Math 203 — **EXAM #1** — March 21, 2001

Please PRINT your name and ID# on the cover of your exam booklet and indicate if you are handing-in more than one booklet. Write clearly and cross-out work not to be graded. NO calculators.

ALL ANSWERS GO IN THE EXAM BOOK. **No calculators allowed.**

1. Let S be the portion of the surface $z = 4 - x^2 - y^2$ that lies above the xy-plane.

   (a) Sketch S and include in your sketch the intersection (that is, the "trace") of S with each of the three coordinate planes. Label each trace as a circle, parabola, hyperbola, or ellipse and write the equations of the traces below your picture. (15 pts.)

   (b) Find an equation of the tangent plane to S at the point $(1, 1, 2)$. (15 pts.)

2. Given the planes $\mathcal{P}_1$, with equation $2x - y - 5z = -14$, and $\mathcal{P}_2$, with equation $4x + 5y + 4z = 28$, find the following:

   (a) the angle between the two planes (you may leave your answer in terms of inverse trigonometric functions) (15 pts.)

   (b) the symmetric equations of the line of intersection of the two planes (15 pts.)

3. Show that (20 pts.)

$$\lim_{(x,y)\to(0,0)} \frac{xy + y^3}{x^2 + y^2}$$

   does not exist.

4. Let $f(x, y) = x^2 + 4y^2 - 4x$, find:

   (a) all critical points of f. Indicate whether each such point is a local maximum, local minimum, or a saddle point. (15 pts.)

   (b) the total differential $df(x, y)$ (5 pts.)