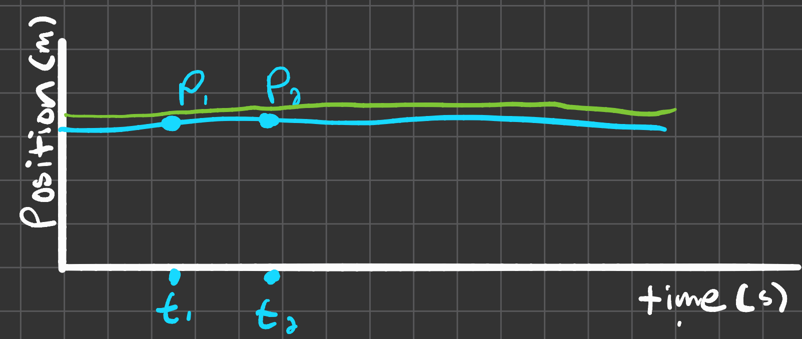
1D Motion

Position and Velocity

Position vs. Time

Standing Still in front of motion detector

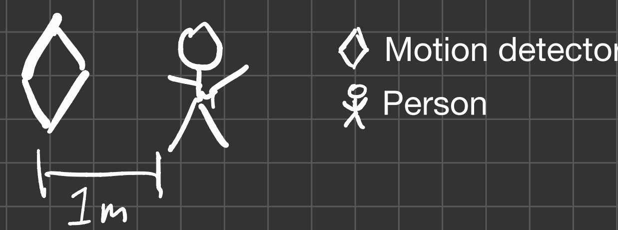
"Predict what a position vs. time graph would look like if you are standing still about 1 m in front of the motion detector."



Prethinking

I predicted that...

Since I started 1m in front of motion detector, the position would start at m > 0



Because I was standing still at 1m away, my position would not change over time

The slope of the position vs. time function would be 0 since the position isn't changing over time

Given $P_1 = P_2$, and velocity $= \frac{\Delta p}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{0}{t_2 - t_2} = 0$

Results

When the experiment was run...

The rate of change was constant, meaning the position didn't change over time

The slope of the was function 0, because the position didn't change over time

The initial position was slightly different than the graph of my prediction, because where I started was inconsistent with my prediction.

Discussion

I realized that....

Personal Being 1m away from detector, the slope would be positive as my position is +1m away.

When standing still, my movement is nothing and therefore constant.

Group Because my movement is nothing, the rate of position vs. time would be zero.

Class Our class realized that...

The line on the position vs. time graph wouldn't be p=0, because we are not at the location of the detector, but in front of it.

Conclusion

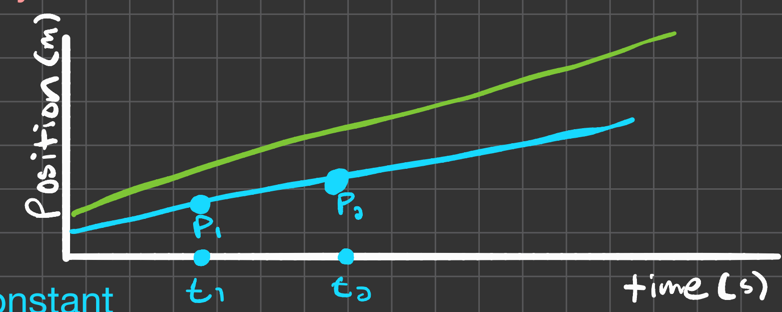
Overall, when an object isn't moving the slope of the position vs. time graph is zero. Regarding the position of the object, when an object is positioned in front of the observation point, the graph regarding the objects position cannot be at the observation point. This concept is important because it describes the situation of lack of motion and how this affects the position vs. time graph of an object. When comparing the slopes of the P vs T graph and V vs T graph regarding a steadily moving object, the P vs. T graph's slope will have a magnitude > 0. For V vs. T, the slope will have a magnitude = 0. The graph produced from the experiment closely matched the graph of my prediction. Since the only discrepancies were the inconsistency in the positive position, I was confident in the evidence validating my reasoning.

The major misconception one needs to look out for is that the position starts in front of the motion detector not at it, so the graph has to start at P>0.
My confidence about this content is 5/5
I have no further questions

Senario 2: slowly & steadily walking away from detecto

"Predict what a position vs time graph would look like if you started close to the motion detector and walked slowly and steadily from the motion detector."

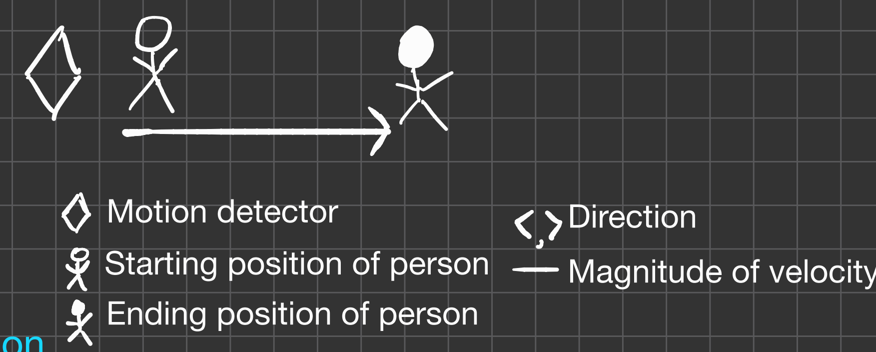
Prethinking



I predicted that…

Moving steadily, the rate of change would be constant

Since I started close to the motion detector, the position would start at m > 0



Walking away and therefore increasing position, the slope of the position vs. time function would be positive.

Walking slowly and steadily away from the motion detector, the slope of the function would incline slightly.

Given $P_2 > P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{+P}{+t} = +$ velocity

Results

When the experiment was run…

The rate of change was constant

The slope of the function was positive, because as time passed while we moved away from detector, the position increased

The initial position was slightly different from the graph of my prediction, because where I started was inconsistent with my prediction.

The slope was slightly different from the graph of my prediction, because how I moved was inconsistent with my prediction.

The slope of the function was closer to 0, meaning that its incline was relatively smaller.

Discussion

Personal I realized that…

When moving steadily, the ratio of the position vs. time would be the same at any point.

Group Since I was walking faster away from the detector than I anticipated, my graph didn't perfectly match that of the experiment.

Class Communicating about slope in terms of how much inclined and declined, is useful in describing the magnitude of the velocity

Conclusion

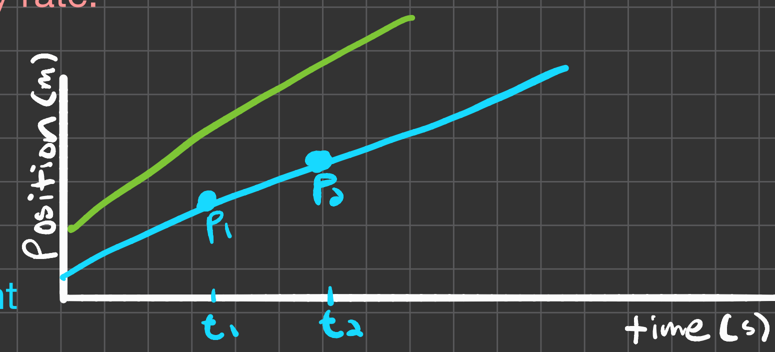
Overall, when moving slowly and steadily away from the detector, the slope of the function is positive due to the position to detector increasing over time. When moving slowly, the slope of P vs. T function is less steep. This concept matters because it describes to us how increasing position affects the ratio of the P vs. T function. Specifically, increasing position makes the ratio positive. Also, the faster the position increases over time the more positive the ratio is. When comparing the slopes of the P vs T graph and V vs T graph regarding a object with increasing position over time, the P vs. T graph's slope will have a magnitude > 0. For V vs. T, the slope will have a magnitude = 0. The graph produced from the experiment closely matched the graph of my prediction. Since the only discrepancies were in the inconsistency of starting position and a slight difference between slopes, I was confident In the evidence validating my reasoning.

The major misconception is associating the word away with negative and therefore decreasing slope. It's important to model the situation explicitly and not take word choice for direct meaning.
My confidence about this content is 5/5
I have no further questions

Senario 3: Fastly & steadily walking away from detector

"Predict what a position vs. time graph will look like if you start near the motion detector and walked away from the motion detector at a fast steady rate."

Prethinking

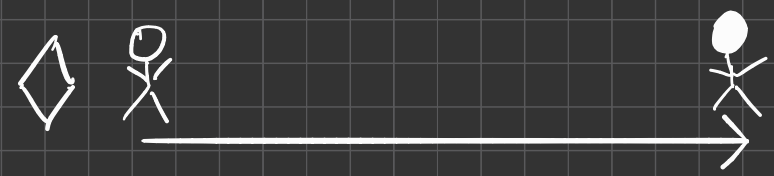


I predicted that…

Moving steadily, the rate of change would be constant

Being close to the motion detector, the position would start at m > 0

Walking away from detector, the slope of the position vs. time function would be positive.



Walking fastly and steadily away from the motion detector, the slope of the function would incline faster than slower.

◇ Motion detector
Starting position of person
Ending position of person

Direction
— Magnitude of velocity

Given $P_2 > P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{+P}{+t} = +\text{velocity}$

Results

When the experiment was run…

The rate of change was constant

The slope of the function was positive, because as time passed while we moved away, the position to detector increased

The initial position was slightly different from the graph of my prediction, because where I started was inconsistent with my prediction.

The slope was slightly different from the graph of my prediction, because how I moved was inconsistent with my prediction.

The slope of the function was larger, meaning that its incline was larger than the slow-moving graph.

Discussion

Personal

My prediction and the experiment graphs are the same type of function. It's just that the slope when steadily walking fast compared to walking slow is quicker

Group

Moving steadily means that for every point on the function, the P vs. T ratio is the same

Class

The slope of the this graph inclined more than traveling slower.

Conclusion

Overall, when moving fastly and steadily away from the detector, the slope of the function is positive due to the position to detector increasing over time. When moving fastly, the slope of P vs. T function is more steep. This concept matters because it describes to us how increasing position affects the ratio of the P vs. T function. Specifically, increasing position makes the ratio positive. Also, the faster the position increases over time the more positive the ratio is. When comparing the slopes of the P vs T graph and V vs T graph regarding a object with increasing position over time, the P vs. T graph's slope will have a magnitude > 0. For the V vs. T graph, the slope will have a magnitude = 0. The graph produced from the experiment closely matched the graph of my prediction. Since the only discrepancies were in the inconsistency of starting position and a slight difference between slopes, I was confident In the evidence validating my reasoning.

The major misconception is associating the word away with negative and therefore decreasing slope. It's important to model the situation explicitly and not take word choice for direct meaning.

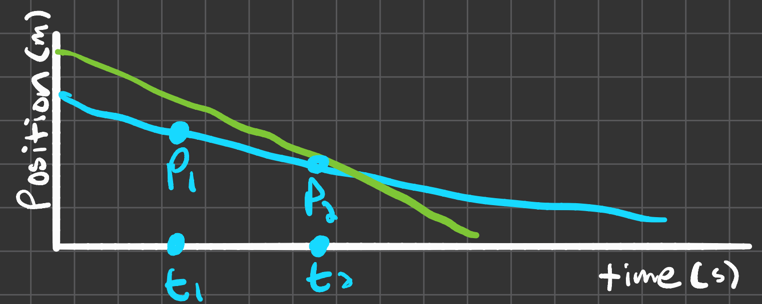
My confidence about this content is 5/5

I have no further questions

Senario 4: slowly & steadily walking toward detector

"Predict what a position vs. time graph would look like if you started away from the motion detector and walked slowly and steadily towards the motion detector."

Prethinking



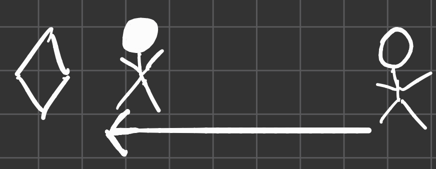
I predicted that…

Moving steadily, the rate of change would be constant

Being farther from the motion detector, the position would start at m > initial position of walking away from motion detector

Walking towards the detector, the slope of the position vs. time function would be negative

Walking slowly and steadily towards the motion detector, the slope of the function would decline slower than faster



Motion detector
Starting position of person
Ending position of person
Direction
— Magnitude of velocity

Given $P_2 < P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{-P}{t} = -$ velocity

Results

When the experiment was run…

The rate of change was constant

The slope of the function was negative, because as time passed while we moved toward the detector, the position to detector decreased

The initial position was slightly different from the graph of my prediction, because where I started was inconsistent with my prediction.

The slope was slightly different from the graph of my prediction, because how I moved was inconsistent with my prediction.
The slope of the function was closer to 0, meaning that its incline was relatively smaller.

Discussion

Personal When moving towards detector, my position decreases over time, because I'm getting closer.

Group My graphs are different with regard to starting position and slope. These are inevitably inconsistent with my predictions because I can't control my movement very precisely.

Class The slope of the this graph declined less than traveling faster.

Conclusion

Overall, when moving slowly and steadily towards the detector, the slope of the function is negative due to the position to detector decreasing over time. When moving slowly, the slope of P vs. T function is less steep. This concept matters because it describes to us how decreasing position affects the ratio of the P vs. T function. Specifically, decreasing position makes the ratio negative. Also, the slower the position decreases over time the less negative the ratio is. When comparing the slopes of the P vs T graph and V vs T graph regarding a object with decreasing position over time, the P vs. T graph's slope will have a magnitude < 0. For the V vs. T graph, the slope will have a magnitude = 0. The graph produced from the experiment closely matched the graph of my prediction. Since the only discrepancies were in the inconsistency of starting position and a slight difference between slopes, I was confident In the evidence validating my reasoning.

The major misconception is associating the word toward with positive and therefore increasing slope. It's important to model the situation explicitly and not take word choice for direct meaning.
My confidence about this content is 5/5
I have no further questions

Senario 5: Fastly & steadily walking toward detector

"Predict what a position vs. time graph would look like if you start away from the motion detector and walked towards the motion detector at a fast steady rate."

Prethinking

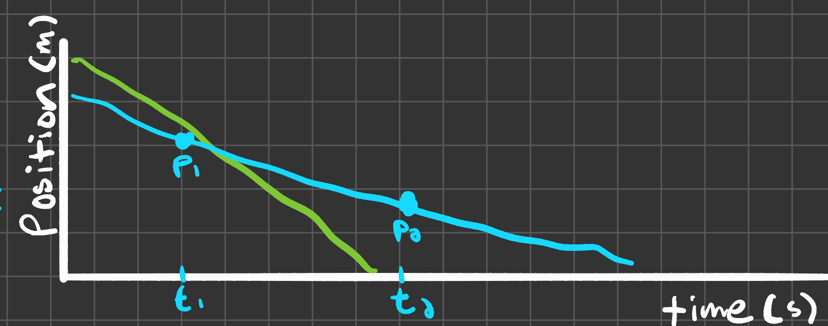
I predicted that…

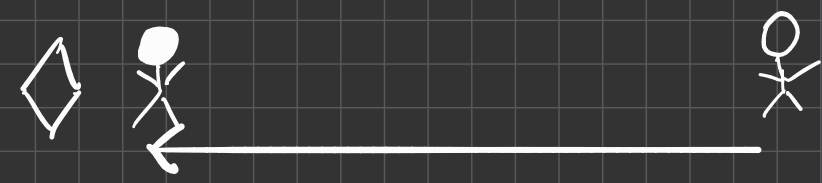
Moving steadily, the rate of change would be constant

Being farther from the motion detector, the position would start at m > initial position of walking away from motion detector

Walking towards the detector, the slope of the position vs. time function would be negative

Walking fastly and steadily towards the motion detector, the slope of the function would decline faster than slower





Motion detector

Starting position of person

Ending position of person

Direction

Magnitude of velocity

Given $P_2 < P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{-P}{t} = -$velocity

Results

When the experiment was run…

The rate of change was constant

The slope of the function was negative, because as time passed while we moved toward the detector, the position to detector decreased

The initial position was slightly different from the graph of my prediction, because where I started was inconsistent with my prediction.

The slope was slightly different from the graph of my prediction, because how I moved was inconsistent with my prediction.

The slope of the function was larger, meaning that its incline was larger than the slow-moving graph.

Discussion

Personal The bigger difference in my prediction graph and the experiment 's graph is the slope. How I moved was different.

Group I moved more fast in the actual experiment than what my predictions showed

Class The slope of the this graph declined more than traveling slower.

Conclusion

Overall, when moving fastly and steadily towards the detector, the slope of the function is negative due to the position to detector decreasing over time. When moving fastly, the slope of P vs. T function is more steep. This concept matters because it describes to us how decreasing position affects the ratio of the P vs. T function. Specifically, decreasing position makes the ratio negative. Also, the faster the position decreases over time the more negative the ratio is. When comparing the slopes of the P vs T graph and V vs T graph regarding a object with decreasing position over time, the P vs. T graph's slope will have a magnitude < 0. For the V vs. T graph, the slope will have a magnitude = 0. The graph produced from the experiment closely matched the graph of my prediction. Since the only discrepancies were in the inconsistency of starting position and a slight difference between slopes, I was confident In the evidence validating my reasoning.

The major misconception is associating the word toward with positive and therefore increasing slope. It's important to model the situation explicitly and not take word choice for direct meaning.

My confidence about this content is 5/5

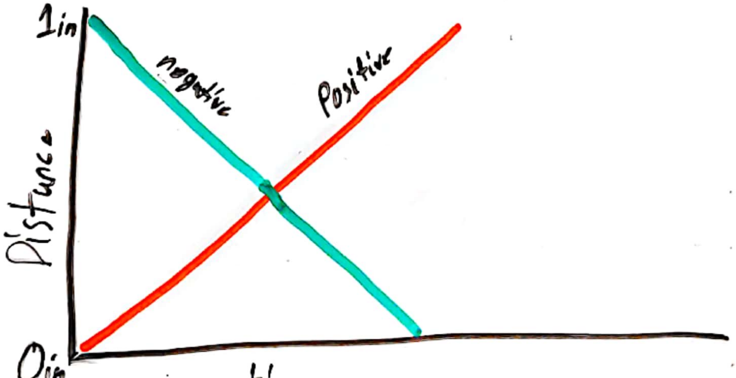
I have no further questions

Results: position vs. time graph

- When Slope is – the starting position is further away.

- When Slope is + the starting position is closer.

Diagram



Conclusion

if the Slope on the graph is positive your walking away or if negative your walking forwards/closer

Velocity vs. Time

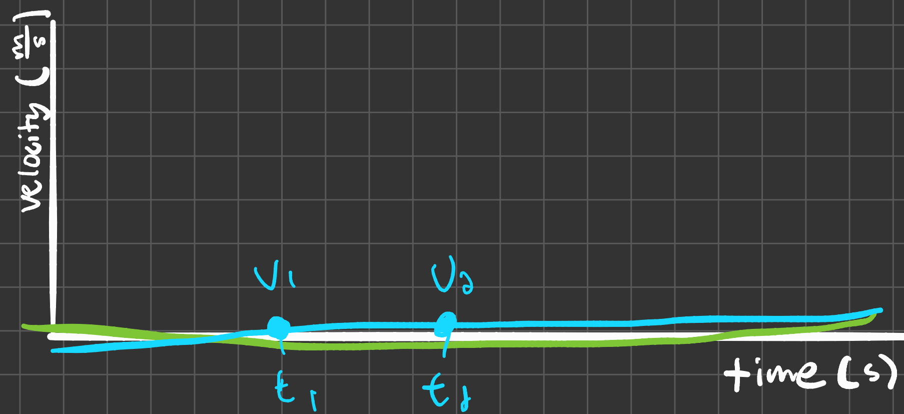
Standing Still in front of motion detector

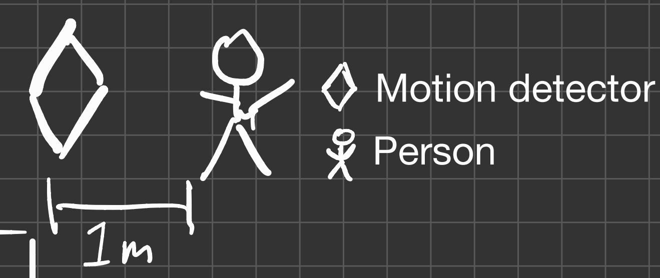
"Predict what a velocity vs. time graph would look like if you are standing still about 1 m in front of the motion detector."

Prethinking

I predicted that...

Not moving, my velocity would remain constant and not change over time.





Standing 1m in front of motion detector, the slope of the velocity vs. time function would be 0

Given $V_1 = V_2$, and velocity $= \frac{\Delta v}{\Delta t}$, then: $\frac{v_2 - v_1}{t_2 - t_1} = \frac{0}{t_2 - t_2} = 0$

Results

When the experiment was run...

The rate of change was constant, meaning the velocity didn't change over time

Standing still, the velocity was 0 since I didn't change position.

Conclusion

Overall, when an object isn't moving the slope of the velocity vs time graph is 0 and the velocity = 0. The initial position of an object isn't relevant when creating velocity vs time graphs. This concept is important because it describes the situation of lack of motion and how this affects the velocity vs time graph of a moving object. When comparing the slopes of the V vs. T graph of a moving object and V vs. T graph of a still object, the slopes are the same and the velocities are different. The slopes both = 0 and for the still object, the velocity = 0, and for the moving object the velocity $<$ or $>$ 0. The graph produced from the experiment almost exactly matched my prediction graph, giving me confidence in the evidence validating my prediction.

The major misconception is that the velocity would be a positive value, and the slope would be 0. This means that one is thinking in terms of a position vs. time graph and not a velocity vs. time graph. Furthermore, if the object is still, the velocity is zero.
My confidence about this content is 5/5
I have no further questions

Discussion

Personal

Standing still and not moving, my velocity started and remained at 0

Group

Velocity isn't directly related to starting position

Class

The velocity will start at zero and remain at zero, and wouldn't be a positive value. If a classmate predicted a positive value, they are confusing position vs. time graphs and velocity vs time graphs.

Senario 2: slowly & steadily walking away from detector

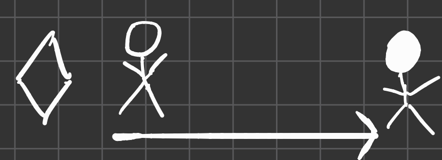
"Predict what a velocity vs time graph would look like if you started close to the motion detector and walked slowly and steadily from the motion detector."

Prethinking

I predicted that…

Moving steadily, the rate of change would be constant

Walking away from the detector, the slope would be negative. I associated the word "away" with negative.



Motion detector

Starting position of person

Ending position of person

Direction

— Magnitude of velocity

Walking slowly and steadily away from the motion detector, the slope of the function would decline slightly.

Given $P_1 = P_2$, and velocity $= \frac{\Delta v}{\Delta t}$, then: $\frac{v_2 - v_1}{t_2 - t_1} = \frac{-v}{t_2 - t_1} = -$ velocity

Results

When the experiment was run…

Walking away steadily (meaning the ratio of position vs. time didn't change over time), the velocity stayed constant

Increasing my position over time by walking away, the velocity was positive

The slope of the function was zero, meaning the velocity didn't change over time

Walking away slowly, the velocity was less than walking away fastly.

Discussion

Personal

It can be easy to confuse position and velocity graphs. Word choice should be taken at direct value without modeling.

Group

We talked about the differences in our predictions. My groups predictions matched the experiment and mine didn't because of my perspective

Class

Our class realized…

To describe the magnitude of constant velocity, we can't talk in terms of slope, because slope is 0 when velocity is constant.

Conclusion

Overall, when moving slowly and steadily away from the detector, the slope of the function is 0 because the slope of velocity with respect to time doesn't change.The initial position of an object isn't relevant when creating velocity vs time graphs. This concept matters because it describes to us how constant velocity at a slow speed is modeled. The graph produced from the experiment did not match my prediction. When reading the problem I associated the word "away" with the negative direction. This meant that I was thinking of the velocity vs time graph in terms of position.

The major misconception is that the velocity would be a negative value, and the slope < 0. This means that one is thinking in terms of a position vs. time graph and not a velocity vs. time graph. Furthermore, if the object is moving away from detector at slow steady rate , the velocity is zero.
My confidence about this content is 5/5
I have no further questions

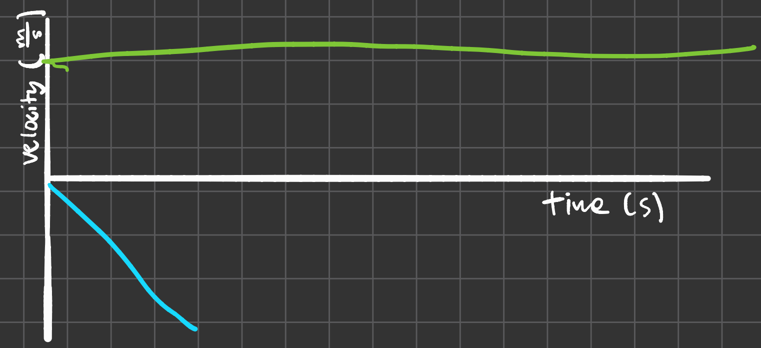
Senario 3: fastly & steadily walking away from detector

"Predict what a velocity vs. time graph will look like if you start near the motion detector and walked away from the motion detector at a fast steady rate."

Prethinking

I predicted that…

Moving steadily, the rate of change would be constant



Walking away from the detector, the slope would be negative. I associated the word "away" with negative.

Walking fastly and steadily away from the motion detector, the slope of the function would decline faster than slower.

Motion detector
Starting position of person
Ending position of person
Direction
Magnitude of velocity

Given $P_2 > P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{+P}{+t}$ = + velocity

Results

When the experiment was run…

Walking away steadily (meaning the ratio of position vs. time didn't change over time), the velocity stayed constant

Increasing my position over time by walking away, the velocity was positive

The slope of the function was zero, meaning the velocity didn't change over time

Walking away fastly, the velocity was greater than walking away slowly

Discussion

Personal The slope of the velocity graph did not change.

Group We discussed constant velocity and how the slope doesn't change.

Class The velocity of this graph is greater than slower moving

Conclusion

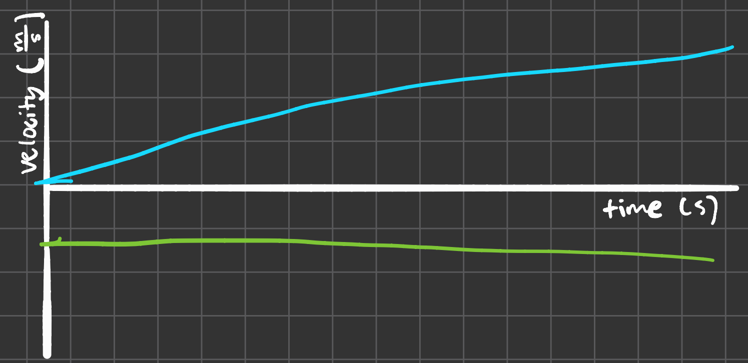
Overall, when moving fastly and steadily away from the detector, the slope of the function is 0 because the slope of velocity with respect to time doesn't change.The initial position of an object isn't relevant when creating velocity vs time graphs. This concept matters because it describes to us how constant velocity at a slow speed is modeled. The graph produced from the experiment did not match my prediction. When reading the problem I associated the word "away" with the negative direction. This meant that I was thinking of the velocity vs time graph in terms of position. This is wrong

The major misconception is that the velocity would be a negative value, and the slope < 0. This means that one is thinking in terms of a position vs. time graph and not a velocity vs. time graph. Furthermore, if the object is still, the velocity is zero.
My confidence about this content is 5/5
I have no further questions

Senario 4: slowly & steadily walking toward detector

"Predict what a velocity vs. time graph would look like if you started away from the motion detector and walked slowly and steadily towards the motion detector."

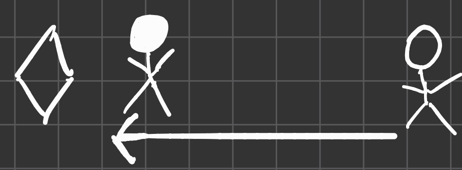
Prethinking



I predicted that…

Moving steadily, the rate of change would be constant

Walking towards the detector, the slope would be positive . I associated the word "toward" with positive.



Motion detector

Starting position of person

Ending position of person

Direction

Magnitude of velocity

Walking slowly and steadily toward the motion detector, the slope of the function would incline slightly.

Given $P_2 < P_1$ and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{-P}{t} = -$ velocity

Results

When the experiment was run…

Walking toward steadily (meaning the ratio of position vs. time didn't change over time), the velocity stayed constant

Decreasing my position over time by walking towards, the velocity was negative.

The slope of the function was zero, meaning the velocity didn't change over time

Walking toward slowly, the velocity was less than walking toward fastly

Discussion

Personal Slowly walking towards, the velocity is less than moving faster and it's direction is negative.

Group Walking toward meant that my position decreased over time

Class The velocity of this graph is less than faster moving

Conclusion

Overall, when moving slowly and steadily toward the detector, the slope of the function is 0 because the slope of velocity with respect to time doesn't change.The initial position of an object isn't relevant when creating velocity vs time graphs. This concept matters because it describes to us how constant velocity at a slow speed is modeled. The graph produced from the experiment did not match my prediction. When reading the problem I associated the word "away" with the negative direction. This meant that I was thinking of the velocity vs time graph in terms of position. This is wrong

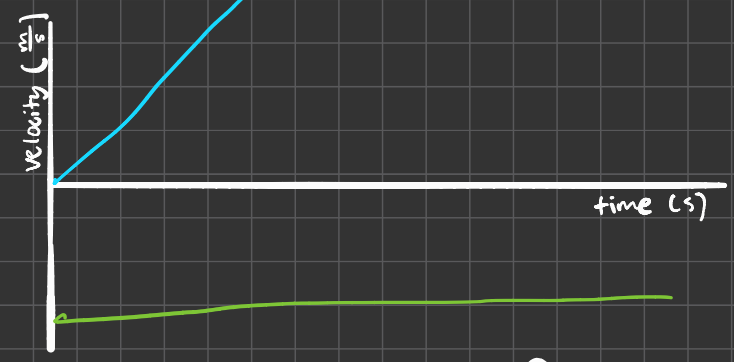
The major misconception is that the velocity would be a positive value, and the slope > 0. This means that one is thinking in terms of a position vs. time graph and not a velocity vs. time graph. Furthermore, if the object is still, the velocity is zero.
My confidence about this content is 5/5
I have no further questions

Senario 5: Fastly & steadily walking toward detector

"Predict what a velocity vs. time graph would look like if you start away from the motion detector and walked towards the motion detector at a fast steady rate."

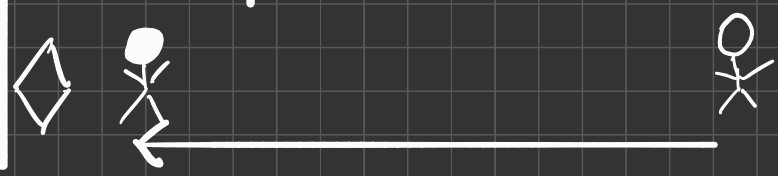
Prethinking

I predicted that…



Moving steadily, the rate of change would be constant

Walking towards the detector, the slope would be positive . I associated the word "toward" with positive.



Walking fastly and steadily toward the motion detector, the slope of the function would incline faster than slower.

Motion detector
Starting position of person
Ending position of person
Direction
Magnitude of velocity

Given $P_2 < P_1$, and velocity $= \frac{\Delta P}{\Delta t}$, then: $\frac{P_2 - P_1}{t_2 - t_1} = \frac{-P}{t} = -$ velocity

Results

When the experiment was run…

Walking toward steadily (meaning the ratio of position vs. time didn't change over time), the velocity stayed constant

Decreasing my position over time by walking towards, the velocity was negative.

The slope of the function was zero, meaning the velocity didn't change over time

Walking toward fastly, the velocity was greater than walking toward slowly

Discussion

Personal Fastly walking towards, the velocity is greater than moving slower.

Group Walking toward faster meant that my position decreased faster over time.

Class The velocity of this graph is greater than faster moving slower

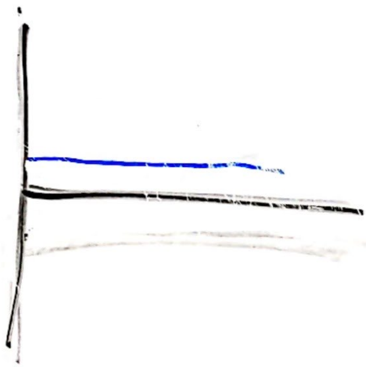
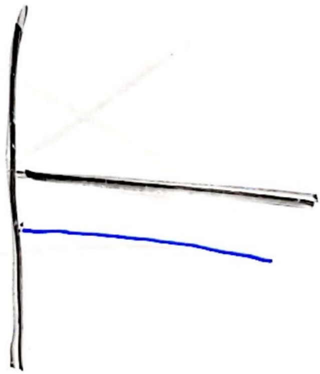
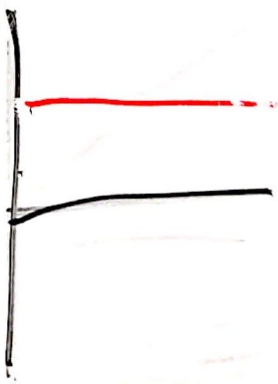
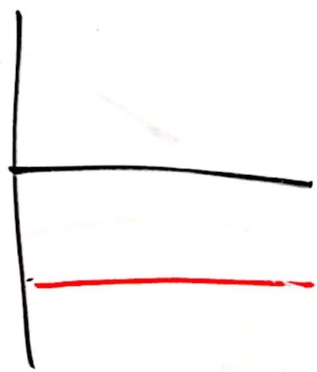
Conclusion

Overall, when moving fastly and steadily away from the detector, the slope of the function is 0 because the slope of velocity with respect to time doesn't change.The initial position of an object isn't relevant when creating velocity vs time graphs. This concept matters because it describes to us how constant velocity at a slow speed is modeled. The graph produced from the experiment did not match my prediction. When reading the problem I associated the word "away" with the negative direction. This meant that I was thinking of the velocity vs time graph in terms of position. This is wrong

The major misconception is that the velocity would be a positive value, and the slope > 0. This means that one is thinking in terms of a position vs. time graph and not a velocity vs. time graph. Furthermore, if the object is still, the velocity is zero.
My confidence about this content is 5/5
I have no further questions

TABLE 6.1

Results: Velocity vs. Time

	+ away	− towards
Slow		
Fast		

Language & Description of Motion

Concepts

I realized that math terms describe quantities and physics terms describe science

Motion is related to the ratio of position and time. This means that the initial position isn't important when directly describing motion.

The positive and negative directions are relative to what we assign them to be.

The starting position isn't directly related to the direction of motion.

Consistent language matters in science. Havin ambiguous language makes it hard to use.

Vocabulary

Ambiguous words
Distance
Increase / decrease
It
Speed
Origin
Toward
Away

Motion requires...
position
direction of motion

Velocity requires...
Direction

$\frac{\text{Position}}{\text{Time}}$

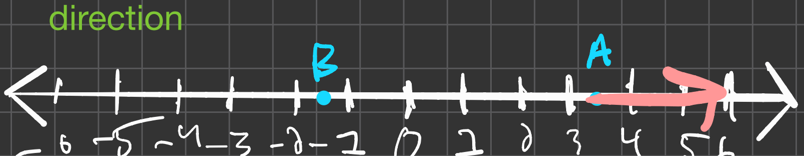
Discussion

Velocity is how the position is changing over time with direction

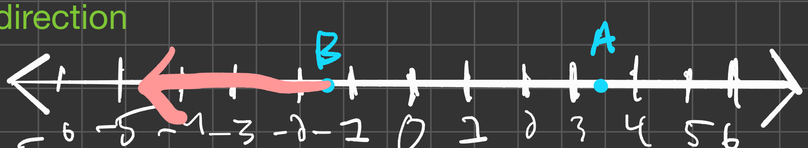
Examples

Starting in the positive direction and moving in the negative direction means moving in the negative direction

Starting in the negative direction and moving in the positive direction means moving in the positive direction



Starting in the positive direction and moving in the positive direction means moving in the positive direction



Starting in the negative direction and moving in the negative direction means moving in the negative direction

What's the positive and negative directions are defined as what we define them to be.