MA 1024: Partial Derivatives

Background

You will be using the commands that you used in the first two labs. Two and three dimensional graphing of functions and implicit equations. Also, graphing level curves of functions and implicit equations. You will also be executing derivatives of functions and implicit equations.

Maple Commands

Last week you used the `diff` command. In order to differentiate equations entered implicitly you will need the `implicitdiff` command.

```
>w:=7*x*sin(y)=z;
>implicitdiff(w,z,x);
```

The second arguement is the DEPENDENT variable. The third (and any following arguments) is the variable the derivative is being taken with respect to. So to do $\frac{dz^2}{dxdy}$:

```
>implicitdiff(w,z,x,y);
```

To evaluate the derivative at a number use the `subs` command.

```
>subs(y=Pi,implicitdiff(w,z,x));
```

Or if it is along the level curve you can substitute inside the derivative command.

```
>implicitdiff(subs(y=Pi,w),z,x);
```

Again, all other commands can be found in previous labs.

Exercises

1. Given the functions $f(x,y) = \frac{e^{(x+y)}}{x^2+y^2}$ and $g(x,y) = 100$
   a) Graph the functions on the domain $1 \leq x \leq 5$ and $1 \leq y \leq 5$.
   b) Graph the intersection of the plane and surface (i.e. the level curve at z = 100).
   c) Rotate the three dimensional graph so you can compare parts a) and b). Does the level curve look like the intersection on part a)?
2. Given the equations $z = 2xy^3 - 3x^3y + y - x^2y^2 - xy^2$ and $y = -4$
   a) Graph the equations on the domain $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$ and $-500 \leq z \leq 500$.
   b) Graph the intersection of the plane and surface (i.e. the level curve at y=-4).

c) Rotate the three dimensional graph so you can compare parts a) and b). Does the level curve look like the intersection on part a)?

d) Find the derivative along the level curve.

3. Given the function $j(x, y) = \frac{x^2}{2} + (y - 3)^2$

a) Graph the function on the domain $-7 \leq x \leq 7$ and $-4 \leq y \leq 10$

b) Graph the level curve at the y vertex of the paraboloid using the domain $-7 \leq x \leq 7$ and $0 \leq z \leq 70$. Then graph the level curve at x vertex of the paraboloid using the domain $-4 \leq y \leq 10$ and $0 \leq z \leq 70$.

c) Calculate the concavity along each level curve. Which level curve has more curve to it?