MATH 125 Assignment 2 February 27, 2009 Name ____________

In the problems below I refer to postings on the course website

`http://myweb.facstaff.wwu.edu/curgus/Courses/125/125.html`.

Problem 1. This problem relates to the posting on February 25, 2009. I posted six examples inspired by the subsection “Volumes of Regions of Known Cross-Section” of Section 8.2. In each of the six examples the base of a solid is a unit disk and the cross-sections are regular polygons with n edges: for $n = 3$ equilateral triangles, for $n = 4$ squares, for $n = 5$ regular pentagons, for $n = 6$ regular hexagons, for $n = 7$ regular heptagons and for $n = 8$ regular octagons.

(a) Find the exact volumes of the solids described in each of the six examples. With the exception of the regular heptagon, the formulas for the volumes should involve only positive rational numbers and the square-root function.

(b) Let n be the number of sides of a regular polygon. In the examples we have $n = 3, 4, 5, 6, 7, 8$. Denote by $V(n)$ the volume of the solid whose base is a unit disk and whose cross-sections perpendicular to a fixed diameter are regular polygons with n edges. Find a formula for $V(n)$.

(c) Calculate the exact value of $\displaystyle\lim_{n\to\infty} \frac{V(n)}{n^2}$.

Hint: Wikipedia is a good source of information about regular polygons. You can find formulas that you need there. In your homework please make clear which formulas you used and where you found them.

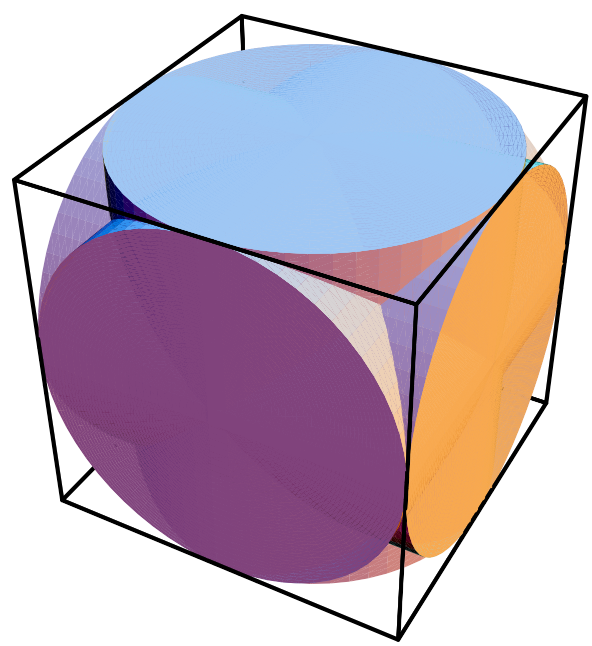
Problem 2. This problem relates to the posting of February 26, 2009 which explains why the slogan for this class is “How long is a smile?”. In class I indicated which function I used in the animation of a smiley face. But in order for a smiley face to change mood, I needed a function with a parameter. Denote this parameter by a. Although, since a determines the level of happiness of a smiley face it would be more natural to denote it by h. But, a is more commonly used as a parameter in a quadratic equation.

(a) Discover which function with a parameter I used. (It is a very simple family of functions.) State specifically what are allowed values for the parameter a and what is the domain of the function.

(b) For each value of the parameter a calculate the length of the smile. Here we understand the word “smile” with an extended meaning which includes all the facial expressions of the smiley faces in the animation posted on February 26, 2009.

(c) In (b) you found a function of a. That is the function $L(a)$, the length of the smile as the level of happiness a changes. Plot an accurate plot of $L(a)$. Take into account only the allowed values for a which you stated in (a).

(d) There is some guessing involved in (b). Here I am asking you to continue with guessing. Provide a short explanation for your guesses. (g1) Which point I used as the center of the smiley face? (g2) What is the radius of the smiley face? (g3) Is there anything special about the vertical position of the eyes? (g4) What is the distance between the eyes?



Problem 3. (a) Do Project 1 on page 435 in the textbook.

(b) In (a) you considered two horizontal cylinders as presented in Figure 8.109 on page 435. Now add the vertical cylinder to the picture and calculate the volume enclosed by these three cylinders.