1. (10%) Find the equation of the tangent plane at the point $(1,1,0)$ to the surface $\ln xy + \sin yz = 0$.

2. (12%) Let $T(x,y,z) = \dfrac{80}{1+x^2+2y^2+3z^2}$ be the temperature at the point (x,y,z). In which direction does the temperature increase fastest at the point $(1,1,-2)$. What is the maximum rate of increase?

3. (12%) Find all the local maxima, local minima, and saddle points of the function $f(x,y) = e^x(x^2-y^2)$.

4. (14%) The flat elliptic plat $x^2+4y^2 \le 1$ is heated so that the temperature at (x,y) is $T(x,y) = x^2+8y^2-x$. Find the temperatures at the hottest and coldest points on the plate. Must use the Lagrange's multiplier method in the process.

5. (10%) Evaluate the integral $\iint_\Omega (x^2+y^2)dA$, where Ω is the triangle with vertices $(0,1)$, $(1,0)$, $(1,1)$.

6. (12%) Evaluate the integral $\displaystyle\int_0^1 \int_{y^{1/2}}^1 \frac{1}{1+x^3}dxdy$.

7. (15%) The region Ω seated on the Upper Half Plane, is enclosed by $r = 1-\cos\theta$, $y = x$, $y = -x$. Compute the double integral $I = \displaystyle\iint_\Omega \frac{1}{\sqrt{x^2+y^2}}dA$.

8. (15%) Evaluate the integral $\iint_\Omega \sqrt{x+2y}(x-y)dA$, where the region Ω is enclosed by the lines $x-y=0$, $x-y=1$, $x+2y=0$ and $x+2y=1$.