Having a Ball

Concepts

- Proportional reasoning
- Rate of change
- Function

Materials

- TI-84 Plus
- Balls with 2 - 4 inch diameter that will bounce well (tennis balls, high-bounce balls, at least 1 for every 5 participants-- it is okay for different groups to have different kinds of balls to bounce)
- Tape measures (meter sticks are less desirable), at least 1 for every 5 participants
- Masking tape

Overview

In this activity, we will collect data from bouncing balls. The data will be analyzed to find the relationship between drop height and bounce height.

Collecting the Data

1. Have participants divide into groups to gather data. (The number of groups depends on the amount of equipment available.) Sometimes the groups like to fasten the tape measures to the wall with masking tape.
2. Drop the ball from the first specified height. Record the bounce height (to the nearest centimeter). Repeat once or twice to practice consistency in measurement. If you have plenty of time, have groups drop the ball three times from the same height and get an average bounce height.
3. Repeat for the other specified drop heights.

Analyzing the Data

1. Collect data from all groups in which L1 = drop height and L2 = average bounce height.
   - The operations (group 1 + group 2 + group 3 + group 4) / 4 are performed while in [STAT] EDIT L2 (1)-- cell one of list 2.
   - This average is recorded on paper.
   - Use a different list location for each type of ball bounced.
2. Create a scatterplot of the data (L1, L2).

3. Determine an algebraic model that fits the data.
   - *This IS NOT using LinReg.*
4. Enter this equation in [Y=], and graph to see how well it fits the data.
5. Use the graph and tables to answer *what ifs.*
   - What if we dropped it from 300 cm? What was the drop height if it bounced 58 cm? ...
6. Demonstrate use of [STAT] CALC menu: Manual Fit, Med-Med, LinReg (ax + b).
7. Demonstrate pasting the regression equation into [Y=].
   - Demonstrate the difference between LinReg (ax + b) and LinReg (ax + b) L1, L2, Y1.
   - If a second type of ball was used, do steps 2-6 using (L1, L3), and compare them.
   - What does it mean for one line to have a greater slope?
   - Is one of the balls more predictable than the other?

Some Sample Data

Drop height (cm)	Bounce height (cm)	Bounce height (cm) different ball
200	101 1/3	157
175	93.54	136
150	81	120
125	68	100.5
100	57.89	81.5
75	44	55
50	29.5	39.5
25	16.5	18.5

Extension

1. The TI-Navigator™ System could be used to collect, aggregate, and then send data from groups using the same type of ball.

