7/02/2002 FUNCTIONS, GRAPHS, QUADRICS (Section 9.6) S-Math 21a

This is part 1 (of 2) of the homework. It is due July 9 at the beginning of class. More problems to this lecture can be found on pages 692-693 in the book.

SUMMARY.

- $f(x,y)$ **function of two variables**, $g(x,y,z)$ function of three variables.
- $\{g(x,y,z)=d\}$ describes **surface**.
- $\{(x,y,z=f(x,y))\}$ **graph** of function $f(x,y)$, describes a surface.
- **trace**: intersection of graph with coordinate planes.
- **intercepts**: intersection of graph with coordinate axes.

Quadrics:

- $x^2+y^2+z^2=1$ **sphere**.
- $x^2+y^2-z^2=1$ **one-sheeted hyperboloid**.
- $x^2+y^2-z^2=-1$ **two-sheeted hyperboloid**.
- $x^2-y^2-z^2=0$ **cone**.
- $x^2+y^2=z$ **paraboloid**.
- $x^2+y^2=1$ **cylinder**.

1) (6 points, Compare Problem 4 in 9.6) Find the domain and the range of the function $f(x,y)=\log(x+y-1)$.

2) (6 points, Compare Problems 24-26 in 9.6) Consider the surface $y=z^2-x^2-2x$. Draw the three traces. What surface is it?

3) (6 points, Compare Problems 15-18,27-31 in 9.6) Sketch the graph of the function $f(x,y)=1/(x^2+y^2)$.

4) (6 points, Compare Problems 15-18,27-31 in 9.6) Sketch the graph of the function $f(x,y)=|x|+|y|$.

5) (6 points, Compare Problem 33 in 9.6) Show that the line $r(t)=(1,3,2)+t(1,2,1)$ is contained in the surface $y=z^2-x^2$.

CHALLENGE PROBLEM:

Find as many curves as you can which are obtained by intersecting two quadrics. To get full credit, you have to provide at least three different curves.

SUPER CHALLENGE PROBLEM:

How would you visualize the graph of a function $f(x,y,z)$ of three variables? How would you describe the set $\{(x,y,z,u) \mid g(x,y,z,u)=d\}$ where g is a function of 4 variables and d is a constant? Take the example of the four-dimensional sphere $x^2+y^2+z^2+u^2=1$.