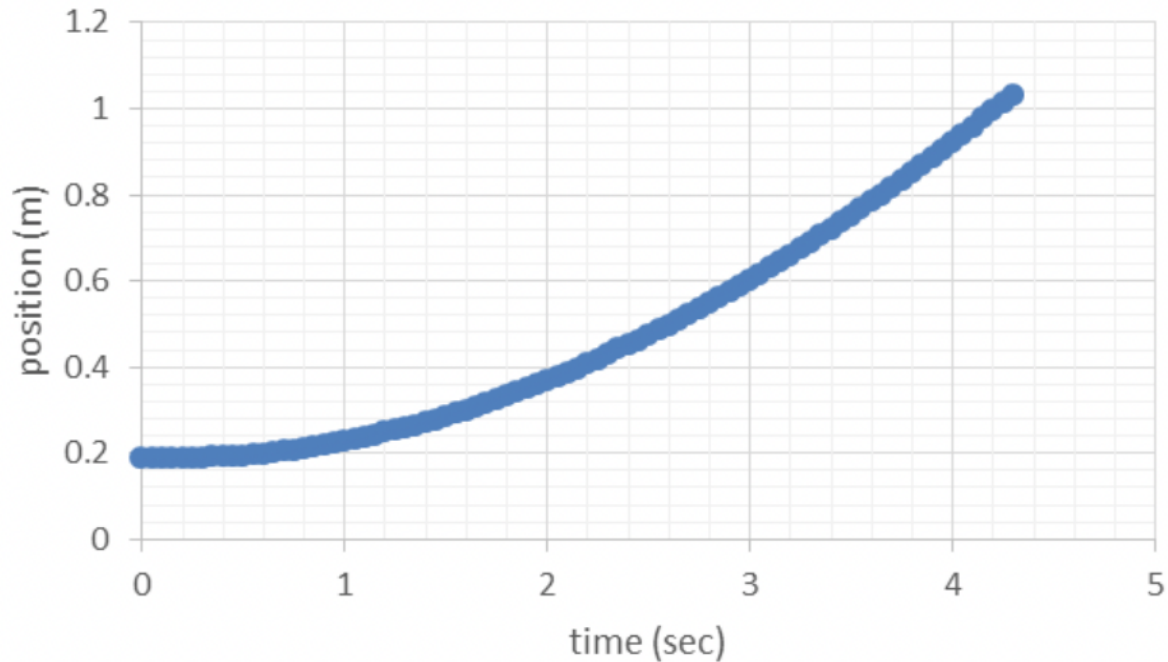
$$\forall t \in [0s, 2.4s); v(t) = \frac{d}{dt}[s(t)] \approx 0.35m/s$$

$$\forall t \in (2.4s, 6s]; v(t) = \frac{d}{dt}[s(t)] \approx -0.35m/s$$

##### 3.1.2 Setup

The equipment setup we choose to recreate Graph 1 consisted of a level track with a magnetic bumper mounted 60cm from the *PASCO Motion Sensor II*. We pushed and released the cart towards the bumper and used the *PASCO Universal 850 Interface* to track the motion using sonar. We consider friction and drag negligible.

### 3.2 Graph 2



Graph discription:

Graph 2 depicts an object speeding up at a constant rate. We know this because the object's position is increasing and the velocity is positive and increasing.

Setup:

Our setup consisted of a track at an downward incline. We released the cart from the top of the track and let it slide to the bottom. We consider friction and drag negligible.

Graph 3:

Graph discription:

Graph 3 depicts an object in freefall that hits the ground and stays there. We know this because the object's position starts from an increased height

Setup:

Our setup consisted of a the sensor positioned upward. We dropped a large beach ball.

Graph 4:

Graph discription:

Graph 4 depicts an object moving down an incline. It comes in contact with something at the bottom and changes direction. As it changes direction it slows down. Then at  $t = 2.6s$  its velocity becomes negaiive but the acceleration staus positive where it is slowing down

Setup:

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Our setup consisted of a the sensor positioned at the bottom of an incline plane. We released the cart from the top

Graph 5:

Graph description:

Graph 5 depicts an object that starts from rest then is pushed then slows to a stop. We know this because the graph depicts the initial velocity as 0m/s, then the velocity rapidly increases and the acceleration is positive. It the acceleration goes to zero and the velocity is constant

Setup:

Our setup consisted a flat plane and we pushed the cart away from the sensor

Graph 6:

Graph description:

Graph 6 depicts an object which is pushed and released up a hill. Eventually gravity slows it down and it returns down the hill

Setup:

Our setup consisted of a incline plane. We gave the cart a push and let it go up the hill then return down

Graph 6:

Graph description:

Graph 6 depicts an object moving up and slowing on a spring.

Setup:

Our setup consisted of an downward incline. The bumper was positioned 60cm away from the sensor.