

**MATH 515 HOMEWORK-3 DUE AT THE BEGINNING OF CLASS ON THURSDAY,
OCTOBER 1.**

One goal for this course is for you to develop your skill in effectively communicating mathematics. With this in mind, you should clearly write up your solutions. Solutions with little or no justification will receive little or no credit.

- (1) Read (at least) pages 69-91 in *Discovering Geometry*.
- (2) A student said that the formula for the arc length of a circle of radius r is $r\theta$, where θ is the central angle defining the arc. Explain this formula.
- (3) In class we found the volume of a sphere using spherical coordinates. Find a calculus book and review this method again.
- (4)
 - (a) Using spherical coordinates, derive the formula for the surface area of a sphere.
 - (b) Write a paragraph comparing our work on the volume and surface area of a sphere to the discussion on page 90.
 - (c) When we began our discussion of volume via integration, some students talked about "slices, washers, and shells." Show how to derive the formula for the volume of a sphere using a slicing method.
- (5) Use integration to derive the formula for the volume of a pyramid.
- (6) ****Do this problem on a separate page.**** Students generally take geometry before calculus, but in the problems above we use limits of Riemann sums to solve problems in geometry. Take the example of the square based pyramid, whose area we computed using calculus. How could you present a *proof* that the volume of a square pyramid is $\frac{1}{3} \times \text{base area} \times \text{height}$, perhaps using the idea of a limit, but without teaching formal limits or integrals.
- (7) Answer the question preceding problem 30 on page 83.
- (8) From chapter 2, do problems 22, 23, 32, 36, and 37.