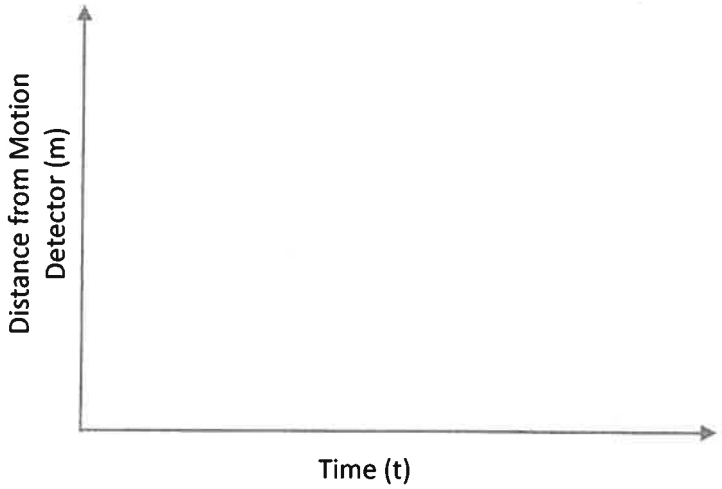
Algebra 1

What would the graph look like if...

a student started 1 meter from a motion detector, took four steps away from the motion detector, then stopped for two seconds before returning to the motion detector. The detector is recording the movement for a total of 5 seconds.



1) Use the graph above to answer the following questions.

a) Could the graph extend into other quadrants for this scenario? Why or why not?

b) How many actions are being described in this scenario? What are the actions?

c) Label the point where your graph touches the y-axis. What is this point called? What does this point represent?

d) Predict the distance (in meters) of the student from the motion detector after 5 seconds.

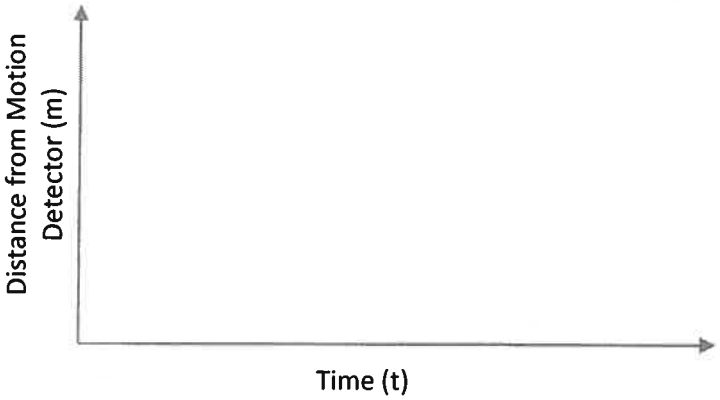
e) Predict the distance (in meters) of the student from the motion detector after 3 seconds.

Algebra 1

Data Collection:

Record the activity as a class and sketch a graph of the results on the axes to the right. Retrieve the data set on your N-Spire calculator.

You should be able to access the table of values and a graph of the data set on your calculators before answering the following questions.



1) Use the graph above and the table on your calculator to answer the following questions.

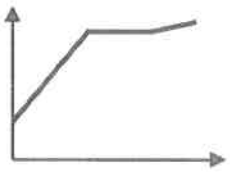
a) Find the distance (in meters) of the student from the motion detector after 0 seconds.

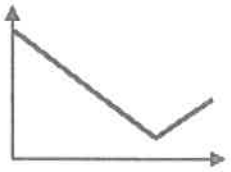
b) Find the distance (in meters) of the student from the motion detector after 5 seconds.

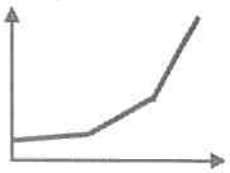
c) Find the distance (in meters) of the student from the motion detector after 3 seconds.

2) How many actions are being described in this scenario? For each action, describe what is happening, when it is happening, and the shape.

3) With your partner(s) write a short description that would result in the following data sets. Be prepared to present these to the class.





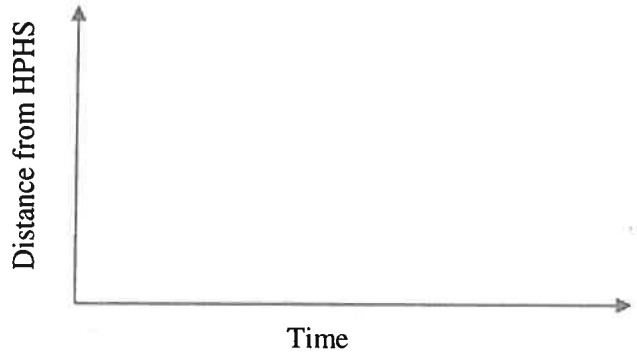


Algebra 1
Data Collection Activity Follow Up

Name: _____

1. Kim has a 15-minute walk home from HPHS and decides to stop at Starbucks on the way to her house. It takes her 2 minutes to order, pay and receive her a vanilla Frappuccino with extra whipped cream. She then continues to walk the rest of the one mile walk home sipping her drink.

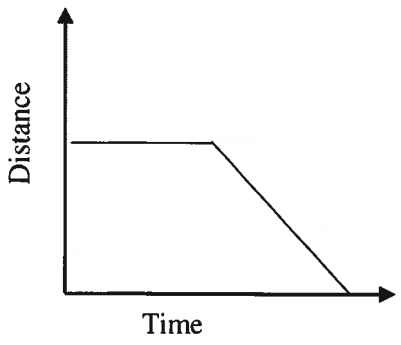
a. Draw a graph that represents the scenario.



b. What is the y – intercept? What does it represent in the context?

c. How many actions are being described in this scenario? For each action, describe what is happening, when it is happening, and the shape.

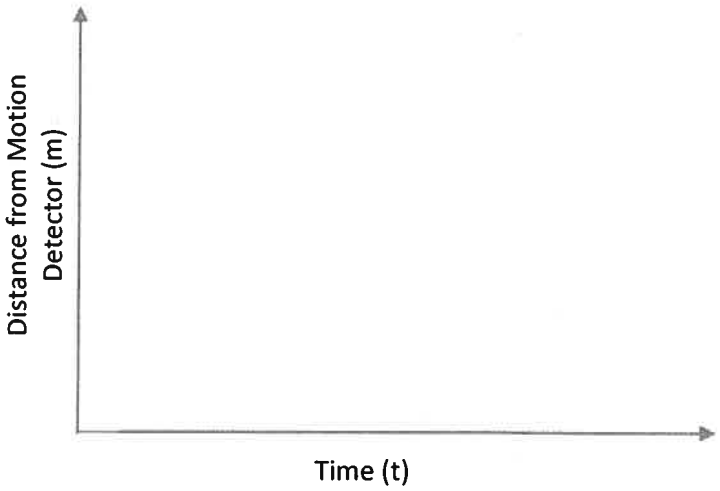
2. Write a scenario that could represent the graph below.



Precalculus

What would the graph look like if...

a student started 1 meter from a motion detector and took six steps away from the motion detector before turning around and returning towards the motion detector. The detector is recording the movement for a total 5 seconds.



1) Estimate the minimum distance from the detector. At what time do you think that it will occur? Label the minimum as an ordered pair on your sketch.

2) Estimate the maximum distance from the detector. At what time do you think that it will occur? Label the maximum as an ordered pair on your sketch.

3) Estimate any intercepts on your graph. Label the intercept as an ordered pair on your sketch.

4) Compare your graph with your partner(s). Do your graphs have the same general shape?

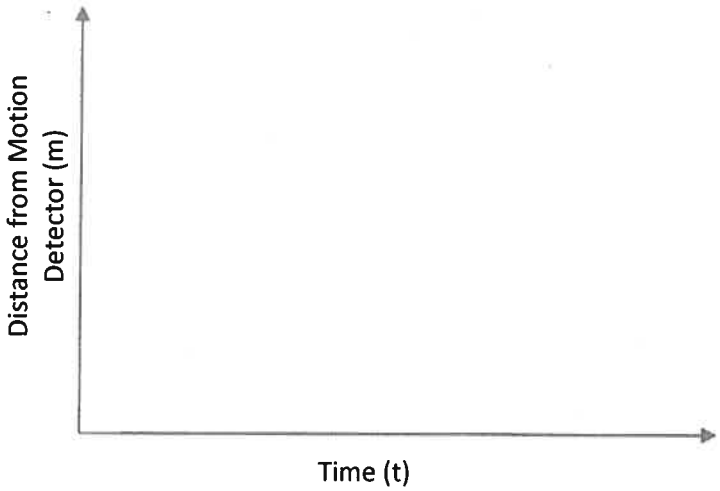
Do not go on until we discuss as a class!

Precalculus

Data Collection:

Record the activity as a class and sketch a graph of the results on the axis to the right. Retrieve the data set on your N-Spire Calculator.

You should be able to access the table of values and a graph of the data set on your calculators before answering the following questions.



1) Use the table of values to find the maximum, the minimum and any intercepts. Write them as ordered pairs on your graph.

2) What is the domain for our data set? What is the range?

Do not go on until we take class notes.

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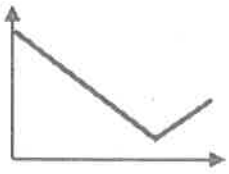
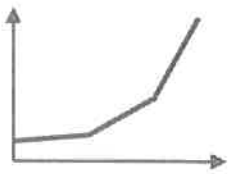
3) Use what you just learned to write a function that describes the data set.

4) With your partner(s) write a short description that would result in the following data sets. Be prepared to present these to the class.

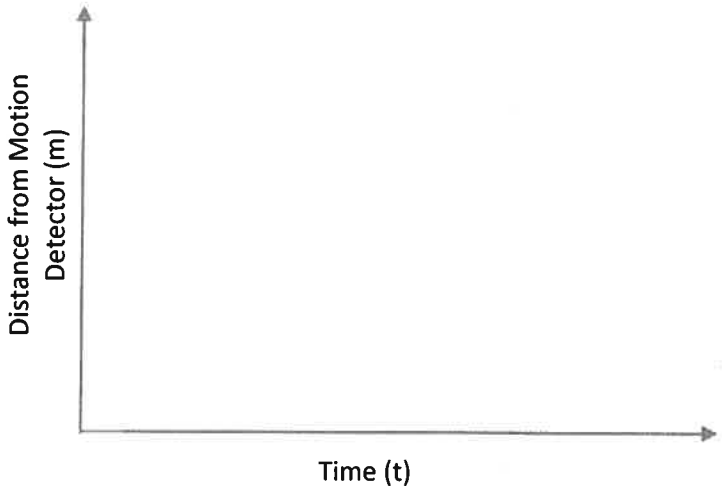




Precalculus

What would the graph look like if...

5 students were lined up, 1 meter apart directly in front of the motion detector. The first student is 1 meter from the detector and the fifth student is 5 meters from the detector. Once data collection begins, the students jump to the side, out of the detectors line of sight one at a time. The first student jumps after 1 second elapses, the second after 2 seconds and so on.



Have 5 students volunteer to demonstrate without the detector on and then sketch a graph of your prediction.

1) Compare your graph with your partner(s). Do your graphs have the same general shape?

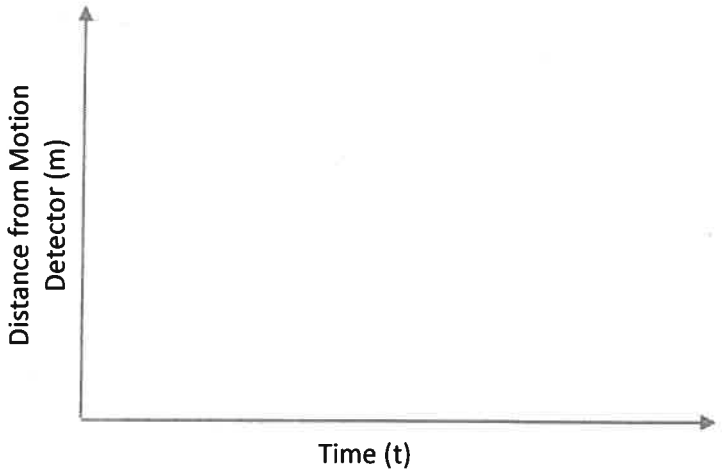
2) Describe what the "jumps" look like on your prediction.

Do not go on until we discuss as a class!

Data Collection:

Record the activity as a class and sketch a graph of the results on the axis to the right. Retrieve the data set on your N-Spire Calculator.

You should be able to access the table of values and a graph of the data set on your calculators before answering the following questions.



1) How many "pieces" do we see in our data? What does each "piece" represent?

Precalculus

2) What is the domain for our data set? What is the range?

3) Write a function that describes this data set. Assume that the domain of each piece is closed at the beginning and open at the end. The final piece is closed at the beginning and the end.

Do not go on until we discuss as a class!

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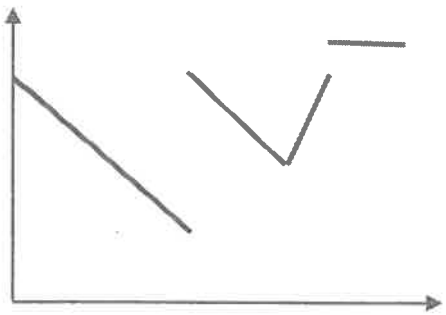
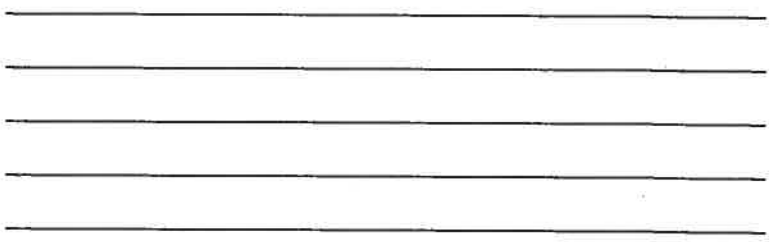
4) With your partner(s) write a short description that would result in the following data set. Be prepared to present this to the class. Be sure to include the number of people required in your description.



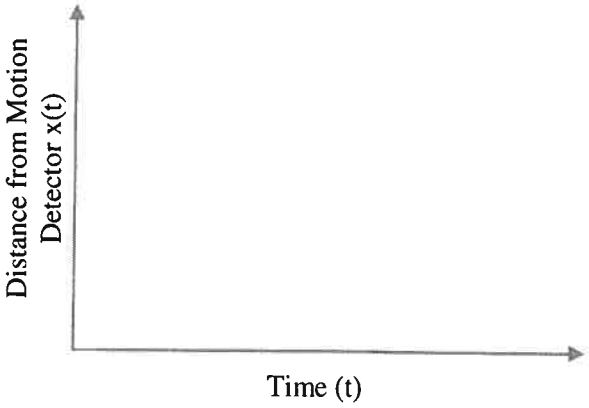


AP Calculus AB

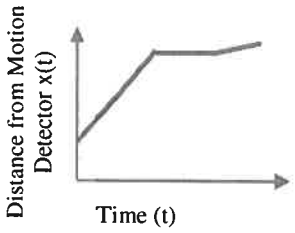
CBR2 Activity

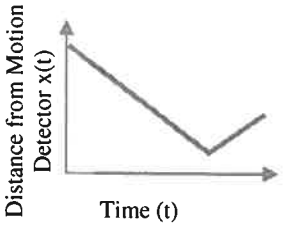
Warm up:

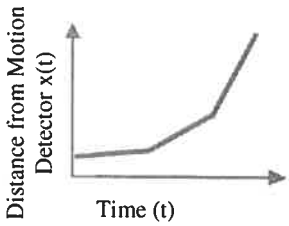
1. What would the graph look like if a student started 1 meter from a motion detector, took four steps away from the motion detector, then stopped for two seconds before returning to the motion detector. The detector is recording the movement for a total of 5 seconds. Sketch a graph and then try and model it using the motion detector.



2. With your group, try to model the following graphs.







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*What would the **position** graph look like if.....? Use the CBR2 to model the situations and graphs below.*

1. A person changes direction after 2 seconds.

2. The table is given below about a person.

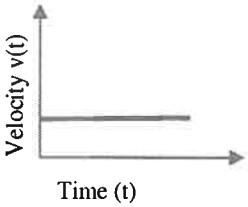
Time (s)	Velocity (m/s)	Speed (m/s)
1	-2	2
2	-1.5	1.5
3	-1	1
4	-.2	.2
5	0	0

AP Calculus AB

3. Three students were lined up, 1 meter apart, directly in front of the motion detector. The first student is 1 meter from the detector and the third student is 3 meters from the detector. Once data collection begins, the students jump to the side one at a time, out of the detectors line of sight. The first student jumps after 2 seconds elapse and the second after 4 seconds elapse. The third student won't need to jump.

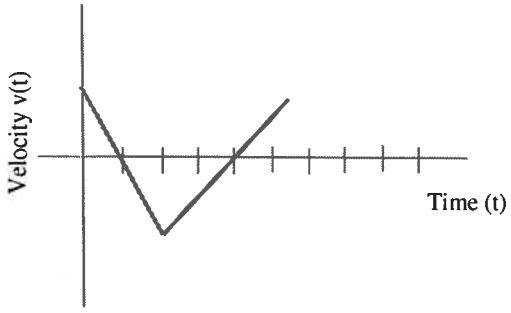
4. An object is dropped with a positive acceleration.

5. The velocity graph of a person is given below.



6. The velocity of an object is positive and the acceleration is negative.

7. The velocity graph of a person is shown below.



8. Total distance traveled by a person is 10m and displacement is 3m.

Now it's your turn! Come up with a situation that can be modeled by using the CBR2. Be prepared to present this to the class.

Match Me
Student Activity

Name _____
Class _____

Activity Overview

In this activity you will match your motion to a given graph of position-versus-time. You will apply the mathematical concepts of slope and y-intercept to a real-world situation.

Materials

- TI-Nspire™ handheld or computer software
- Calculator-Based Ranger 2™ data collection device with USB CBR 2-to-calculator cable

  Note: If the CBR 2 is used with a computer, a mini-standard USB adaptor to plug the CBR 2 into the computer is needed.

Part 1—Step-by-step setup

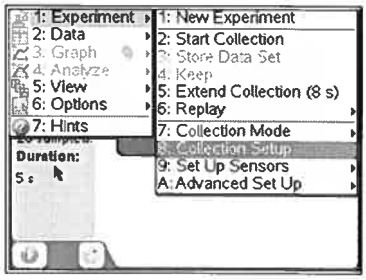
To utilize the built-in, easy-to-use **Motion Match** activity, first turn on the TI-Nspire handheld and choose **New Document**. Then, plug in the CBR 2 and the Vernier DataQuest™ app for TI-Nspire will automatically launch.

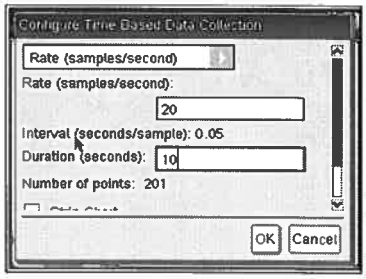
Hold the CBR 2 so that it points toward a smooth surface like the wall or door. Move forward and backward to observe the reading changes on the meter.

1. How far are you from the wall? _____

Record all the digits that are given, as well as the units.

You will set up an experiment for 10 seconds. Press **Menu > Experiment > Collection Setup.** Change the duration to 10 seconds.





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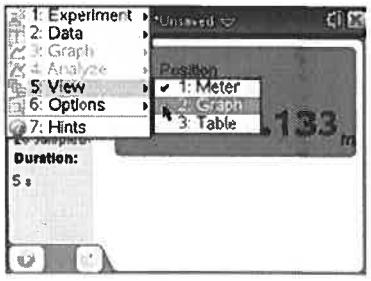
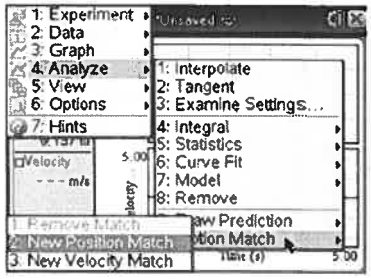
Match Me
Student Activity

Name _____
Class _____

Now, set up the graph. Press **Menu > View**. There are three views. The first view displayed was **Meter**. Choose the **Graph** view for additional menu options.



Press **Menu > Analyze > Motion Match > New Position Match**.



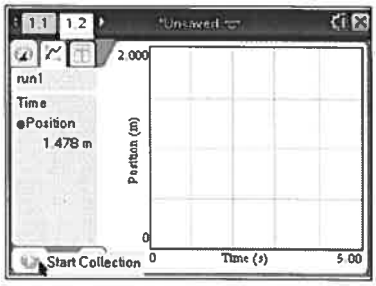
2. What physical quantity is the dependent variable?

   ____

   A. velocity in meters/second
   B. position in meters
   C. time in seconds

3. What variable is plotted on the *x*-axis?

   _____



Draw your Position Match on the graph to the right.

4. What is the domain? Include units. _____

5. What is the range? Include units. _____

6. Record your observations about the graph by answering the following questions:

   a. What is the *y*-intercept?

   b. What does the *y*-intercept represent physically?

   c. At approximately what distance from the wall should the motion detector be located to match the initial position in the motion graph?

   d. The slope is the rate of change of position with respect to time. Between what times does the graph depict the slowest motion?

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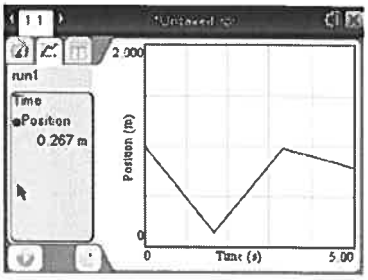
Match Me
Student Activity

Name _____
Class _____

7. Press the **Start Collection** arrow in the lower-left corner of the screen. Point the CBR 2 at a wall and move back and forth until your graph matches the Position Match graph as closely as possible. If you are not pleased with your first attempt, press **Start Collection** again to repeat. You may want to review the information that you wrote about the graph to assist you. When you are satisfied with your match, sketch the graph you created on top of the given graph.

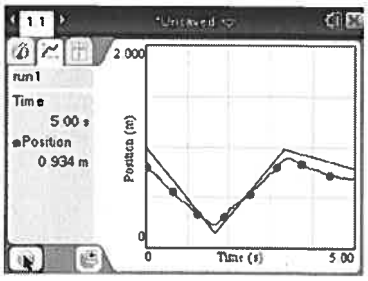
8. Describe the parts of your graph that were difficult to match and how you made adjustments, based on your graph of your walk, to make a better match in your next attempt.

Now, look at the graph shown at the right.



9. Describe how you would need to walk in order to match that graph with your motion. Be sure to include information about the *y*-intercept, position at various times, velocity, and direction. For what times does the graph depict the slowest motion and the fastest motion?

10. Describe the graph with the round dots that was created when **Start Collection** was pressed. Contrast the graph of position-versus-time that should have been created with what actually happened. Write at least two complete sentences. Example: *From 2 seconds to 3.5 seconds, the person moved too slowly to reach the original position – one meter from the wall.*



Part 2—Extend and Explore

Press **Menu > Analyze > Motion Match > New Position Match**. Press **Start Collection** and walk to match the graph. A trial can be saved by pressing the Store Data Set icon next to **Start**.

11. Discuss your new match with a classmate.

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