TEACHER INFORMATION

Making Cents of Math:

Linear Relationship between Weight and Quantity

1. There are currently 2 different combinations of equipment that will work for collecting force data. The most common method, which works for both the TI-83 Plus and TI-84 Plus families of calculators, is to use a Force Sensor attached to a CBL 2 or LabPro.

   The TI-84 Plus calculator has a USB port located at the top right corner. Using the USB port, an EasyLink with a Force Sensor can be connected to collect force data. For more information on EasyLink refer to Page *ix* located in the front section of this book.

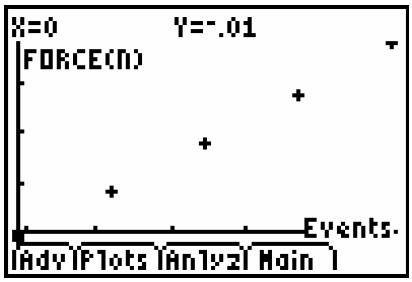
2. When connecting an EasyLink to a TI-84 Plus calculator using USB, the EasyData application automatically launches when the calculator is turned on and at the home screen.

3. Be sure that the Force Sensor is positioned as shown in the setup diagram and that nothing is in contact with the hook except for the penny cup string.

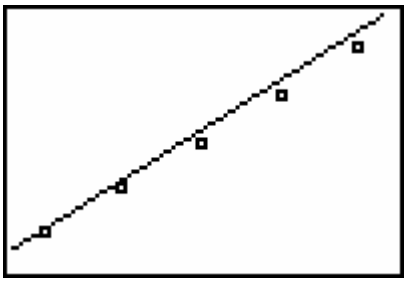
4. Pennies minted between 1959 and 1981 are composed of 95% copper and 5% zinc with an average weight of 0.030 N, or a mass of 3.11 g. Pennies minted from 1983 on are composed of 99.2% zinc and 0.8% copper with an average weight of 0.0245 N. That's why it is important to sort the pennies by date before conducting the experiment.

5. Each time pennies are added to the bucket, students should wait until it stops swinging before pressing Keep to collect the weight data. Be sure that nothing is touching the penny bucket while readings are being taken.

SAMPLE RESULTS



Raw data in EasyData



Data with model line

DATA TABLE

Number of pennies	Weight in Newtons
0	– 0.01
8	0.17
16	0.36
24	0.56
32	0.77
Model equation	y = – 0.01 + 0.026 x
Regression equation	y = – 0.02 + 0.024 x

ANSWERS TO QUESTIONS

1. Answers will vary but should be close to 0.025.
2. The *x* values correspond to the number of pennies.
3. The *y* values correspond to the weight of the pennies.
4. The slope represents the change in the weight of the pennies in Newtons divided by the change in the number of pennies.
5. The value for slope in this data set represents the weight in Newtons per penny.
6. The *y*-intercept is –0.01 N, as read from the table.
7. The model is a good fit for the data, but not all the points are similarly close to the model line.
8. The calculator's regression line is very close to all the points, and is similar to the model developed using only two points for the slope.
9. Since quarters weigh more, the slope of the graph would be larger.
10. The slope would represent the weight in Newtons per quarter, or the weight of a quarter.