

4.10 Modeling Data with a Quadratic Function

MATERIALS • compass • 50 pennies • graphing calculator

QUESTION How can you fit a quadratic function to a set of data?

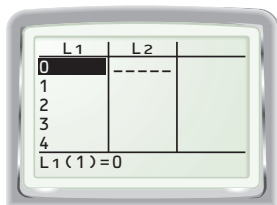
EXPLORE Collect and model quadratic data

STEP 1 Collect data

Draw five circles using a compass. Use diameters of 1 inch, 2 inches, 3 inches, 4 inches, and 5 inches. Place as many pennies as you can in each circle, making sure that each penny is completely within the circle.

STEP 3 Enter data

Enter the data you collected into two lists of a graphing calculator.



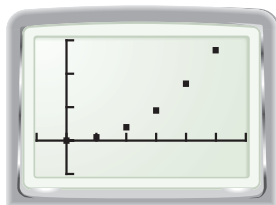
STEP 2 Record data

Record your results from Step 1 in a table like the one shown at the right. Also, record the number of pennies that would fit in a circle with a diameter of 0 inch.

Diameter of circle (in.), x	Number of pennies, y
0	
1	
2	
3	
4	
5	

STEP 4 Display data

Display the data in a scatter plot. Notice that the points appear to be a power function.



STEP 5 Find model

Use the general equation of a power function to find a model for the data.

$$y = ax^n$$

DRAW CONCLUSIONS Use your observations to complete these exercises

- Graph your model from Step 5 on the same screen as the scatter plot. Describe how well the model fits the data.
- Use your model from Step 5 to predict the number of pennies that will fit in a circle with a diameter of 6 inches. Check your prediction by drawing a circle with a diameter of 6 inches and filling it with pennies.
- Explain why you would expect the number of pennies that fit inside a circle to be a quadratic function of the circle's diameter.
- The diameter of a penny is 0.75 inch. Use this fact to write a quadratic function giving an upper limit L on the number of pennies that can fit inside a circle with diameter x inches.