Displacement Graphs

IB PHYSICS | MOTION

What is Motion?

An object's change in ______ relative to a reference point.



Relative to the earth: Moving 17,500 mph

Relative to the shuttle: Not moving

Distance vs. Displacement

Distance

Displacement

Distance and Displacement in 2D



Map Showing the Distance Between Minnetonka High School - The Cove, Minnetonka and Niagra Falls, Canada



Try this | Distance and Displacement

You walked 5 km East, turned around and walked 2 km West, turned around again and walked another 4 km East. What is your distance? What is your displacement?



Graphing Displacement

You walked 5 km East, turned around and walked 2 km West, turned around again and walked another 4 miles km. What is your distance? What is your displacement?



Stroboscopic Photographs



In a stroboscopic photograph, a new snapshot is captured every _____ seconds and combined to show the motion over a period of time.

Circle the part of the motion where this soccer ball is moving the FASTEST

Circle the part of the motion where this soccer ball is moving the SLOWEST

Stroboscopic Photographs



Constant Velocity or Accelerating?

How do you know?



Which cart do you think has the best chance of reaching the 10-meter location first?

| Time | 0.0 s | 1.0 s | 2.0 s | 3. 0 s |
|--------|-------|--------------|--------------|---------------|
| Cart A | 0.0 m | | | |
| Cart B | 2.0 m | | | |
| Cart C | 3.0 m | | | |

Now which cart do you think has the best chance of reaching the 10-meter location first?

| Time | 0.0 s | 1.0 s | 2.0 s | 3.0 s |
|--------|-------|--------------|--------------|--------------|
| Cart A | 0.0 m | 4.0 m | | |
| Cart B | 2.0 m | 4.0 m | | |
| Cart C | 3.0 m | 4.0 m | | |

What new information do you have about the carts now that you didn't before?

Now which cart do you think has the best chance of reaching the 10-meter location first?

| Time | 0.0 s | 1.0 s | 2.0 s | 3.0 s |
|--------|-------|--------------|--------------|-------|
| Cart A | 0.0 m | 4.0 m | 7.0 m | ?? |
| Cart B | 2.0 m | 4.0 m | 6.0 m | ?? |
| Cart C | 3.0 m | 4.0 m | 6.0 m | ?? |

What patterns do you see? Can you use these to predict the next position?

It's more than just position, you need multiple frames to see motion

| Time | 0.0 s | 1.0 s | 2.0 s | 3.0 s |
|--------|-------|--------------|--------------|--------------|
| Cart A | 0.0 m | 4.0 m | 7.0 m | 9.0 m |
| Cart B | 2.0 m | 4.0 m | 6.0 m | 8.0 m |
| Cart C | 3.0 m | 4.0 m | 6.0 m | 9.0 m |
| | | | | |



An object not moving



An object moving forward



An object moving backward



Showing Velocity



Speeding Up (moving positive)



Speeding Up (moving negative)



How are these Similar?



Slowing Down (moving positive)



Slowing Down (moving negative)



Displacement vs Time Graphs

Which graph(s) represent an object moving in the negative direction?

Which graph(s) represent an object slowing down?



Lesson Takeaways

- I can describe the difference between distance and displacement
- □ I can calculate distance and displacement for 1D motion
- I can plot constant velocity on a displacement vs time graph
- I can plot changing velocity on a displacement vs time graph
- I can use a displacement vs time graph to identify if an object is moving in the positive or negative direction as well as if it is speeding up or slowing down