FUNCTIONS EXPERIMENT
BOUNCING BASKETBALL

Introduction

When a basketball is dropped and allowed to bounce on a hard surface, the height to which the ball rebounds is typically less than its initial height. This is because some of the ball's energy is dissipated as it collides with the surface. The goal of this experiment is to determine how the rebound height of a ball decreases as it continues to bounce. In this experiment we will use the motion detector to measure the height of the ball as it bounces after being dropped. From this data we will determine the rebound height of the ball after each bounce.

Equipment and Setup

For this experiment you will need a TI calculator with the Vernier PHYSICS program loaded, a CBL unit, a motion detector, and a basketball.

Plug the motion detector into SONIC on the CBL unit. Select the PHYSICS program on the calculator. In the home menu choose SET UP PROBES. When asked for the number of probes, enter 1. In the next menu choose MOTION. The screen will display the home menu again. Now select COLLECT DATA, and choose TIME GRAPH. Set the calculator to take 90 measurements 0.05 second apart.

Procedure

When the calculator is ready to begin taking measurements, have a student hold the motion detector high above the ground. Another student will drop the ball directly under the motion detector as soon as the motion detector can be heard clicking. After collecting the data, view the graph of distance versus time. (Press ENTER to move from the graphing screen back to the SELECT GRAPH menu.)

Note: The graph displayed will be the graph of the distance of the ball from the motion detector versus time. If you want to get the graph of the height of the ball versus time, simply find the maximum distance recorded by the motion detector and create a new list by subtracting distance from the maximum distance.

Data

While viewing the graph of the height of the ball versus time, use TRACE to locate the maximum height of the ball on each bounce and record the information in the table below.

Number of bounces	0	1	2	3	4	5	6
Rebound height							

Analysis

1. Determine if an exponential model is appropriate for approximating the rebound height data by graphing the natural logarithm of the height versus the number of bounces. What characteristics of the graph convince you the rebound height data is exponential?

2. Find the equation of the regression line for the logarithm of the data.

3. Use your answer to Part 2 to find an exponential function that approximates the rebound height data.

4. Check your formula by graphing it with the rebound height data.

5. Describe how the rebound height of the basketball decreased with each bounce. On average, by what percentage did the basketball's rebound height decrease with each bounce? How did you determine this?

6. Suppose we consider a rebound height of less than 0.01 meter to indicate the ball has stopped bouncing. Use your formula from Part 3 to determine how many times the ball bounced after it was dropped before it stopped bouncing.