

Laboratory Investigation Using a Graph to Find Area

Modern technology makes it possible for paper and cardboard mills to produce products of extremely uniform thickness. Many of these paper products are used in your everyday life__ for example, notebook paper, cereal boxes, or tissues. In this activity, you will be using a sample of ordinary poster board with uniform thickness to study area. Since the thickness is constant, you can measure the mass and area of rectangular poster board samples and graph the data to find a relationship between mass and area (mass/area). Using the graph, you will then be able to find the unknown area of an irregularly shaped sample of poster board.

Materials: Balance 4 Rectangles of Different Sizes
 Graph Paper One Irregular Piece of Poster Board
 Ruler (cm scale)

Procedure:

Prior to lab, construct a table to record all measurements and calculations.

Measure the mass (0.01 g), length, and width of all 4 rectangles. **(use correct number of significant figures)**

Mass the irregular piece of poster board (0.01g).

Record all data in a carefully prepared table.

Calculations and Results:

For all calculations the process used must be illustrated for any credit. USE UNITS AND ROUND OFF ALL ANSWERS TO THE CORRECT NUMBER OF SIGNIFICANT FIGURES.

1. Calculate the Area (cm^2) of each regular shaped rectangle.
2. Prepare a graph of mass versus area for your rectangular samples. Follow the graphing instructions included with this activity.
3. Draw a "best-fit" curve for your data points.

Why should the curve on your graph go through the origin?

4. From your graph, determine the area of the irregular piece of poster board. Record results into data table.

Summary:

1. Use the graph to find the mass of a poster board sample with an area of 300 cm^2 .
2. What is the mass of 1 cm^2 of poster board?
3. Find the mass of a whole sheet of poster board measuring 7.12 cm by 56.4 cm .
4. Determine the mass of a piece of poster board 100 m by 50 meters .

Rules for Good Graphing

1. Give your graph a descriptive **title**.
2. **Indent** the axes from the edge of the graph paper and draw them with a **straight edge**.
3. **Label** each axis and indicate the **units** used.
 e.g. temperature (°C)
 mass (g)
 distance (cm)
4. Choose an **appropriate scale** that allows you to get all data on the graph. Check the largest and smallest values to determine the range for each axis. For most graphs there is **no need to begin the scale at zero**.
5. Chose a **convenient scale**. A graph is easier to read and/or plot when each square represents a value of 1, 2, 5, or a multiple of ten times these numbers: 10, 20, 50, or 0.2, 0.5.
6. Draw a **smooth curve or straight line** to represent the general tendency of the data points. Graphs drawn in math classes represent absolute numbers, and each data point falls on the curve being plotted. This situation is seldom the case in science, where the data points represent experimental measurements. Data points based on experimental measurements have uncertainty associated with them.

Graphs should be made on....

*Graph
Paper*

COMPUTER GRAPHING:

The Dependent Variable (Y-axis) is generally what you are trying to determine. In a linear relationship, $Y = mX + b$. If you are using the graph to determine area, then the Y-axis should be area.

Many graphing programs and graphing calculators will compute the relationship between the X and Y (Mass and Area) variables. For example, the computer or calculator may indicate that $Y = 0.45112 + 26.5467X$. This formula for a line can then be used to calculate Area (Y) or Mass (X). Suppose that you were told that the poster board had a mass of 4.52 grams. The calculation below will determine Area.

$Y = 0.45112 + 26.5467X$	= αρεα = Ψ ασσ
$\Psi = 0.45\chi\mu^2 + 26.55\frac{\chi\mu^2}{\gamma}(4.52\gamma)$: η ααηεινπερχεπ ανδ σλοπε ηαπε βεεν ρου
$\Psi = 0.45\chi\mu^2 + 120.\chi\mu^2$: σιφγσ Note
$\Psi = 120.\chi\mu^2$: 0.45 ισ νδ ηα γνιφχαντ ηερε