**Ch. 7 Calculus Project: Volumes of Solids with Known Cross-Section**

You must make a physical model of a solid with a known cross section on a base using standard functions.

The following guidelines apply:

1. The base function can be any non-linear function, but it must be between two curves.
2. The cross section can be any shape.
3. The materials can be no thicker than 0.25". Your model must be at least 6 inches long in some direction. Just because the directions are English units, it doesn’t mean you can’t use metric. There must be at least 16 laminations.
4. You must show the calculations of the actual volume of your model along with the definite integral to represent the theoretical volume. If your problem is not integrable, you may use your calculator to compute the volume.

**Two Major methods**: Either make the graph and then build a model of it. This will require you to struggle to find scale factors to reconcile the differences between you integral and your model volume.

Or...Make the model and then struggle to write the equations for it then integrate them.

**20 Points towards your test scores will be awarded for**

1. difficulty of the function and cross section used. (8 points)
2. neatness and appeal of your model. Quality work (4 points)
3. presentation and correctness of calculations. (8 points)

Those projects showing extra effort and performance can be awarded extra-credit points. General project suggestions from your peers:

* Try starting early and do a little at a time. Giving yourself enough time by starting early and pacing yourself was the most frequent advice past students have given. It really does take between 5 and 10 hours for this project. Leave time to go over your work.
* Plan it out, don’t just jump in. Know what your project should look like before you start. Understand the integral and the equation.
* Patience is key.
* Pick equations you understand. You might want to use equations from old HW problems.
* Get snacks
* Use a spreadsheet to help you with your project write-up. It makes things amazingly easy.
* Presentation counts: make it look pretty.
* Be creative. Make something cool that you can be proud of and show off to your friends.
* circles are HARD without a gasket or circle cutter...shells are easy because they are rectangles, but they are hard because lining up the layers and getting the right cylinder circumference is persnickety.
* Pick a function(s) where the conversions either aren’t necessary or are easy. OR don’t worry about building a 1-to-1 model. The model can merely be a representation of the project.
* Measure twice, cut once. BE CAREFUL when cutting.
* Make sure you get enough materials, so you don’t have to keep going out to get more.
* Don’t use a glue pen or glue stick. Superglue gel is great...some art foam comes preglued on one side and that might be better still. Rubber cement and foam is a sad combination.
* Drafting compasses are better than cheap school compasses.
* If you do circles or washers, use the gasket cutter or a circle cutter, both can be purchased at Michael’s.
* If you use the gasket cutter or a circle cutter think about what the cutter is using: diameter or radius and set your measurements accordingly.
* If you use foam, it’s easier to work in cm or mm.
* Hot glue works well with cardboard
* If you have a ponytail, tie it back so it doesn’t swing into your glue.
* Don’t throw around your project until the glue is dry.
* Don’t get distracted with friends and tv.
* Ask questions after you’ve spent some time thinking about it.
* Don’t overcomplicate the project looking for points only to lose those points in a messy result or math you don’t understand.
* Do the math before the cutting...you don’t want to find out after you build the model that you used all the wrong values.
* If you use discs, then make sure you use a compass. It’s hard to cut circles out with a utility knife, a coping saw might work better. It’s easy to cut discs out of foam.
* If you use shells, use foam
* If you use foam it’s more expensive than cardboard and is hard to cut small interior circles for washers. It cuts well with scissors and not a utility knife. Use Low Heat glue gun or superglue. High heat glue guns will melt the foam and glues like Elmers and foam glue take waaaaaay to long to dry. Remember, it will take many more laminations to use foam core than if you use cardboard. The foam is generally 2mm or 1/8” thick...5 layers € ≈ 1cm or 8 layers € ≈ 1”. Foam stretches, don’t stretch it out when measuring or cutting