# Assignment # 4

1 (a) $f(x,y) = x^2 - y^2$ subject to $x^2+y^2 = 4$.

Introducing Lagrange's multiplier $\lambda$, we get, a new function,

$$L(x,y,\lambda) = x^2 - y^2 - \lambda(x^2+y^2-4)$$

Now, partially differentiating this function, we get,

$$\frac{\partial L}{\partial x} = 2x - 2x\lambda = 0 \quad -(i)$$

$$\frac{\partial L}{\partial y} = -2y - 2y\lambda = 0 \quad -(ii)$$

From (i), we get,

$$x(1-\lambda) = 0$$

So, either, $x = 0$ or $(1-\lambda) = 0$ or $\lambda = 1$

From (ii), we get,

$$y(1+\lambda) = 0$$

$$y = 0 \text{ or } \lambda = -1.$$

$x = 0$ and $y = 0$ cannot be a soln as it doesn't satisfy the constraint $x^2+y^2 = 4$.

~~When λ = 1, putting λ = 1 in (ii), we get~~

~~=2~~

When $x = 0$, $\quad 0 + y^2 = 4$ or $y = \pm 2$.

$\left.\begin{array}{l} x=0,\ y=2 \\ x=0,\ y=-2 \end{array}\right\}$ are solutions.

When $y = 0$, $\quad x = \pm 2$

So, $\left.\begin{array}{l} x=2,\ y=0 \\ x=-2,\ y=0 \end{array}\right\}$ are solutions