CALCULUS PROJECT

VOLUME OF A SOLID WITH KNOWN CROSS SECTIONS

Description:

You are to construct a model of a solid with a known cross-section. The envelope functions can be any functions except linear or quadratic functions. The cross-sections can be any shape. Extra points may be awarded for more challenging functions and/or cross sections.

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<th>The length of the model depends on the thickness of the material, but must fit the following inequality:</th>
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| \[
\frac{\text{Length of Model}}{\text{Thickness of Material}} \geq 24
\] |

For example: A model that is six inches long should be made with building material that is no greater than .25 inches thick.

Suggested materials needed:

Some sort of building material (cardboard, foam board, wood, etc.), object to cut building material (scissors, Exacto knife, saw, etc), glue (or some other adhesive material), pens, markers, compass, ruler, calculator/computer, and some time.

Grading Criteria:

#1: [10 points] Create a region based upon 2 or more envelope functions. They are called envelope functions because they enclose the region. In other words, define the region that will be used as the base of your solid. Remember, you may not use linear or quadratic functions. Extra points may be awarded for more challenging functions and/or regions.

#2: [10 points] Decide upon a cross-sectional shape. An equilateral triangle or rectangular shape would be the easiest. Extra points may be awarded for more complicated shapes.

Before moving on to the actual construction of the model think about how large or small your model will be. Some projects in the past ended up being about 3 feet tall.

#3: [10 points] Make sure that your building material meets the requirements in the box above.

#4: [10 points] A detailed drawing/model must be given showing how the volume is calculated from the dimensions for ONE slice of your model.

#5: [10 points] You must provide a spreadsheet/chart giving the important dimensions of EVERY slice along with the volume of each slice.

#6: [10 points] You must show the total volume of the model from the spreadsheet.

#7: [10 points] You must show the definite integral that gives the theoretical volume of your model.

#8: [10 points] You must then integrate the definite integral. If the function cannot be integrated by hand, you may use your calculator to give an approximation. Extra points may be awarded if the integral is calculated by hand with all appropriate work neatly shown.

#9: [10 points] The two volumes must be reasonably similar.

#10: [10 points] Presentation and Neatness. Your project should be displayed on some sort of poster/foam board will all the above requirement easily identified.

This project is worth 100 points and counts the equivalent of a Chapter Test.