1. (10 points) Evaluate the surface area of the part of the surface \( z = \sqrt{x^2 + y^2} \) between the planes \( z = 1 \) and \( z = 2 \).

2. (10 points) Find the volume of the region that lies above the paraboloid \( z = 2x^2 + 2y^2 \) and lies below the cone \( z = 2\sqrt{x^2 + y^2} \).

3. (10 points) Consider the sphere \( x^2 + y^2 + z^2 = 9 \) which models an imaginary planet. Suppose that the temperature on this sphere (at a particular time) is given by the function \( T(x, y, z) = 2x + 2y + z \). Find the largest temperature and the smallest temperature on this sphere.

4. (10 points) Evaluate the integral
\[
\int_0^1 \int_0^1 f(x, y) \, dx \, dy
\]
where
\[
f(x, y) = \begin{cases} y & \text{if } y > x^2 \\ x^2 & \text{if } y \leq x^2 \end{cases}
\]

5. (10 points) Suppose that the density function of the square lamina, \( 0 \leq x \leq 1, 0 \leq y \leq 1 \), is given by
\[
\rho(x, y) = \int_x^1 \cos(t^2) \, dt.
\]
Evaluate the mass of the lamina.

6. (10 points) Let \( E \) be the solid tetrahedron with vertices \((0, 0, 0), (0, 0, 1), (1, 0, 1)\), and \((0, 1, 1)\). This tetrahedron is bounded by the planes \( x = 0, y = 0, z = 1, \) and \( x + y = z \). Evaluate the integral
\[
\iiint_E x \, dV.
\]
7. (10 points) Consider the function

\[ f(x, y) = e^{-x^2-y^2} (x^2 + 4y^2). \]

Its partial derivatives are \( f_x = 2x(1 - x^2 - 4y^2)e^{-x^2-y^2} \) and \( f_y = 2y(4 - x^2 - 4y^2)e^{-x^2-y^2} \). You do not need to check this. Find the absolute maximum and the absolute minimum of the function \( f(x, y) \) on the set \( D \) which is the disk \( x^2 + y^2 \leq 1 \).

(Hint: The method of Lagrange multipliers may not be easy to apply to the above function when you check the max and the min on the boundary of \( D \). You may like to use a different method.)