

## FINAL EXAM

1. The surface is given by equation  $z^2 = x^2 + y^2$ . Find all points on this surface such that the tangent plane at these points is parallel to the plane  $x + y + z = 3/\sin(1)$ .

2. Let  $F(x, y, z) = x^2 + y^2 + z^2 - 25 = 0$ . Differentiate the function  $z = z(x, y)$  implicitly to find  $\frac{\partial z}{\partial x}$ ,  $\frac{\partial z}{\partial y}$  at  $(x_0, y_0) = (4, 0)$ .

3. Given the lamina  $G = \{(x, y) | x^2 + y^2 \leq 4\}$  with the density function  $\rho(x, y) = e^{x^2+y^2}$ . Find the mass of lamina.

4. Find the volume of the cylinder  $Q = \{(x, y, z) | x^2 + \frac{y^2}{4} \leq 1, -1 \leq z \leq 1\}$ .

5. Check either or not the infinite series  $\sum_{n=1}^{\infty} \frac{(n^2+1)^{\frac{1}{2}} - n}{\sqrt{n}}$  converges.

6. Evaluate the line integral  $\int_C 2xyz dx + x^2 z dy + (x^2 y + x) dz$  there  $C$  is the line segment with the initial point  $(0, 0, 0)$  and terminal point  $(1, 1, 3)$ .

7. Find all values of parameter  $x$  for which the infinite series  $\sum_{n=1}^{\infty} \frac{\cos(x)+2)^k}{k}$  converges.

8. Let  $\mathbf{N}$  denote the inward-pointing unit normal vector for the surface  $S$  of the ellipsoid  $x^2 + (\frac{y}{2})^2 + (\frac{z}{3})^2 = 1$  and let  $F = (-z - 3y, 5xy^2z, -xyz^2)$ . Compute  $\int \int_S F \cdot N dS$ .