ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

A Wild Ride! Week 2: Grades 6-8

Day 2: Graphing Motion

Teacher/Parent Background:

All motion can be represented using graphs. There are three types of graphs used to describe how an object moves over time: Position v. Time graphs, Distance v. Time graphs or Speed v. Time graphs. What you are trying to demonstrate or measure will determine which graph is best to use.

Position v. Time Graphs

Position graphs show an object's location compared to a reference point. Imagine you are in a car with your mom, driving 30 mph (miles per hour) to your house. If you compare your body's motion to your mom's, you are not in motion. If you compare your body to a green light you drive through, you are moving at 30 mph. If you compare your motion to a jogger that is running on the street in the same direction as you, you are moving around 25 mph. These are all reference points, or objects or locations that you compare an object's motion to. Position graphs show motion relative to a specific location.

Distance v. Time Graphs

Distance graphs do not compare motion to a reference point. Instead, they show the total distance covered over time. For example, if you walk 30 meters to the water fountain, and back to your classroom another 30 meters, your total distance would be 60 meters on a Distance v. Time graph.

Speed v. Time Graphs

Speed graphs show how fast an object moves over time. For example, if you are riding your bike at 10 mph, and stop to talk to a friend, then ride off at 15 mph, a speed graph will show this motion. It will not show your total distance or compare your motion to a reference point.

Overview:

In this activity, students are introduced to ways of visualizing motion through graphs to help them understand that motion is a change in position, direction, or speed. They will continue to think like an engineer and ask more questions about motion as it relates to roller coaster design.

Related Standards:

- Construct an explanation on how energy can be transferred from one energy store to another.

Key Terms:

- Motion
- Direction
- Speed
- Force

Materials List:

- Graphing Paper
- Pen/Pencil

Activity Description:

1. Read the following story:
    - You are watching your favorite television show. During the commercials you get up to grab a snack. The commercials will last for 3 minutes. It is 100 meters to the kitchen from the couch. The kitchen is at the end of the hall. It takes you 30 seconds to get to the kitchen. You open the refrigerator and take 90 seconds to decide to grab a piece of fruit. You walk 50 meters in 15 seconds back towards the couch then stop to pet your dog for 30 seconds. You finally hurry the remaining 50 meters back to the couch in 10 seconds.
2. Fill in the data table (see student handouts) based on the story.
3. Create a position v. time graph based on the information in your table. Remember to use the couch as your reference point.
4. Create a distance v. time graph based on the information in your table. Remember to use the couch as your reference point.
5. Create a speed v. time graph based on the information in your table. Remember to use the couch as your reference point.

Closure:

Discuss the Following:

- Each graph you created showed the same story in a different way. Explain how each graph showed your motion.
    - Position v. Time
        - *Showed how my position compared to the couch. You can see the kitchen is farthest from the couch at 100m. You can also see me return to the couch after 175s.*
    - Distance v. Time

        - *Showed how I walked 200 m total on my trip to the kitchen and back to the couch.*
    - Speed v. Time
        - *Showed how my speed changed on my trip to the restroom. I was the fastest at the end of my trip because I was rushing back to the couch before the show started, again.*
- If you are going to build a roller coaster that you want to have lots of variety and be exciting what kind of data may you want to collect during prototyping. What graph would you use? Explain.
    - *I would want to collect data on how quickly the roller coaster is moving at various places on the track. The best graph would be a speed v. time graph so you can know how fast the roller coaster is moving.*

Extension:

Make your own motion story and then graph it!

Read & Watch: Roller Coaster Physics

ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.™

Student Handouts

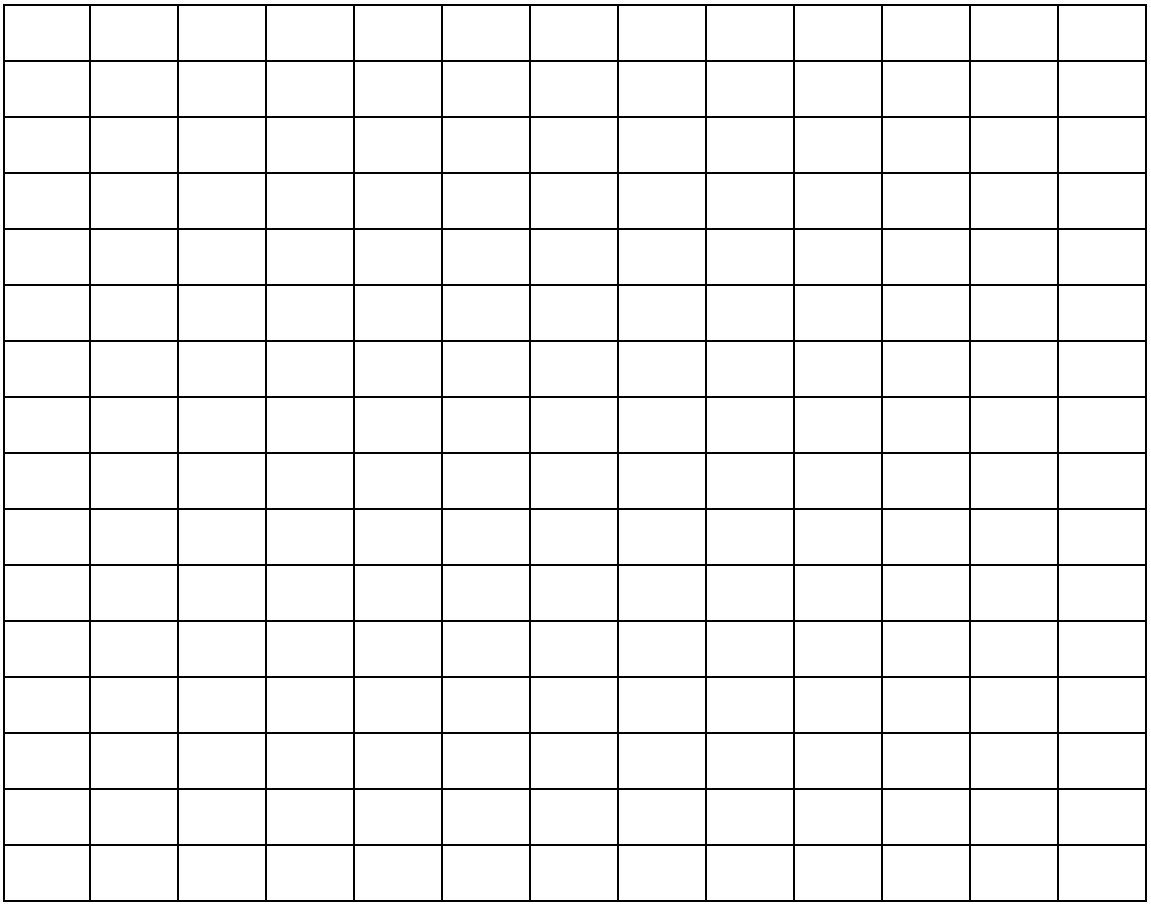
Data Table

Time (seconds)	Position (m)	Distance (meters)	Speed (m/s)
0 s	0 m	0 m	0 m/s
30 s	100 m	100 m	3.3 m/s

Position v. Time Graph

ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.™

Distance v. Time Graph



ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.™

Speed v. Time Graph