Graphing in the Primary Grades, Real Life Functions

Math Objectives:

- Examine rate of change
- Analyze and Interpret the graph of a function

Materials:

- TI-83/TI-84 Calculator
- CBR- Calculator-Based Ranger, (motion detector)

Standards:

2-SDAP 1.0 – Students collect numerical data and record, organize, display, and interpret the data on bar graphs and other representations.

4-SDAP 1.0 - Students organize, represent, and interpret numerical and categorical data and clearly communicate findings.

4-SDAP 1.3 – Interpret one- and two- variable graphs to answer questions about a situation.

5- SDAP 1.2 – Organize and display single-variable data in appropriate graphs and representations and explain which types of graphs are appropriate for various data sets.

6- AF 2.2 – Demonstrate an understanding that rate is a measure of one quantity per unit value of another quantity.

7 – SDAP 1.0 – Students collect, organize, and represent data sets that have one or more variables and identify relationships among variables within a data set…

Prerequisite Knowledge:

- Ability to organize, display, and interpret data on bar graphs and other representations.

WARM-UP: (7 minutes)

1) **Patterns, Functions and Algebra: Mystery Graph**
2) **Patterns, Functions and Algebra: Waiting For The Bus**
3) **Patterns, Functions and Algebra: Get The Most For Your Money**
4) **Patterns, Functions and Algebra: Hefty Relationships**
5) **Tell A Story: Swimming Race (debrief)**
6) **Tell A Story: Parachutist's Fall (debrief)**

(See attached pages. Each participant will receive one warm-up graph problem to interpret. Each warm-up will be printed on a separate (colored) paper. This will help identify groups by color for the activity portion of the presentation.

Set up the CBR on a table in front of the classroom.

Tell the class that the CBR is a motion detector that graphs distance over time (a graph; with only x and y axis labeled, will be in the front board of the room). The teacher will walk in front of the motion detector and the calculator graphs that motion.

"I will be moving in front of the motion detector and you will predict what the graph looks like".

1) Walk away for 6 seconds
2) Stop for 4 seconds
3) Come back for 3 seconds
4) Stop for 3 seconds

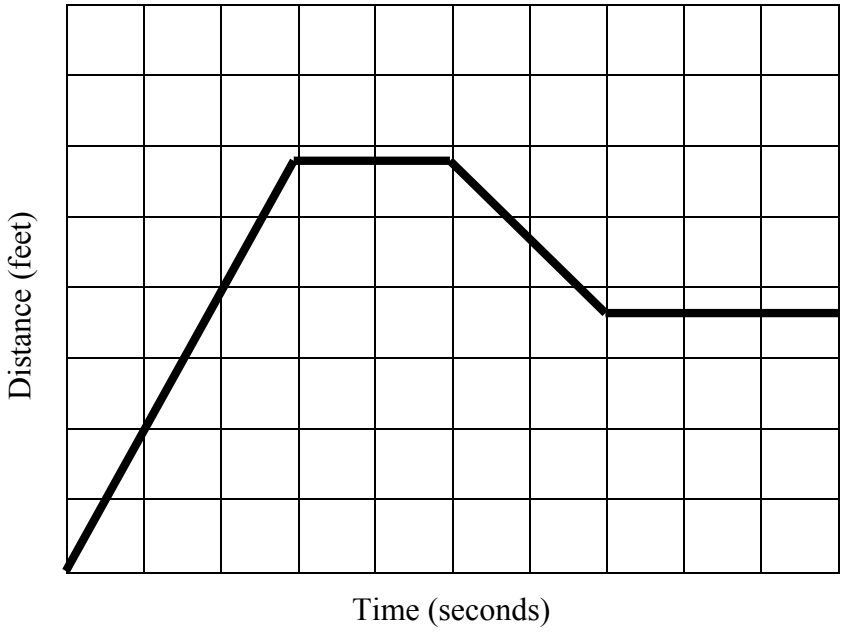
"Draw your prediction of what

The graph will look like".

"Talk to your neighbor and

See if you got the same graph.

Why or why not?"



Ask for a few volunteers to draw their interpretation on the front board and ask the class for verification. Allow for some discussion. Ask for a volunteer to replicate the graph by moving in front of the motion detector. Allow for a trial and error.

Presentation of Purpose:

Bar graph display of data and bar graph interpretation starts in 2nd grade. By 4th grade students are asked to interpret one- and two- variable graphs to answer questions about a situation. By 7th grade students are asked to identify relationships on graphs that have one or more variables. Graphs are representations or a drawing from statistical data of the relationship between things.

For example line plots are used to see frequency of data items and display a visual comparison between items. Line graphs show a change in a set of data over a period of time. The relationship of distance over time, like we just did can be graphed and interpreted. Usually in elementary school graphs are presented to students and they are asked to interpret the data. The task can be daunting for many students. Usually graphs are dense with different types of information. The

problem can have lots of numbers, words and sentences or more than one graph. The student has to interpret the context, the questions, and the data. On a multiple choice item there can be four graphs with similar vertical and horizontal units but different lines or one graph with a choice of different (and confusing) interpretations. The situations displayed by the graphs are also confusing. Usually students have no experience with items such as "Average Traffic Volume", "price per dollar for Grand Prix Go Carts", "Wading Pools" water levels, "Age of Students in a CPR class", or "Number of Common Dolphins: Santa Barbara Channel between 1995-2005".

Giving students opportunities to experiment with graphs gives them some experience to understand the context of the given information. This activity increases student's access to real-life application of a graphical representation of distance over time.

Activity:

Instructions: Each group will have a motion detector. You will go outside and experiment with it. You will have 12 minutes to do the following:

A) Form a parabola* – concave up
B) Form a parabola* – concave down
C) Form a step function ** (steps going up)
D) From a step function** (steps going down)
E) Come back with a graph on your calculator with each step (include seconds) written down on an index card.

YOU WILL RETURN IN 10 MINUTES WITH YOUR GRAPH AND INDEX CARD.

Keypad Instructions for Graphing Calculator:

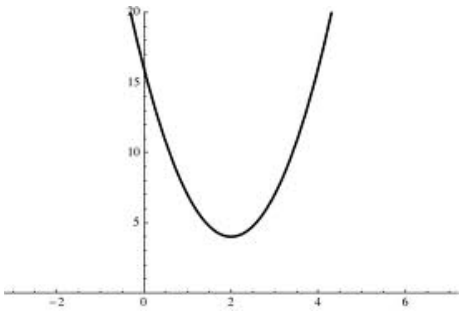
1) APPs key
2) 2 key
3) Any key
4) 3 key (Ranger)
5) Enter
6) 1 key (Set-up Sample)
7) Enter (Real Time-Yes)
8) Up Arrow ↑ (cursor now on upper screen START NOW)
9) Enter
10) Enter
11) GRAPH MOVEMENT
12) Enter key
13) 3 key (repeat sample) to start graphing movement again)

Whole Group Activity: (return)

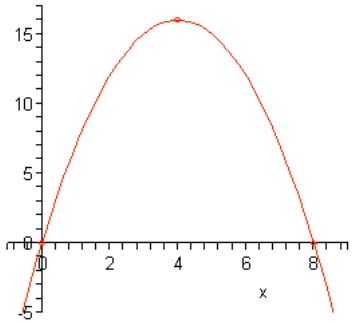
Choose a volunteer group to step to the front to demonstrate their movement. Ask the class to predict the graph. Show the graph for verification. REPEAT one more time with different groups.

Show release items (If there is time)

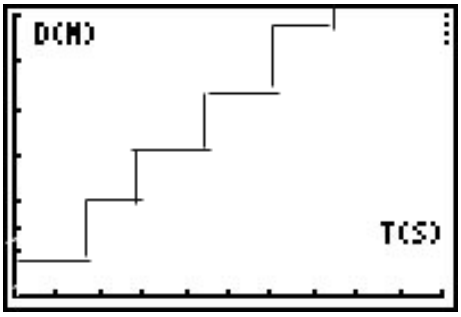
*Parabola – concave up



*Parabola – concave down



**A step function is a piecewise function defined by a constant value over each part of its domain. Its graph resembles a series of stair steps. The constant values can increase with each step or decrease with each step.

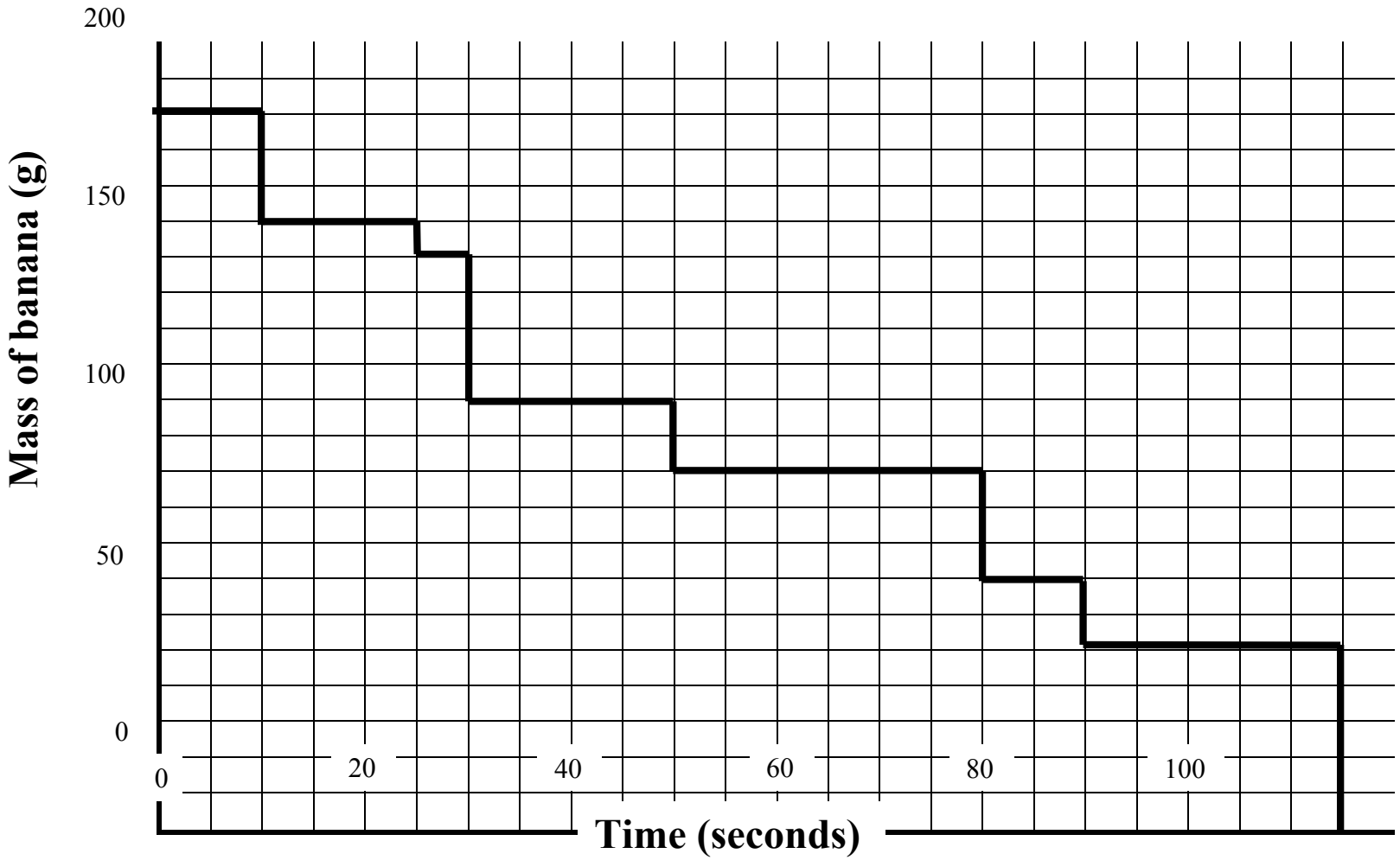
. 

Explanation:

In the event of ERROR message on the TI-83 follow the key instructions below to clear the error:

1) 2^{nd} key
2) + key
3) 7 key
4) 2 key
5) 2 key

Eating a banana graph



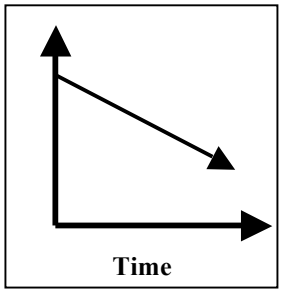
Eating a banana T-P-S

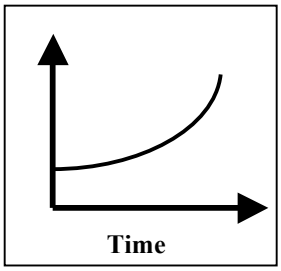
With your elbow partner discuss the graph and ask the following questions:

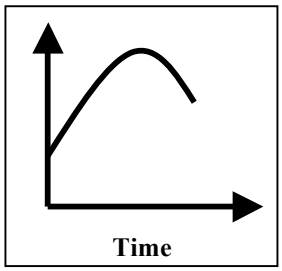
- What do the vertical portions of the graph represent?
- What do the horizontal portions of the graph represent?
- How many bites did it take to finish the banana?
- What was the weight of the biggest bite?
- How long did it take to eat the first bite?
- What is the original weight of the banana?
- How long did it take to finish the banana in seconds/in minutes and seconds?

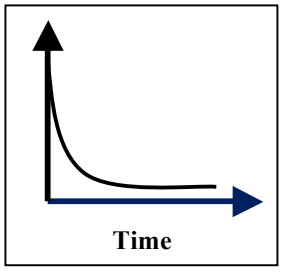
Matching graphs to statements

The number of hits on a YouTube site, which was rising steadily at the beginning of the year, is now beginning to fall.	
The number of students that are absent has been falling steadily over the last year.	
The price of gasoline was falling rapidly but is now steady.	
Car prices, which were rising slowly, are now starting to rise rapidly.	

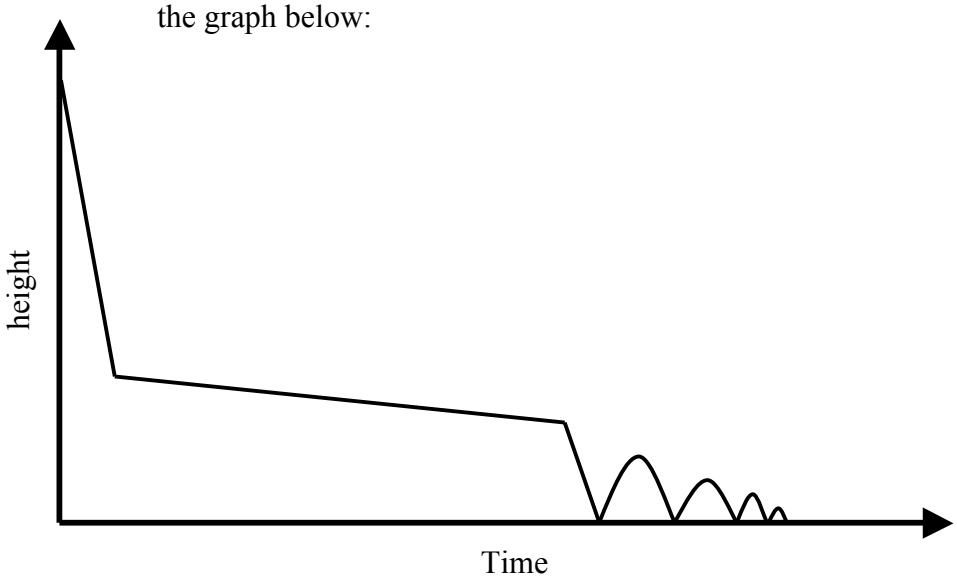








Discuss the graph with your elbow partner then write a story about a parachutist's fall based on the graph below:



Use the following sentence stems if needed:

I know that…because…

I agree because…

That makes sense because…

That is how I see it too because…

I don't think that is right since…