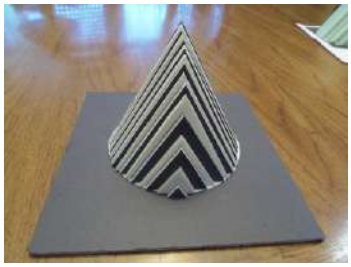
AP Calculus AB spring final project

Volume of a solid with a known cross-section



You will construct a model with a known cross-section. The enveloping functions can be any functions except for linear or quadratic. The cross-section may be any shape; rectangles or equilateral triangles will be easiest.

The size of your model will depend on how thick your cross-sections are, but the overall length of your model should fit this inequality:

$$\frac{\text{length of model}}{\text{thickness of material per slice}} \geq 24$$

So…if your model is 6 inches long, your slices should be no more than 0.25 inches thick.

List of materials suggested:

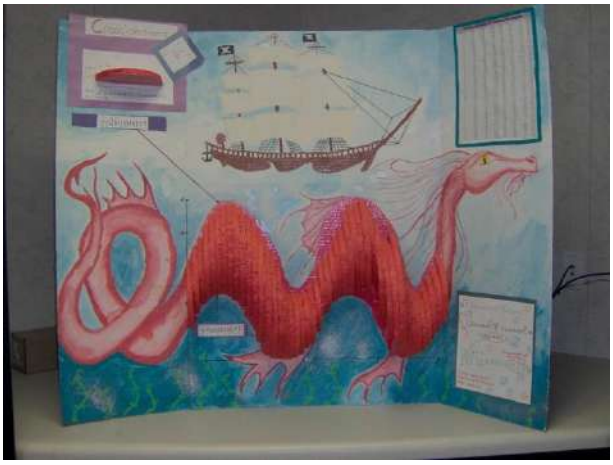
Backboard material (cardboard, foam board, etc.) cutting utensil (scissors, razor knife, etc.) glue (crazy glue, hot glue, etc.) pens, markers, compass, ruler, calculator or computer and TIME. This is far too complicated to complete in one night, so <u>don't wait until the last minute</u>.

How to:
Create the base from two or more functions that are NOT quadratic or linear. (A circle is one function, btw.)

1. Determine your cross-sectional shape.
2. Decide how large your model will be, and make sure that your building material meets the requirements of the inequality.
3. Provide a graph of the enveloping functions as the base.
4. Provide a detailed drawing or model of one cross section and show how the volume is calculated for that specific slice of your model.
5. Provide a spreadsheet (this is easiest because you can use a formula) or a chart that gives the dimensions of each slice and the volume of each slice.
6. Show the total volume of your model based on your spreadsheet or chart.
7. Use calculus and a definite integral that gives the theoretical volume of your model and calculate the definite integral. (You do not have to do the integration by hand.) It should be reasonably close to the actual volume of the model.
8. Make a statement about why your volume is or is not close to the theoretical volume
9. Incorporate your shape into a larger theme that is presented on your backboard.
10. This is due on exam day (5/18) and will count as your final exam grade, 20% of your overall grade.

*Late submissions will be accepted, but you will lose 10% per day late.

Examples



A word about cheating vs. not cheating:

Cheating: Fred does not know how to use a spreadsheet so Sandy does the spreadsheet for him.
Not Cheating: Fred does not know how to use a spreadsheet so Sandy explains to Fred how to use a spreadsheet without doing it for him.

Cheating: Electra is running out of time on her project so Travis does almost all the work in making a physical model.
Not Cheating: Two people get together, check calculations, and help each other cut out the shapes for the physical model.

Cheating: Having someone else make the physical model for you.
Not Cheating: Having someone help hold the model as you glue it together.

Cheating: Asking a classmate to figure out the integral for your cross-section and copying it.
Not Cheating: Getting help from your teacher or a classmate on how to set up the integral for the cross-section.

Cheating: Taking credit for work that is not your own.
Not cheating: Getting feedback from others on the work you have done on your project so far.
Not cheating: Having a Project Party and sharing materials and helping each other cut out cross sections.

Name _____

Scoring

Item	5	2.5	0	score
Region	2 or more non-quadratic/linear functions	Used one or more quadratic/linear function	No model	
Building material	Meets inequality requirements	Does not meet inequality requirements	No model	
Drawing for one slice	Drawing is detailed, shows dimensions and calculates volume for one slice	Drawing is not detailed or is missing at least one characteristic	No drawing	
Chart for total volume	Chart is easy to read and complete for each slice, showing total volume	Chart is not easy to read or is incomplete	No chart	
Definite integral	Provides correct definite integral to determine theoretical volume	Provides incorrect definite integral to determine theoretical volume	No definite integral	
Theoretical volume	Calculates theoretical volume correctly	Calculates theoretical volume incorrectly	No calculation	
Volume comparison	Effectively explains similarities/differences in theoretical/actual volume	Ineffectively explains similarities/differences in theoretical/actual volume	No comparison	
Presentation	Model is carefully constructed and attractive	Model appears to be a last minute effort	No model	

Total score _____

Total possible 40

Score earned _____

Late deduction _____

Final percentage _____