Show your work!

1) For parts a), b), c) below, let \( f(x, y, z) = xze^{xy} \).
   
   a) At the point \((2, 0, 3)\), in what direction does \( f \) increase most rapidly?

   b) At the point \((2, 0, 3)\), does \( f \) increase or decrease in the direction of \( \mathbf{v} = \langle z^2 - 2y^2 + 2z \rangle \)? At what rate?

   c) As one moves from the point \((2, 0, 3)\) in the direction of \( \mathbf{v} = \langle z^2 - 2y^2 + 2z \rangle \) with speed equal to 5, what is the time rate of change of \( f \)?

   d) Find an equation of the tangent plane to the graph of \( xze^{xy} = 6 \) at \((2, 0, 3)\).

   e) Given \( xze^{xy} = 6 \), find \( \frac{\partial x}{\partial z} \) at \((2, 0, 3)\).
2) Given \( g(x,y) = y(1+y/x)^5 \), find \( g_{xy} \).

3) Find all critical points of \( f(x,y) = x^2 - xy + y^2 - 8x + 7y + 5 \) and classify each as a point where \( f \) has a local max, local min or saddle (or none of these).
4) Find the coordinates of the points on the ellipsoid $x^2 + 3y^2 + 4z^2 = 25$ at which the function $f(x,y,z) = 3x - 6y + 4z$ is maximized and those at which $f$ is minimized.