

**Title:** [A Different Way of Measuring](#)

**Adapted from** [Jefferson Lab Teacher Resources](http://education.jlab.org/indexpages/teachers.html) <http://education.jlab.org/indexpages/teachers.html>

**Objective:** To determine the size of an object by indirect measurement.

**Materials:** Dime sheet

**Procedure:**

1. Draw a 10 cm by 10 cm square on a blank page in your lab notebook  
USE A RULER.....DRAW CAREFULLY  
Write the exact measurements down!
2. Place 50 dots within the large square.  
Make the dots as small as possible.  
Scatter the dots randomly over the area of the square.  
Recount to make sure you have made 50 dots.
3. Place the dime sheet under the data sheet and align the squares.
4. Circle every dot that landed on a dime and circle half of the dots that partially landed on a dime.
5. Record the number of dots circled.
6. Determine the RATIO of dots circled to total number of dots  
Convert this fraction to a decimal.....this is a PROPORTION  
(This is related to the area covered by the dimes. For example, if 0.20 of your dots are circled, you can ASSUME that 0.20 of the square is covered by dimes.)
7. Determine the total area (cm<sup>2</sup>) of the square.  
Remember: area of a square = s<sup>2</sup> or lw
8. Determine the area (cm<sup>2</sup>) covered by all the dimes  
This would be the area of the square multiplied by the proportion of dots circled!
9. Divide the area covered by the dimes by the total number of dimes to determine the area of 1 dime.
10. REPEAT PROCEDURE so that you have 2 sets of calculations and values for the area of the dime.  
You will need to draw a new square and scatter 50 dots in that square!
11. Make a data chart to record your results and class results
  - Gather the results of 4 other class groups...you should have a total of 10 dime measurements!
  - Determine the CLASS AVERAGE for the area of a dime.
12. Calculate the percent error:

$$\% \text{ Error} = \frac{A - O}{A} \times 100$$

**Discussion:**

- Summarize what you did.
- Explain how this is an indirect measurement technique
- Compare your results to the class average.
- Comment on the importance of repeated measurements
- List sources of error
- Suggest improvements to the procedure

**Conclusion:**

***The area of a dime is \_\_\_\_\_ ± \_\_\_\_\_ %***

**Reflection:** Personal commentary

