FUNCTIONS EXPERIMENT
BALL DROP

Introduction

This experiment involves dropping a basketball and measuring the height and speed of the ball during the drop. You will use the data you collect to describe the motion of falling objects.

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.

Place the motion detector on the floor and set a stack of books on both sides of the motion detector to protect the detector from the falling ball. 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 16 measurements 0.05 second apart.

Procedure

When the calculator is ready to begin taking measurements, have a group member stand on a chair and hold the motion detector facing the ground, and have another group member hold the basketball directly under the motion detector. The basketball should be released as soon as the motion detector begins clicking. After collecting the data, view graphs of the distance of the ball from the motion detector versus time and the speed of the ball versus time. (Press ENTER to move from the graphing screen back to the SELECT GRAPH menu.) In our analysis of the data, we will ignore data points taken before the ball was dropped and after the ball bounces.

Data and Analysis

Distance versus Time

1. Complete the table below showing the distance between the ball and the motion detector at the given time.

t=time (seconds)	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40
D=distance (meters)								
t=time (seconds)	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80
D=distance (meters)								

2. Make a graph of D versus t. Is it appropriate to approximate distance with a linear function? Why or why not?

3. Complete the table below showing the distance the ball traveled over the given time interval.

Time interval	0.15 to 0.20	0.20 to 0.25	0.25 to 0.30	0.30 to 0.35
Distance traveled				
Time interval	0.35 to 0.40	0.40 to 0.45	0.45 to 0.50	0.50 to 0.55
Distance traveled				

4. Use the graph of D versus t and the table above to describe how the ball falls. How does the data support what you already know about gravity and falling objects?

Speed versus Time

1. Complete the table below showing the speed of the ball at the given time.

t=time (seconds)	0.05	0.10	0.15	0.20	0.25	0.30	0.35
S=speed (meters per second)							
t=time (seconds)	0.40	0.45	0.50	0.55	0.60	0.65	0.70
S=speed (meters per second)							

2. Input the data from the table above into your calculator and make a plot of S versus t. Is it appropriate to approximate the speed of the ball with a linear function? Why or why not?

3. Find the equation of the regression line giving S as a function of t, and add the graph of S to your graph in Part 2.

4. Identify the slope in your formula for S, and explain its meaning in practical terms.

5. In the first part of the analysis, you determined that the data showed that objects speed up as they fall. What does this part of the analysis tell us about how the speed of falling objects increases?