

**I. Volume of a Paper Cup** Select one of the paper cups that has a known volume in ml. (1 ml = 1 cu. cm). Trace a side of the paper cup on the axes below as shown in the diagram. The height of the cup should lie horizontally along the x-axis. Record three to five data points traced along the edge of the cup, measuring in centimeters, rounded to the nearest tenth.

Use a linear regression to find the equation of the line that best fits the side of the cup. Store the equation in  $Y_1$  and record it here, rounding coefficients to the nearest hundredth.

$Y_1 =$  \_\_\_\_\_

Set up an integral to compute the volume of the cup. If you centered the cup at the origin, the lower bound will be 0. What is the upper bound? Write the integral here.

\_\_\_\_\_

Use your calculator to compute the integral, and compare your answer to the stated volume of the cup.

Calculator = \_\_\_\_\_ Stated volume = \_\_\_\_\_ difference = \_\_\_\_\_

% error = difference / stated volume = \_\_\_\_\_

Now use Geometry to compute the volume of the cup. A paper cup is a frustum of a cone. Look up that formula, and compute the volume. Record the cup's height, top radius and bottom radius.

h = \_\_\_\_\_ top radius = \_\_\_\_\_ bottom radius = \_\_\_\_\_ Volume = \_\_\_\_\_

**II. Designing a Box** Design a box so that it has the same volume as the cup in part I. Record the dimensions of your box below (in cm).

Length = \_\_\_\_\_

Width = \_\_\_\_\_

Height = \_\_\_\_\_

**III. Area and Volume** Consider the curve  $y^2 = 4+x$  and chord AB joining points A (-4,0) and B (0,2) on the curve.

a) Sketch the problem situation below.

b) Find the x- and y-coordinates of the point on the curve where the tangent line is parallel to chord AB. What theorem does this illustrate?

c) Find the area of the region R enclosed by the curve and chord AB. Show the integral you set up.

d) Find the volume of the solid generated when the region R, defined above, is rotated about the x-axis. Show the set up of the integral. You may use your calculator to compute the volume, if you wish.