

MATH 211- EXAM III -NOVEMBER 17, 2004

1) For the function  $f(x,y,z) = \frac{x}{y} - yx + \frac{z}{x}$

- a) Determine the directional derivative in the direction  $\mathbf{V} = \mathbf{i} - 3\mathbf{j} - 2\mathbf{k}$  at the point  $(1,1,1)$
- b) Determine the equation of a plane tangent to the surface  $\frac{x}{y} - yx + \frac{z}{x} = 1$  at the point  $(1,1,1)$

2) Determine, using Lagrange multipliers, the maximum Profit for a company whose profit is given by the equation  $P = \frac{xy^3}{810}$  and the total budget is given by  $x + y = 12$ , where  $x$  and  $y$  are the research and production costs allocated ( in millions of dollars )

3) For the integral  $\int_0^1 \int_{\frac{y}{2}}^{\frac{1}{2}} e^{-x^2} dx dy$

- a) Sketch the region of integration
- b) Reverse the order of integration
- c) Evaluate the integral

4) Evaluate the integral  $\iint (y + 1) dx dy$  over the region described by the triangle formed by the points  $(0,0)$  ,  $(1,1)$ ,  $(3,0)$

5) Evaluate the integral  $\iint xy dA$  , over the region enclosed in the first quadrant, outside the circle  $r = 1$  and inside the circle  $r = 2\cos\theta$ .

6) Using triple integration and cylindrical coordinates, find the mass  $(\iiint \delta(x,y,z) dV)$  of the ellipsoidal solid  $4x^2 + 4y^2 + z^2 = 16$  lying above the  $x$ - $y$  plane. The density at any point in the solid is given by  $\delta(x,y,z) = 10z$ .