MATH 261, Spring 2001 **Due Date:**_____ **Name(s):** _____

Project 15.1c: Graphs of Functions

Objective

The objective of this project is to illustrate some techniques we can use to visualize the graph of a function of two real variables.

Narrative

If you have not already done so, read Section 15.1 in the text.

In this project we introduce the commands `plot3d` in Maple's `plots` package. This command allows us to plot the graph of a function of two real variables over a specified range of values.

Tasks

1. a) Type the command lines below into Maple; they produce a graph of $f(x, y) = e^{-x^2-y^2}$.

```
> # Project 15.1c:  Graphs of Functions
> restart; with(plots):
> setoptions3d(axes=normal,color=red,grid=[50,50],
      orientation=[80,80],lightmodel=light1):
> f := (x,y) -> exp(-x^2-y^2);
> plot3d(f(x,y),x=-3..3,y=-3..3,style=patch);
```

   b) Continue by typing the following command line into Maple; note that the effect of the `%;` is to produce *two* copies of the same graphic.

```
> plot3d(f(x,y),x=-3..3,y=-3..3,style=patchcontour); %;
```

   Adjust the first graphic so that you get a good perspective view of the graph, and rotate the second graphic so that the second view is from directly overhead (that is, $\phi = 0$).

2. Repeat both parts of Task 1 for $f(x, y) = -5x/(x^2 + y^2 + 1)$.

   At this time make a hardcopy of your typed input and Maple's responses. Then, ...

3. By hand, draw a level curve (other than one of the ones produced by Maple) on the second graphic you produced in Task 1 (the "patchcontour" graphic that is in perspective), and the corresponding level curve on the third graphic you produced in Task 1 (the "patchcontour" graphic for which $\phi = 0$).

4. By hand, draw a level curve (other than one of the ones produced by Maple) on the second graphic you produced in Task 2 (the "patchcontour" graphic that is in perspective), and the corresponding level curve on the third graphic you produced in Task 2 (the "patchcontour" graphic for which $\phi = 0$).

Comments

Since a computer is not always available to help you visualize the graph of a function, it is wise to study the graphics produced by computer and try to produce them by hand. One of the things you can add to a graphic that help in visualization are x- and y-curves, particularly those that might bound the region over which the graph is drawn. Another thing you can draw are the occluding contours: the curves on a surface consisting of those points at which the normal to the surface is perpendicular to the line determined by the viewer's eye and the point.