Name _____

Date _____

EXPLORATIONS

ACTIVITY 11

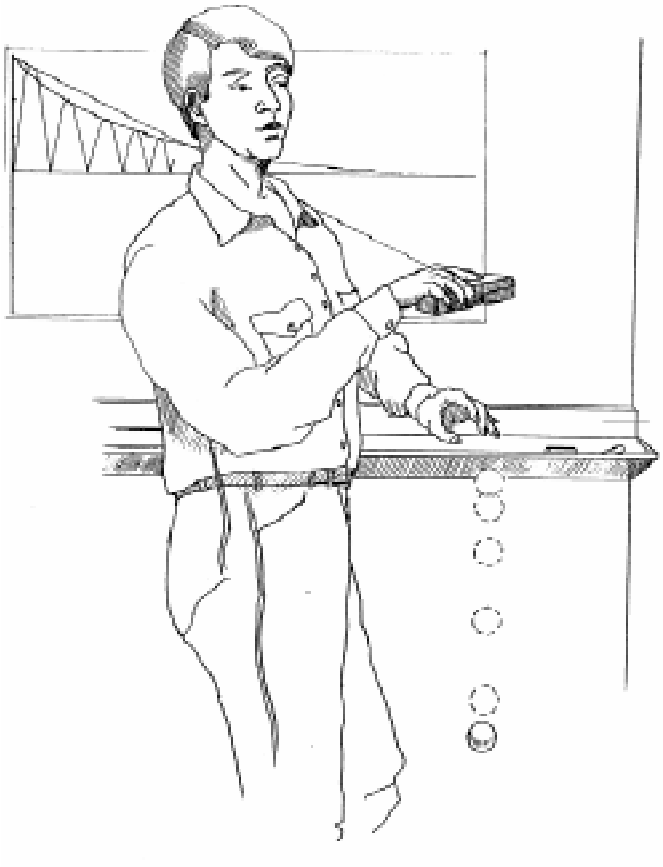
Bounce Back

When a ball is dropped from a given height, is there a pattern to the rebound height of the ball? Is there a model that can be used to predict the height of the ball for a particular bounce?

In this activity, you will explore the rebound height of a ball and develop a function that will model the rebound heights for a particular bounce. The model can then be used to predict the height of the ball for any bounce.

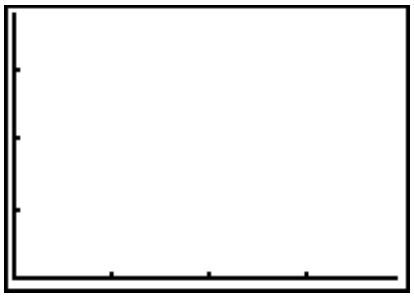
You'll Need

- 1 CBR unit
- 1 TI-83 or TI-82 Graphing Calculator
- Ball (a racquet ball works well)



Instructions

1. Run the **RANGER** program on your calculator.
2. From the **MAIN MENU** of the **RANGER** program, select **3:APPLICATIONS**.
3. Select **1:METERS**, then select **3:BALL BOUNCE**.
4. Follow the directions on the screen of your calculator. Release the ball. Press the TRIGGER key on the CBR as the ball strikes the ground.
5. Your graph should have a minimum of five bounces. If you are not satisfied with the results of your experiment, press ENTER, select **5:REPEAT SAMPLE**, and try again.
6. When you are satisfied with your data, sketch a Distance-Time plot.

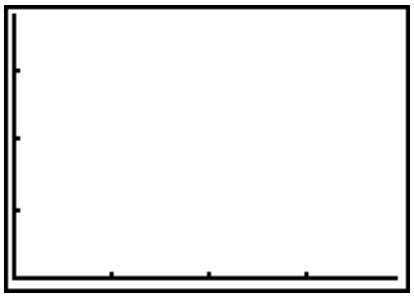


Data Collection

1. Use ▶ (the right arrow key) to trace to the approximate vertex of the first bounce. Record the coordinates of this point in the table below. Repeat for four more bounces.

Bounce	***t***	***y***
1		
2		
3		
4		
5		

2. Press ENTER to return to the **PLOT MENU**. Select **7:QUIT** to exit the **Ranger** program.
3. Press STAT, select **1:Edit** to enter the coordinates of each vertex in Lists 5 and 6. Enter the t-coordinates in **L5** and the y-coordinates in **L6**.
4. Press 2nd **[STAT PLOT]**. Select **2:Plot2.** Highlight **On**, and press ENTER. This will turn on the scatter plot of the maximum height of each bounce versus time. Select ⌐∿ for the **Type** of plot, **L5** for the **Xlist**, **L6** for the **Ylist**, and the **square** for the **Mark**. Press GRAPH. Sketch a plot of this data.



Questions

1. What is the equation of the line that would best fit this data?

> **For the TI-83:** Press STAT ▸ and select **4:LinReg(ax+b)**.
>
> **For the TI-82:** Press STAT ▸ and select **5:LinReg(ax+b)**.

This will place the command **LinReg(ax+b)** on the home screen. Press 2nd **[L5]** , 2nd **[L6]** ENTER to find the linear regression. Record the equation of this line:

$y =$ _____

Press Y= and store the equation in **Y1** by entering the equation and pressing ENTER.

2. Press GRAPH. Describe how well this line fits the data.

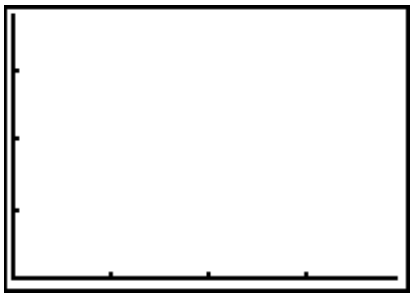
_____

_____

_____

_____

_____



3. Sketch a plot of the graphs in the space provided.

4. What is the equation of the exponential function that would best fit this data?

> **For the TI-83:** Press STAT ▸ and select **0:ExpReg**.
>
> **For the TI-82:** Press STAT ▸ and select **A:ExpReg**.

This copies the command **ExpReg** on the home screen. Press 2nd **[L5]** , 2nd **[L6]** ENTER to find the exponential regression. Record the equation of this function:

$y =$ _____

Press Y= and store the equation in **Y2** by pressing ▾, entering the equation, and pressing ENTER.

Press GRAPH. Describe how well this function fits the data.

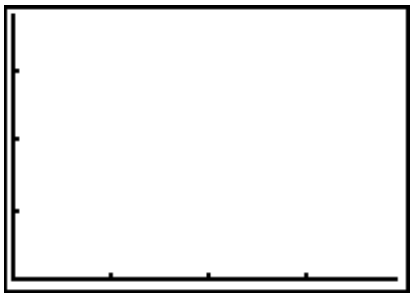
_____

_____

_____

_____

_____



6. Sketch a plot of the graphs in the space provided.

7. Press WINDOW. Change the **Xmax** value to 10 seconds and the **Ymin** value to –4 meters. Press GRAPH. Sketch the plot of the graphs in the window at the right.

8. Using each model, predict the maximum possible rebound height of the ball.

Time (seconds)	Rebound Heights	
	linear	exponential
5s		
6s		
7s		
8s		
9s		

Make a Mathematical Statement

1. Which type of function do you think best fits this data?

_____

2. Explain why you made this choice.

_____

_____