

# Displacement Graphs

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IB PHYSICS | SCIENCE SKILLS

# What is Motion?

An object's change in **position** 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

Distance as the Crow Flies : 1170.297



Distance by Land Transport : 1525.995

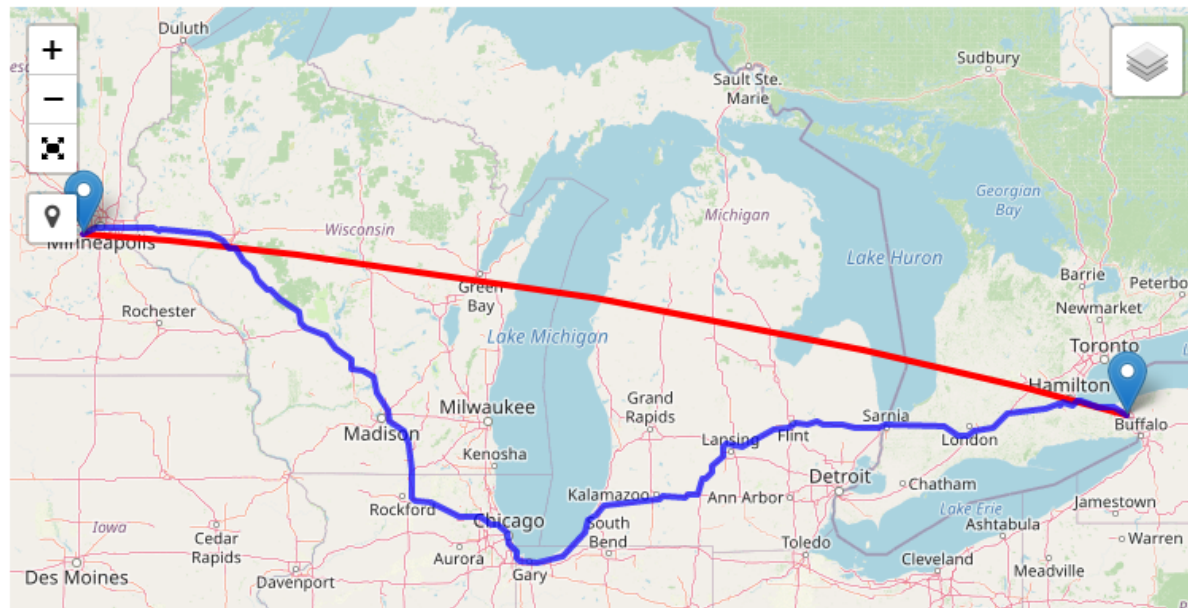


This road journey will take 21 Hours, 11 Minutes

You can link to this result : [How Far is it Between Minnetonka High School - The Cove, Minnetonka and Niagara Falls, Canada](https://www.freemaptools.com/how-far-is-it-between-minnetonka-high-school---the-cove_-minnetonka-and-niagra-falls_-ca)

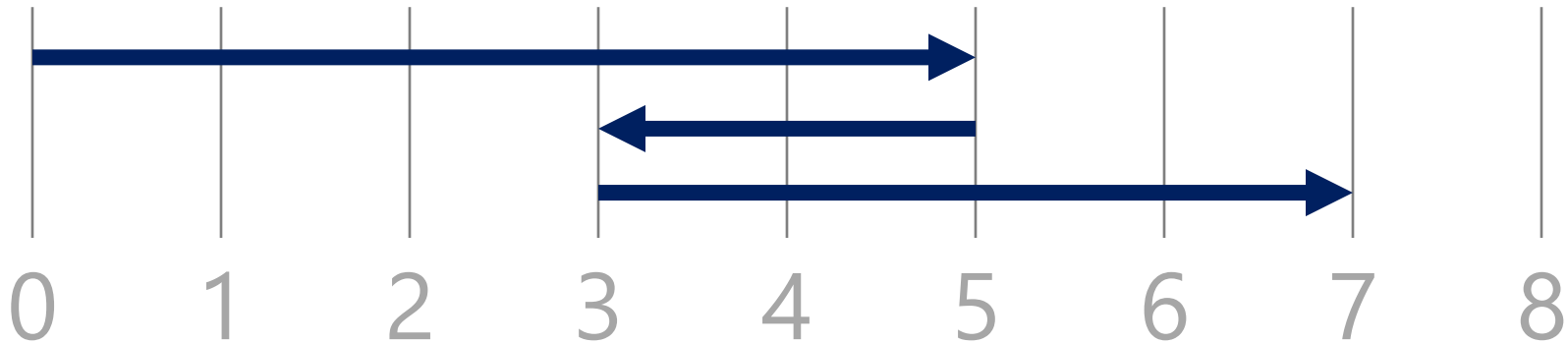
[https://www.freemaptools.com/how-far-is-it-between-minnetonka-high-school---the-cove\\_-minnetonka-and-niagra-falls\\_-ca](https://www.freemaptools.com/how-far-is-it-between-minnetonka-high-school---the-cove_-minnetonka-and-niagra-falls_-ca)

Map Showing the Distance Between Minnetonka High School - The Cove, Minnetonka and Niagara 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?



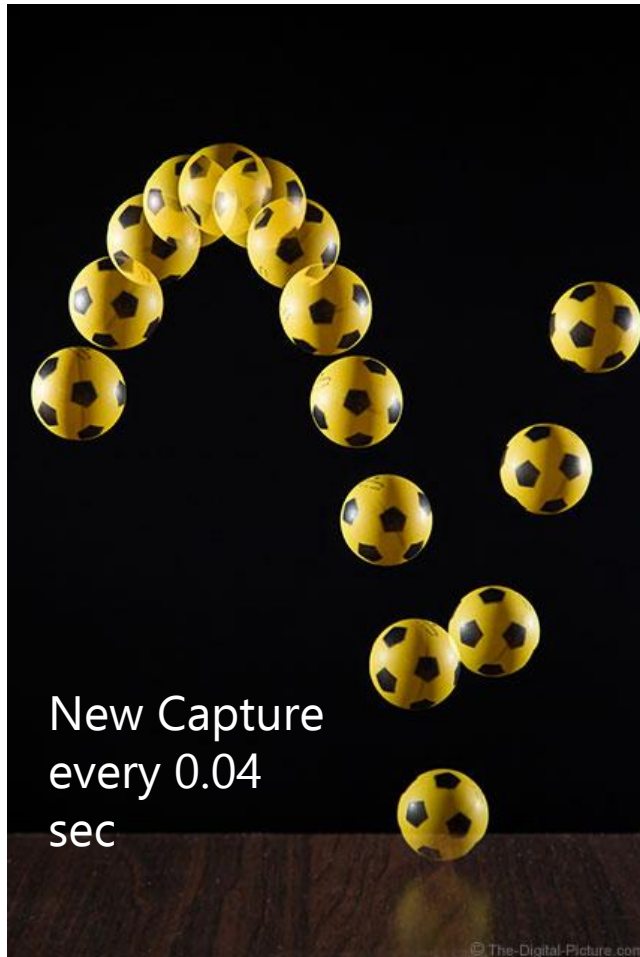
Distance	
Displacement	

# 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

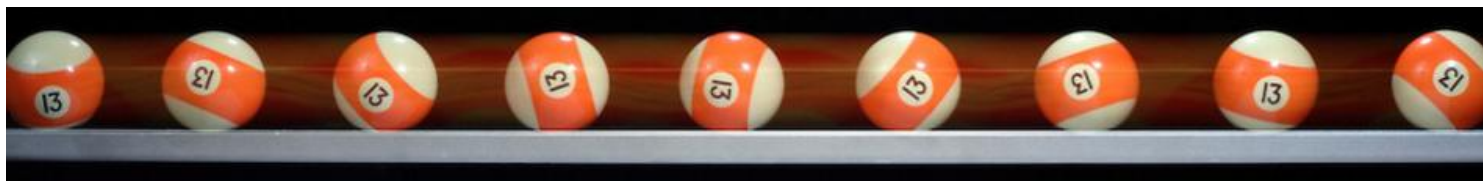


In a stroboscopic photograph, a new snapshot is captured every \_\_\_ seconds and combined to show the motion over a period of time.

**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**

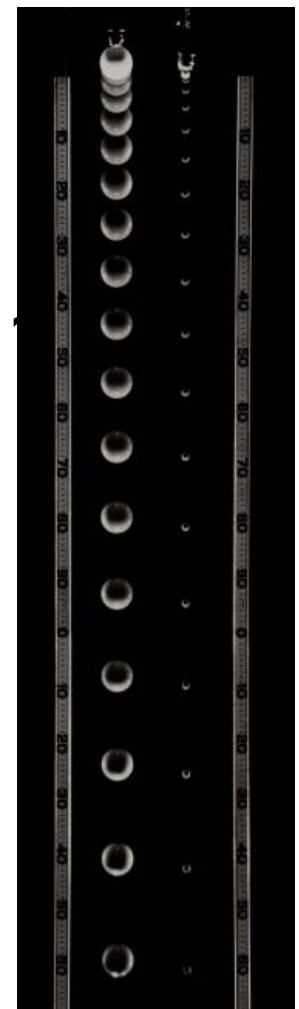
# Stroboscopic Photographs



Constant Velocity or Accelerating

How do you know?

More spacing between pictures = moving faster



# 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?

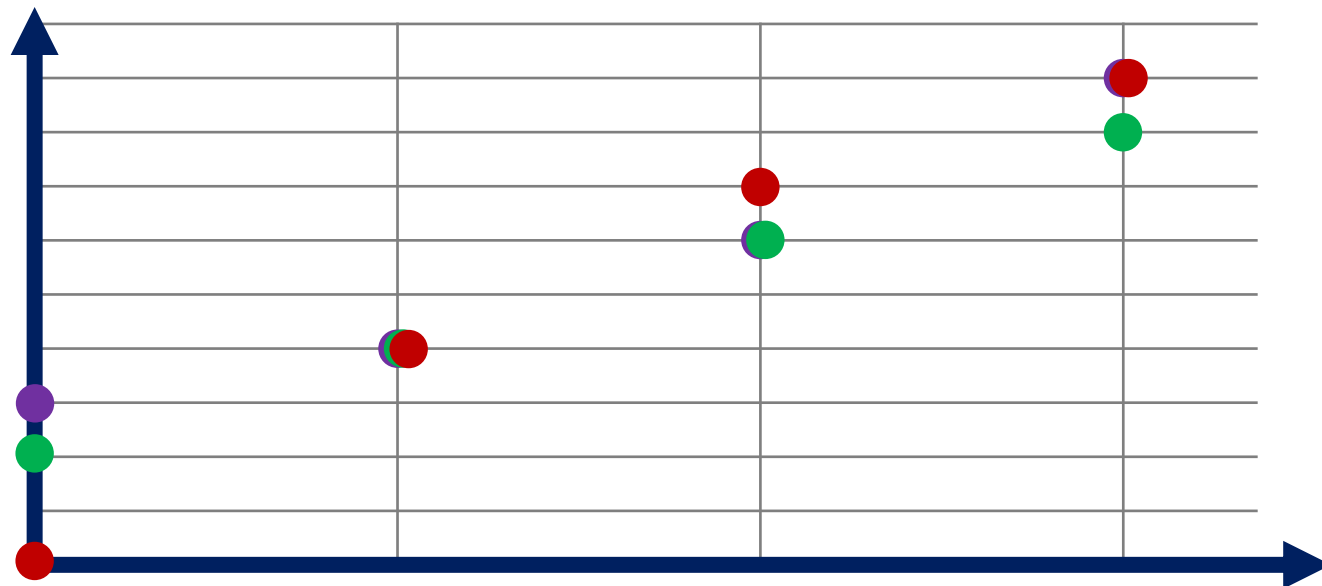
Time	0.0 s	1.0 s	2.0 s	3.0 s
Cart A	0.0 m	4.0 m	7.0 m	??
Cart B	2.0 m	4.0 m	6.0 m	??
Cart C	3.0 m	4.0 m	6.0 m	??

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

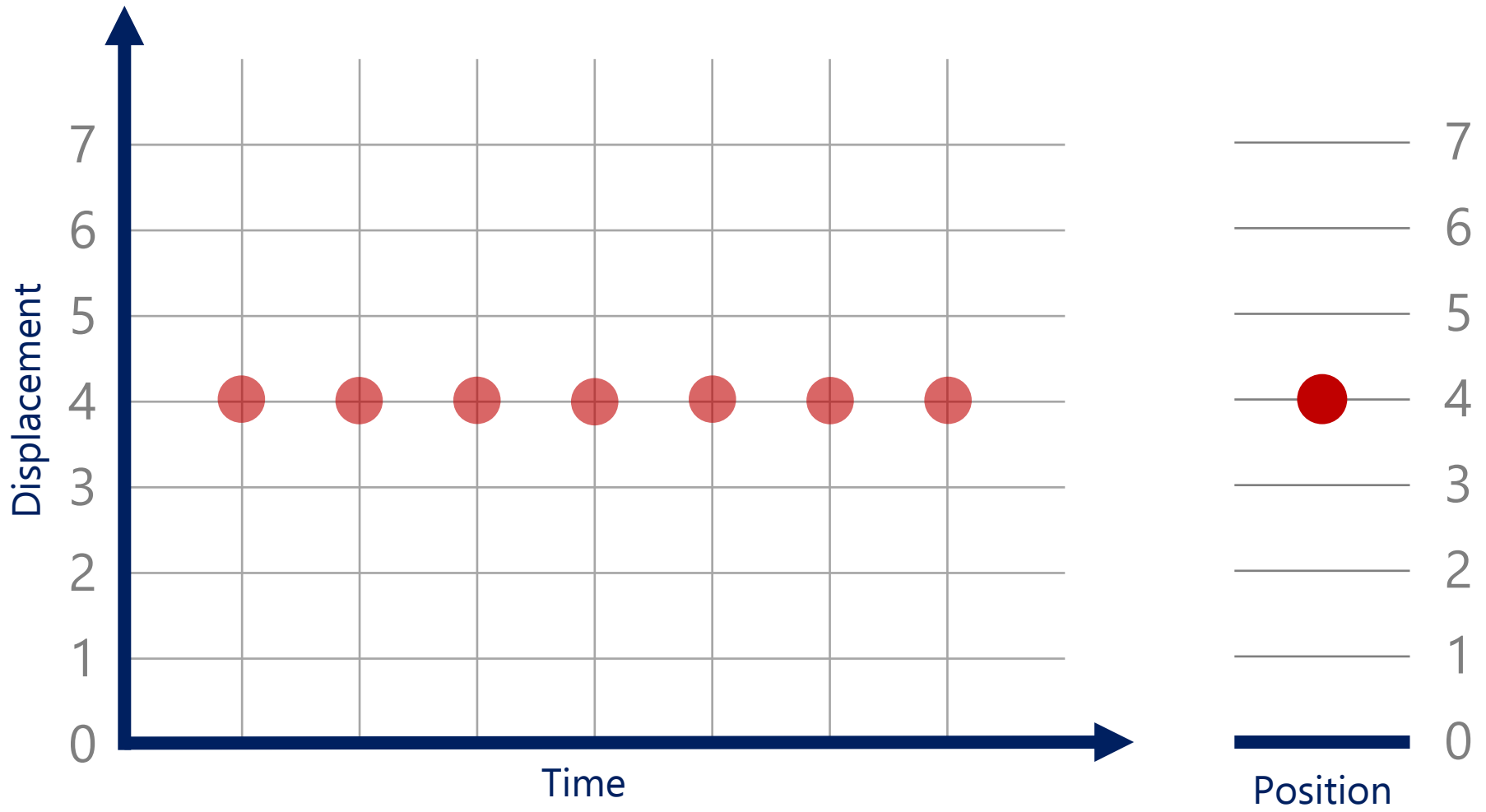
# Predict the Motion...

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

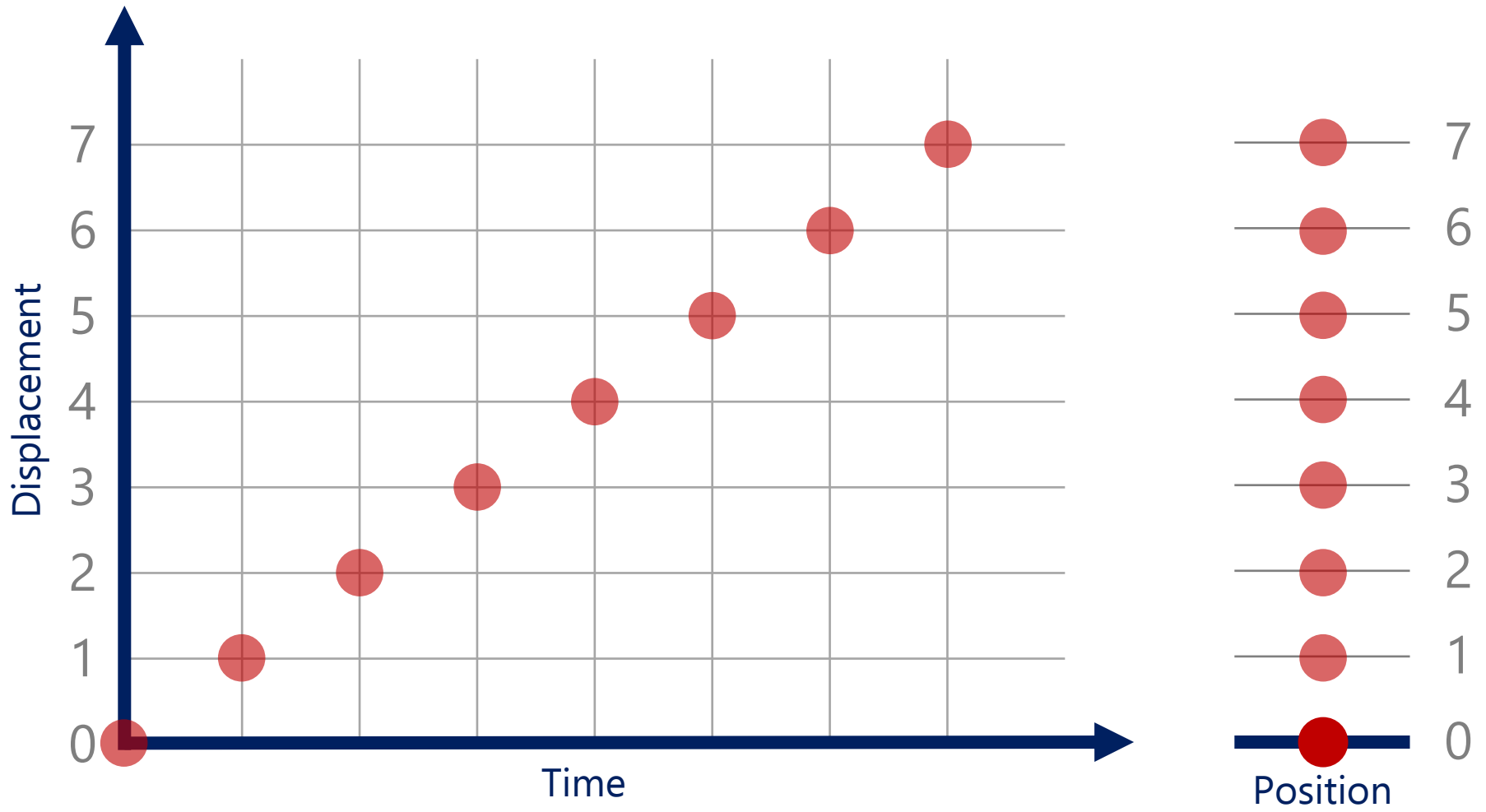
Time	0.0 s	1.0 s	2.0 s	3.0 s
Cart A	0.0 m	4.0 m	7.0 m	9.0 m
Cart B	2.0 m	4.0 m	6.0 m	8.0 m
Cart C	3.0 m	4.0 m	6.0 m	9.0 m



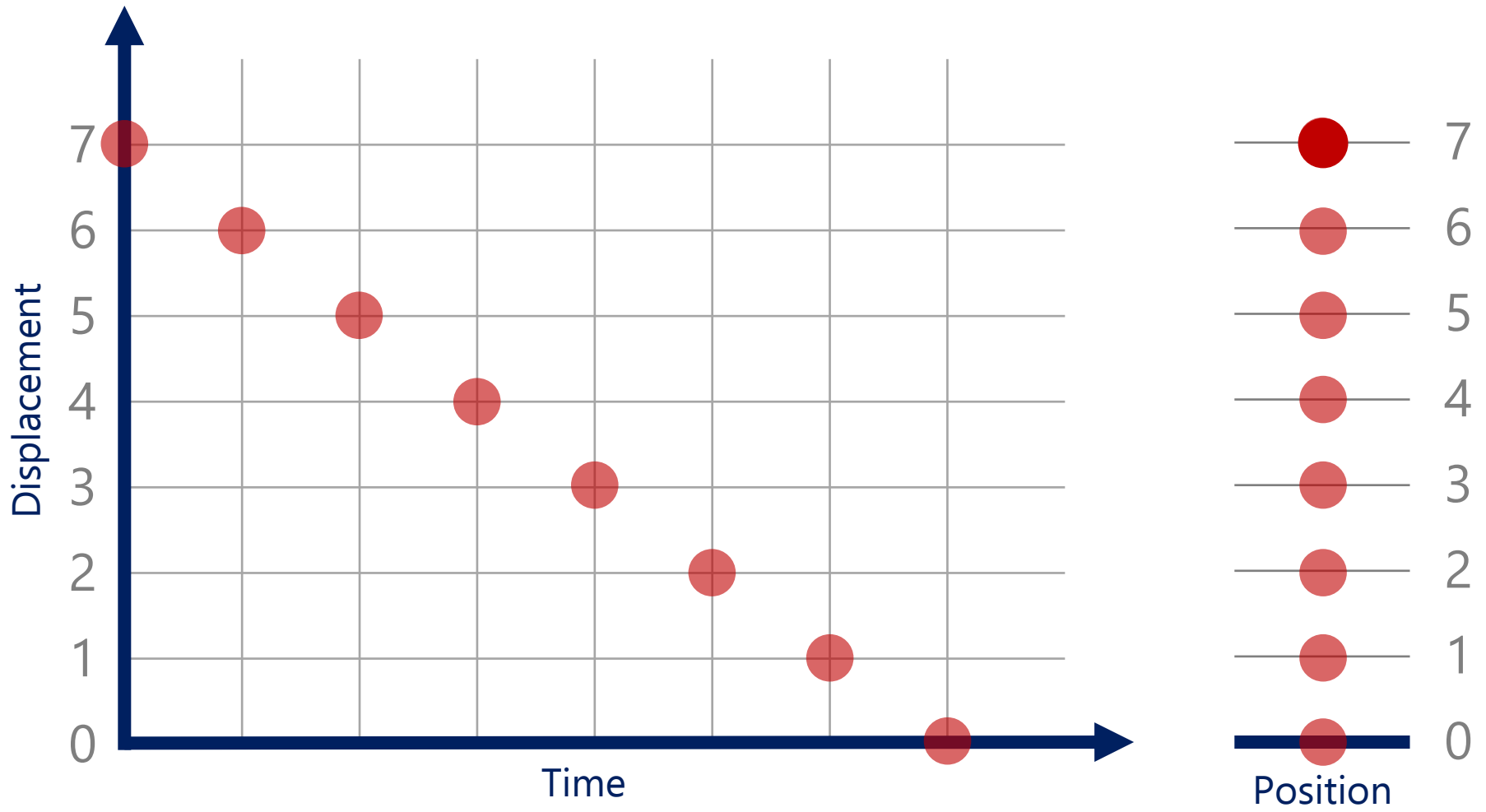
# An object not moving



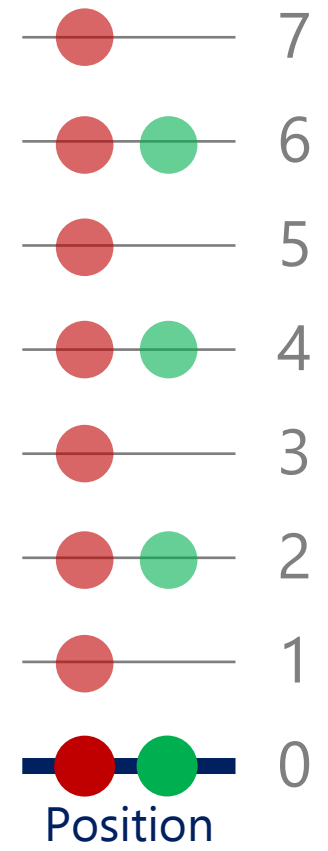
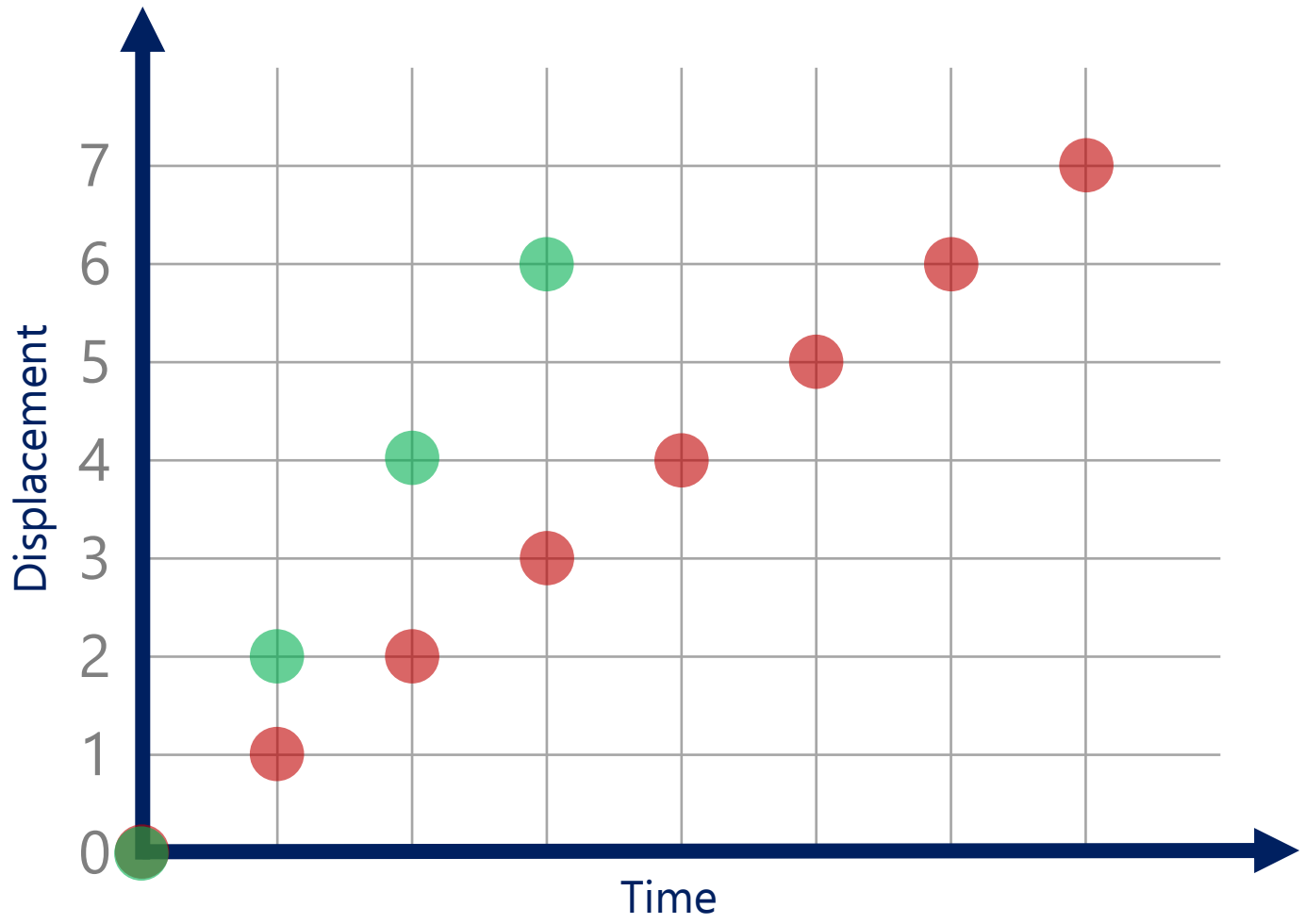
# An object moving forward



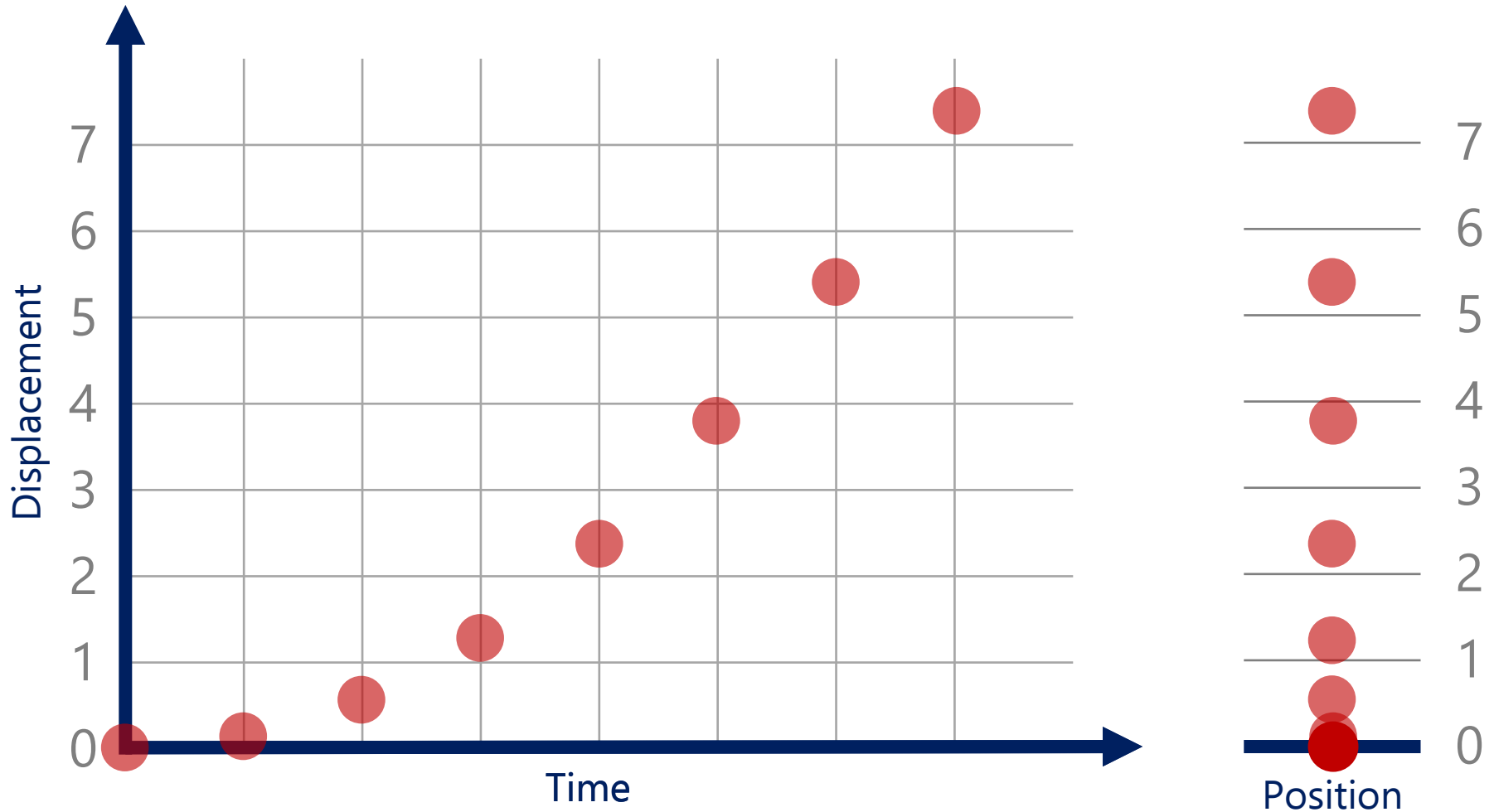
# An object moving backward



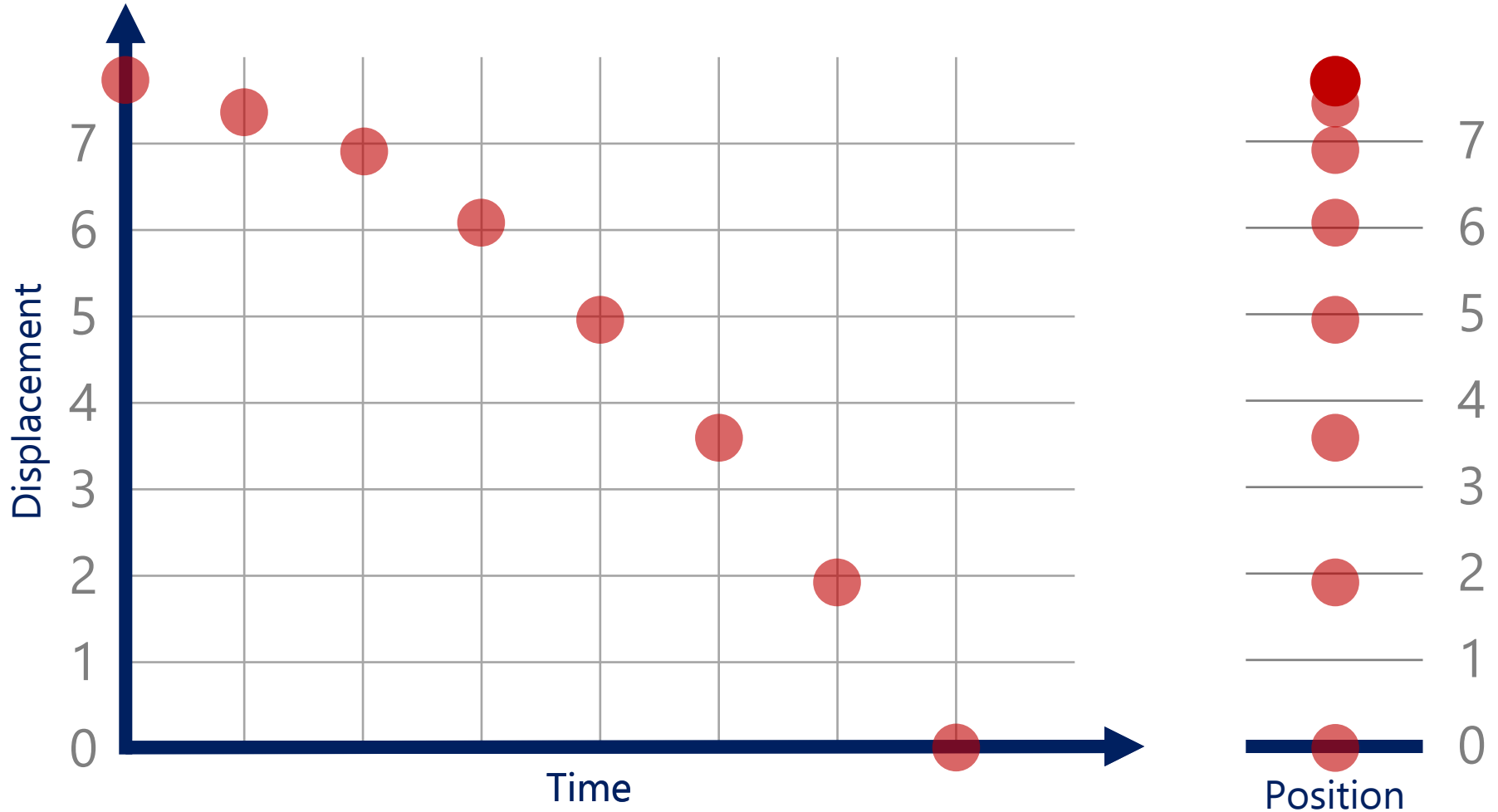
# Showing Velocity



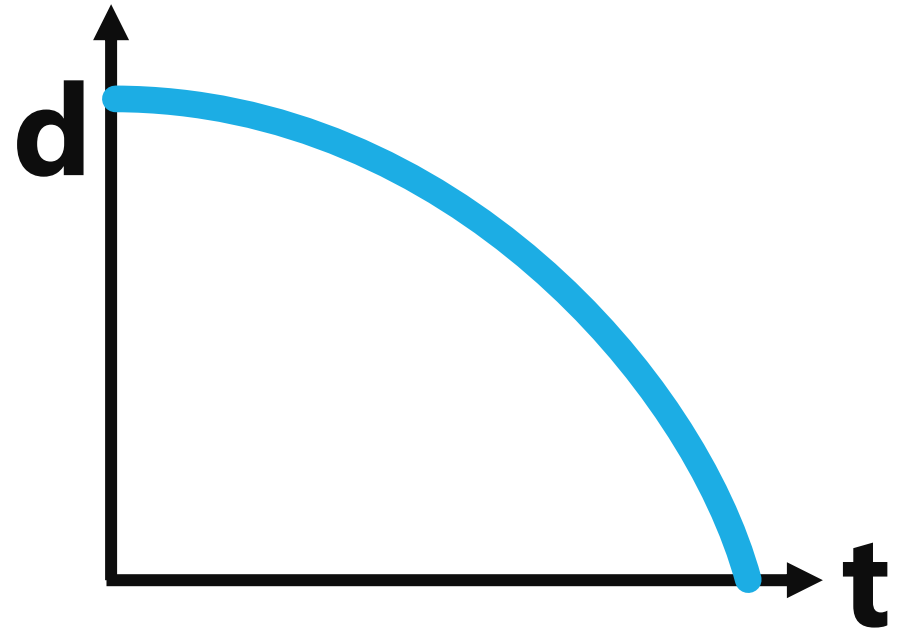
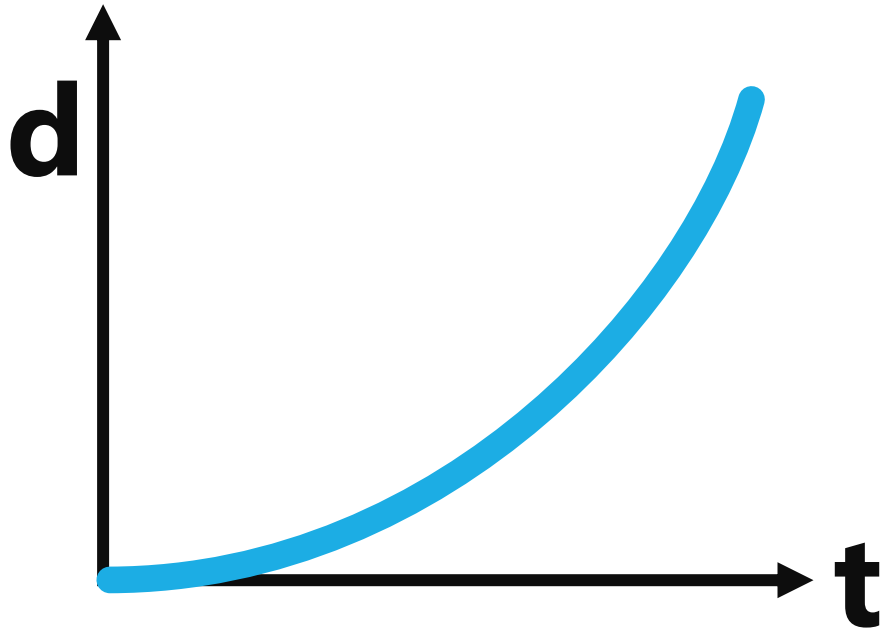
# Speeding Up (moving positive)



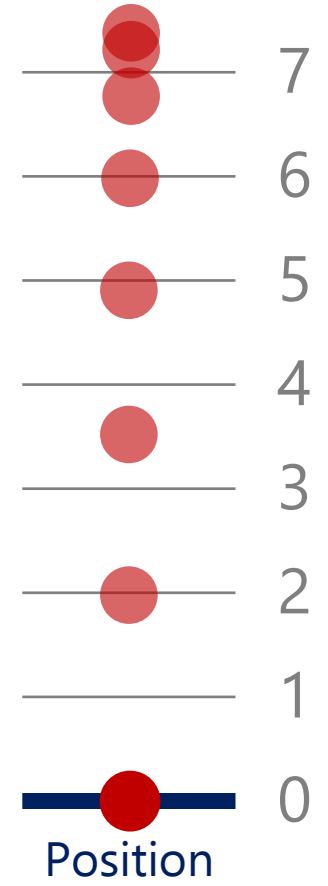
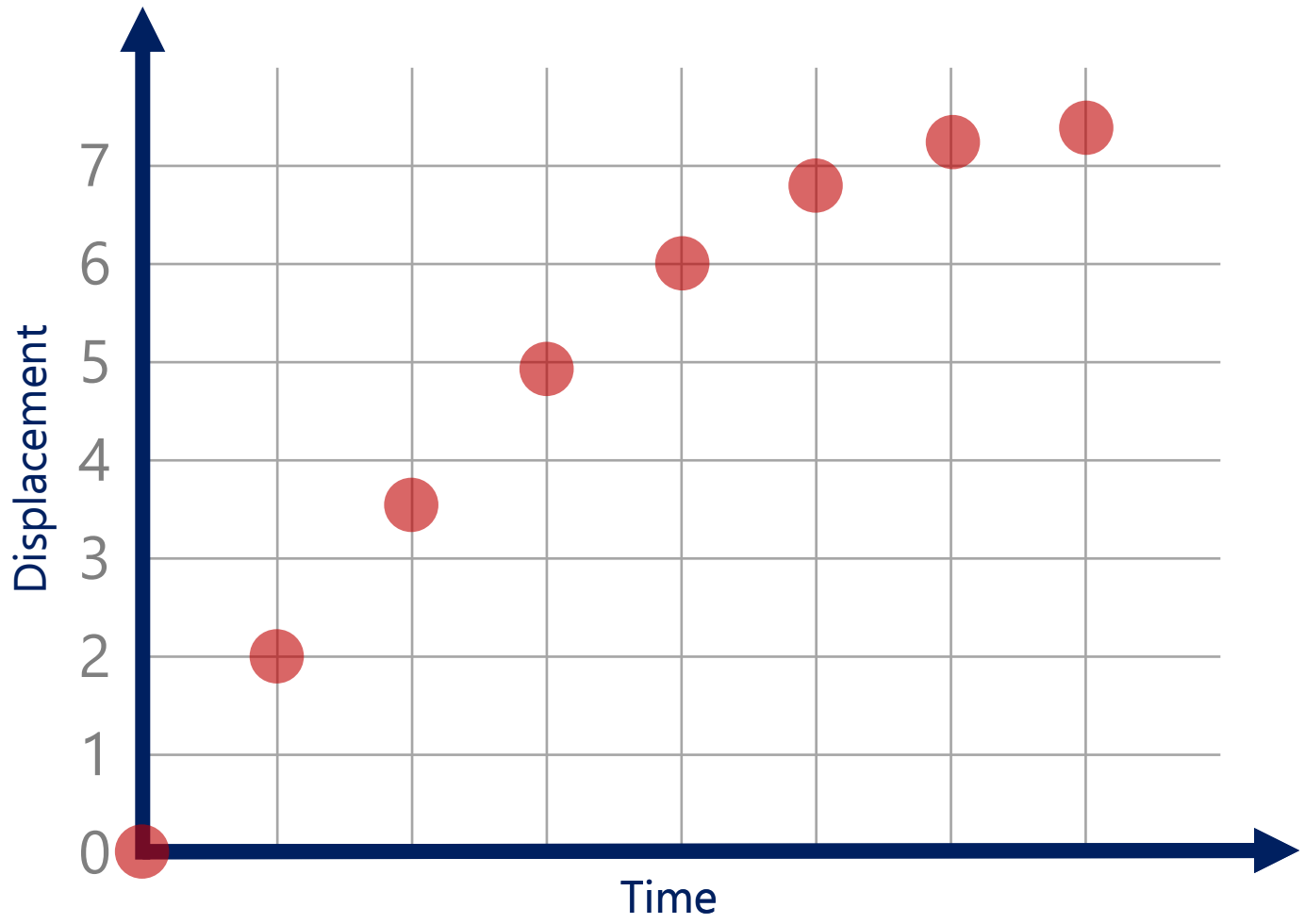
# Speeding Up (moving negative)



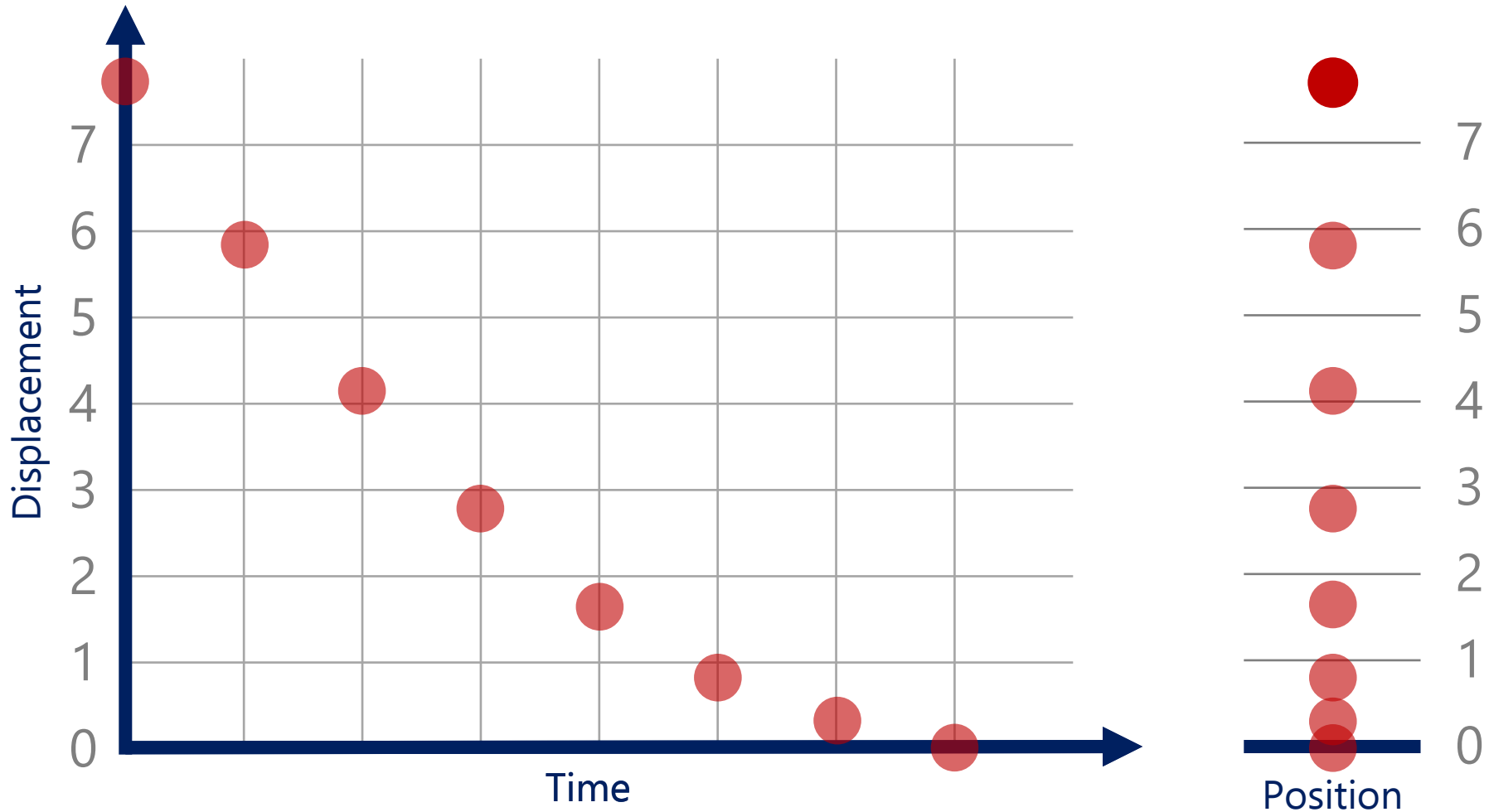
# How are these Similar?



# Slowing Down (moving positive)



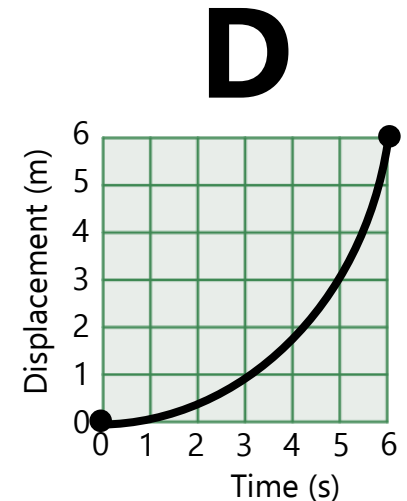
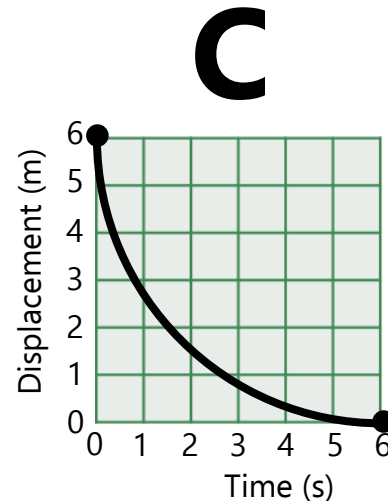
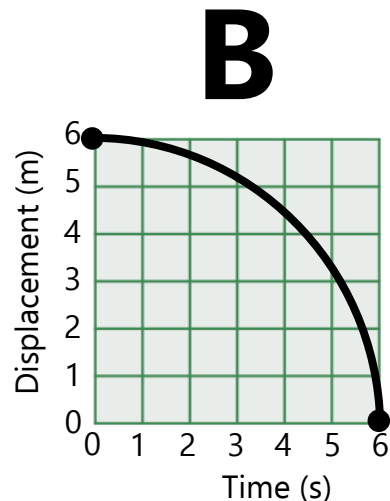
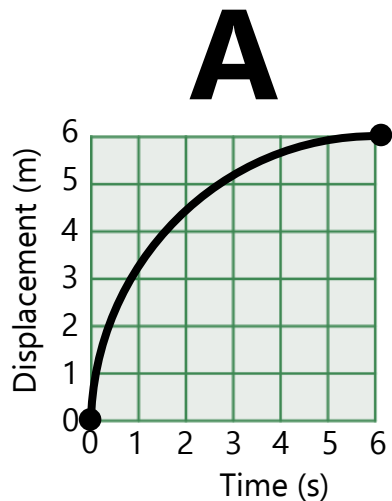
# Slowing Down (moving negative)



# 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