

# Ball Bounce III

## Algebraic Connections

Date\_\_\_\_\_ Period\_\_\_\_\_

Team Members (Indicate yourself!):

\_\_\_\_\_

\_\_\_\_\_

We now wish to explore the Bouncing Ball for one last (?) time in our quest for the Quadratic within. If “we” didn’t collect the information, then we could collect information about time as well as height from the bouncing ball. Maybe that would be where we could find the Quadratic? So, here we go with one more try!

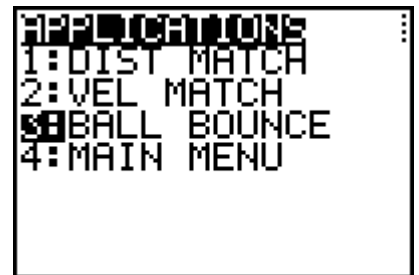
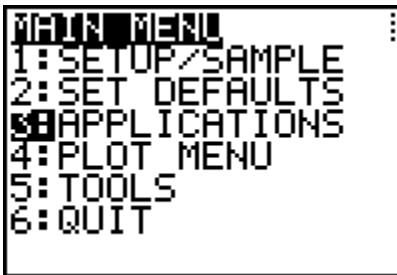
### Materials

- Racquet Ball
- 150 Centimeter Tape measure
- Digital Camera
- Pen or Pencil
- Long CBR to TI-83/82 Cable
- Tape for the wall
- TI-83 Plus/ TI-83/TI-82 graphing calculator with 8000 bytes free
- Instructions
- Clamp for the CBR
- CBR
- TI-Interactive! Excel or Graphical Analysis (Optional)
- RANGER program
- TI Graph Link

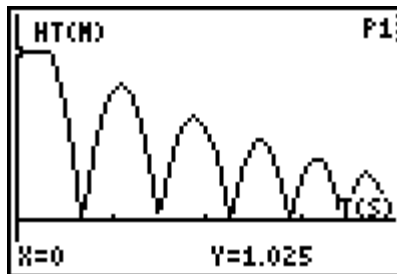
1. In your group, collect the data for a dropped ball when it is dropped from a height of just above 100 centimeters. Pick a location from which you can attach the CBR clamp so that the “eye” of the range finder is 150 cm above the floor. The goal is to use the RANGER program, using the Ball Bounce application to get data for about 5 or 6 bounces, with the times that are associated with the bouncing ball. Drop the ball so it moves straight up and down as it bounces.
2. Set up the experiment and test it out with the RANGER program.
3. To get the RANGER program into your calculator, make sure you have enough free space (press **y** [MEM] and see if you have at least 8000 bytes free). If needed, go to the Graph Link and save your files so that you

may then delete them, or just delete them. If you have a TI-83 Plus you may ARCHIVE files to free up working memory. This program uses list L1 through L6, so they will be erased as you do the experiment. Connect the CBR to the calculator and prepare the calculator to receive. If the screen shows Waiting.... Then press the 82/83 button on the CBR to send the RANGER program. TI-83 Plus people may use the CBL/CBR APP, and select RANGER from that menu.

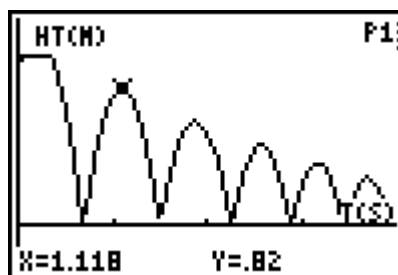
- Run the RANGER program and select 3:APPLICATIONS from the MAIN MENU. Then select 1:METERS from the UNITS? Menu and 3:BALL BOUNCE from the APPLICATIONS Menu.



- Follow the instructions and drop the ball, just after your partner presses the TRIGGER on the CBR. The ball should be held under the CBR at just above 100 cm from the floor, so that the CBR will pick up the bounces from 100 cm down. If you get a graph like this, then you have your data! It will take several trials to get data like this.



- Trace on this data to make sure you have at least 100 cm as the first bounce. In this case we have 82 cm.

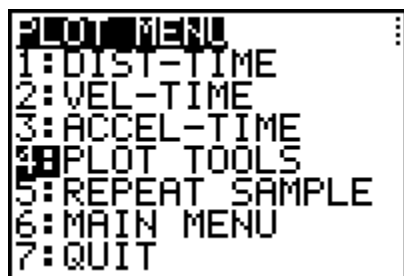


7. Take a Digital photograph showing your experimental set up and the positioning of the ball as it is dropped.
8. Trace along the graph and identify the X (time in seconds) and Y (height in meters) of each peak of the graph. This represents the height of each bounce. Call the 1<sup>st</sup> good peak Bounce 1. Fill in the data in TABLE 1. Collect as many peaks as you are sure of.

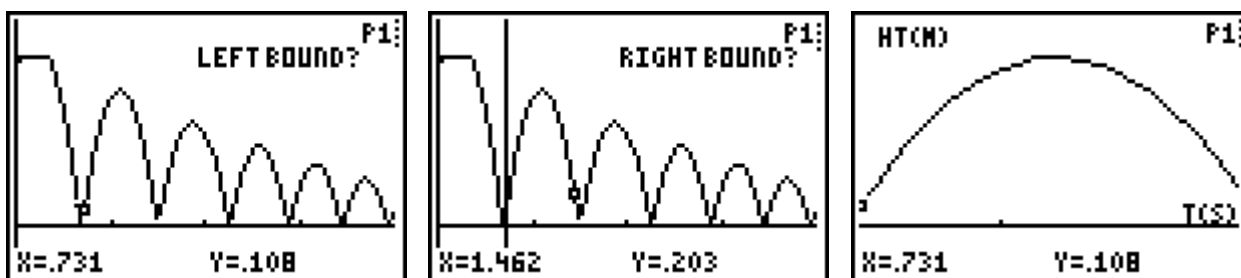
**Table I**

Bounce Number	Time (seconds)	Height (cm)
1		
2		
3		
4		
5		
6		
7		

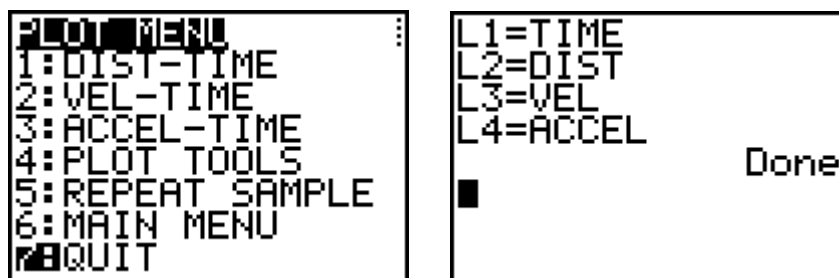
9. Now select off one bounce to see the Quadratic. From the PLOT MENU pick option 4:PLOT TOOLS and the 1:SELECT DOMAIN from the PLOT TOOLS menu.



10. Move the cursor to select the Left and Right bounds of one complete bounce. Make sure you collect only data for that bounce and not grab data from the bounce before and the one after. If you are successful, your graph should look like mine.



11. Leave the program and share the lists (L1 and L2) with your team members. Make sure everyone has the data before you leave class, and someone should place it on the computer for safe keeping. If you screw up the data, you might be able to pull it off of the CBR again, before the next class uses it.



12. Calculate the Ratios of the Heights from Table I and then report the Average Ratio.

**Table II**

Ratio of Bounce Heights

13. Average of the Ratios: \_\_\_\_\_

14. Now we wish to get the name of the Quadratic that represents this bounce. Go to the **0** editor and place in the other general form of the Quadratic. Let A, H, and K have their default values.

```

P1ot2 P1ot3
Y1: A(X-H)²+K
Y2:
Y3:
Y4:
Y5:
Y6:
Y7:

```

```

1→A:0→H:0→K

```

15. Before we test this choice out, let us change the values of the distance in **L2** to centimeters. This will help us as we calculate, and guess BubbleBaby.

```

SetUpEditor
Done
round(L2*100,0)→
L2
(1100 2600 4000...

```

16. Make sure your Plot is set up correctly and then **q** <sup>®</sup> .

```

P1ot2 P1ot3
Off
Type: [ ] [ ] [ ]
Xlist: L1
Ylist: L2
Mark: [ ] [ ] [ ]

```

```

MEMORY
4: ZDecimal
5: ZSquare
6: ZStandard
7: ZTrig
8: ZInteger
9: ZoomStat
0: ZoomFit

```

17. Adjust the values of A, H, and K until you have the best fit.

18. Turn in your work from the calculator, with the photo and the lists with this sheet.