1. Suppose \( f(2, 1, 1) = 4, f_x(2, 1, 1) = -3, f_y(2, 1, 1) = 2 \) and \( f_z(2, 1, 1) = 6 \). Estimate \( f(2.1, 0.9, 1.2) \).

2. Find an equation for the tangent plane to the graph of the function \( f(x, y) = y^x \) at the point \((1, 2, 2)\).

3. Find the local extremal values, saddle points and absolute extremal values of the function \( f(x, y) = \frac{2y^2 - x^2}{2 + 2x^2y^2} \)
   (a) on the region \( R \) bounded by the lines \( y = x, y = 2x \) and \( y = 2 \). (Hint: Draw the region \( R \) first.)
   (b) on \( \mathbb{R}^2 \).

4. Find the local extremal values and saddle points values of the function \( f(x, y) = x^2y - 3 \). Decide if \( f \) has extremal values on \( \mathbb{R}^2 \) and on \( R = \{(x, y) : y \geq 0\} \).

5. Find the extremal values of the function \( f(x, y, z) = x^2 + y^2 + z^2 \), subject to the constraint \( xyz = 4 \).

6. Find the local extremal values, saddle points and absolute extremal values of the function \( f(x, y) = x^4 + 4x^2y - 8x^2 + 8y^2 - 16y + 1 \) on the region \( \{(x, y) : x^2 + y^2 \leq 4\} \).

7. Draw the gradient vectors at all the marked points of the following contour map of a differentiable function \( f(x, y) \). Decide from the picture if \( f \) has any saddle points, or local extremal values.