Summary

Calculus techniques can be applied to many different fields of study. In section, three different problems were discussed: estimating the volume of fluid in an eye, estimating the volume of fluid in a specific part of a cochlea in an ear, and estimating the volume of a saguaro cactus. These volumes can be estimated by applying integration techniques. The idea is to divide a continuous entity into discreet parts and then calculate the sum of the parts. The problem is choosing the best method to divide a continuous object. For example, when trying to estimate the volume of a cylinder using integration, is it best to slice a cylinder to create circular slices or is it best to create rectangular slices? Both methods of slicing the cylinder create a valid answer, but which slice is easier to compute? An easy approach is to look at the problem in sections by starting at what is known and moving towards what is required to achieve the final answer. For instance in the cactus problem, one could find the volume by finding a function that related the radius of a section of cactus with the height of the cactus at that section (the function relating radius to height could possibly be found by fitting a curve to data points along the outside of the cactus). Then horizontal slices (cross-sections) could be taken to create circles with a certain radius at a certain height, fitting the previously found function, which could be summated to find the total volume of the cactus. Another approach to this cactus problem could be to divide the cross-section through the center of a cactus into tiny square 'pixels', adding them up to find surface area of the cross-section, and then revolving them 180 degrees around the center of the cactus. Again, both of these approaches are valid solutions to the problem.

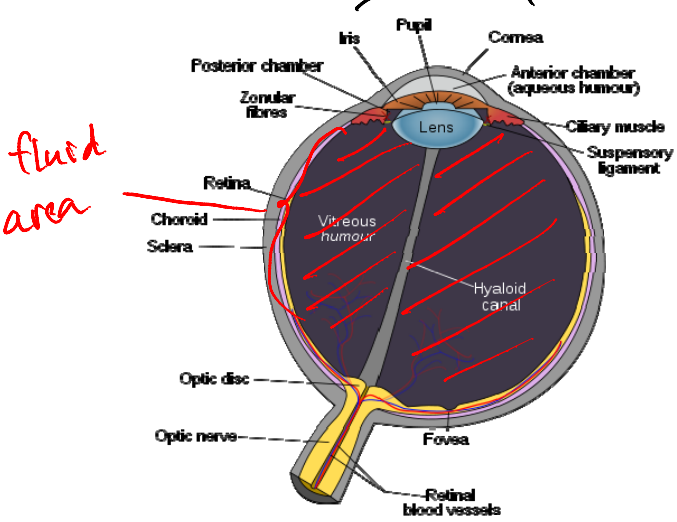
Either way, a good place to start is to divide the problem into simple parts and use them to build up to the final answer (like using a triangular spiral to estimate the volume of a complex compartment of a cochlea in an ear).

Tue 20th Math 250B Notes

Tuesday, January 20, 2009
2:12 PM

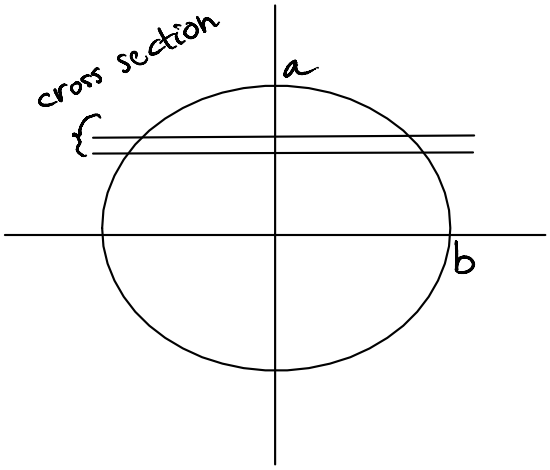
- Volume of fluid in an eye

cross section



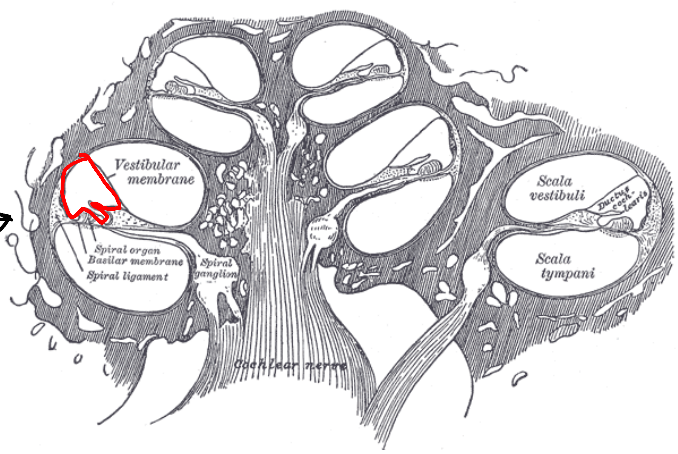
fluid area

Pasted from <http://en.wikipedia.org/wiki/File:Schematic_diagram_of_the_human_eye_en.svg>



- Cochlea in ear
  - compartments which hold fluid
    - How much fluid is in a given region?
    - appears in a spiral in 3D

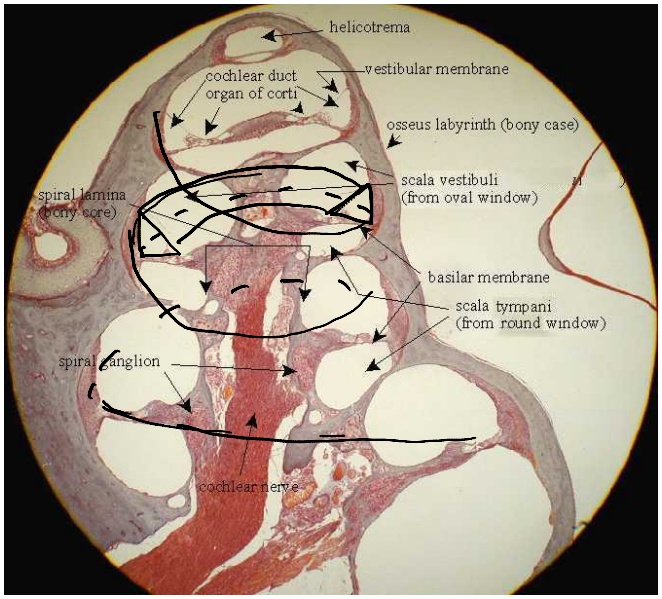
Special fluid compartment →



Pasted from <http://en.wikipedia.org/wiki/File:Gray928.png>

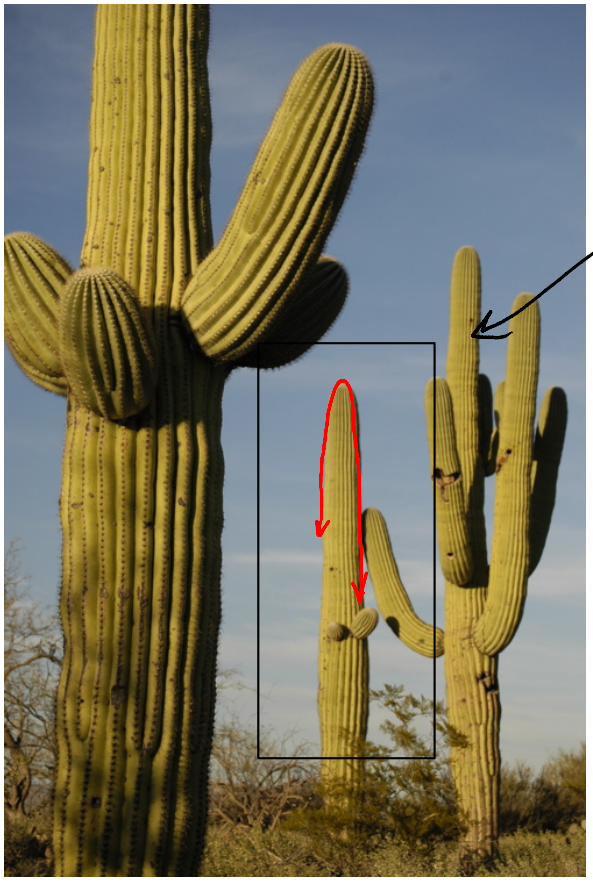
- Spiral

rough triangle shape



Pasted from <http://biology.clc.uc.edu/fankhauser/Labs/Anatomy_&_Physiology/A&P202/Special_Senses/Ear/cochlear_nerve_40x_P2182170lbd.JPG>

Volume of a Saguaro



Pasted from <http://tour.airstreamlife.com/weblog/Tucson%20Saguaro.jpg>

zoom in to measure how radius changes