## 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 



This road journey will take $\mathbf{2 1}$ Hours, 11 Minutes
You can link to this result : How Far is it Between Minnetonka High School - The Cove, Minnetonka and Niagra Falls, Canada -minnetonka-and-niagra-falls_-ca

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?
0


$\mid$
4

$\mid$
5


## Distance

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?

## Predict the Motion...

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 |  |  |  |

## Predict the Motion...

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?

## Predict the Motion...

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?

## Predict the Motion...

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 |  |
|  | C |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

## 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?




D


## Lesson Takeaways

$\square$ I can describe the difference between distance and displacement
I can calculate distance and displacement for 1D motion
$\square$ 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

