REVIEW 1:

1. Find the distances of the point (2, 3, -1) to
   (a) the xy-plane
   (b) the point (1, 4, -3)
2. Give an equation of the sphere of radius 2 centered at the point (1, -2, 3).
3. Depict the plane whose equation is y = 2.
4. Depict the surfaces whose equations are
   (a) \( z = y^2 \)
   (b) \( z = 3 - x - 2y \)
5. Match the functions (i) \( z = 2x + y - 1 \); (ii) \( z = 1/(x^2 + y^2) \); (iii) \( z = 1 - e^{-(x^2+y^2)} \); (iv) \( z = 5 - x^2 \) with
   (a) the cross-sections at \( x = 0, 1, 2 \)
   (b) the directional derivative of the given function at the given point in the direction of the vector \( \vec{i} + 3\vec{j} \).
6. What is the linear function of \( x \) and \( y \) with value \( z = 2 \) when \( x = 1 \) and \( y = -1 \), slope 3 in the \( x \) direction and slope \((-0.5)\) in the \( y \) direction?
7. Match the functions \( f(x, y, z) = x^2 + y^2 \) and \( g(x, y, z) = x^2 + y^2 + z^2 \) with the following families of level surfaces.
8. Given the function \( f(x, y) = 3x^2 - y^3 \) and the point (1, 2),
   (a) use difference quotients with \( \Delta x = 0.1 \) and \( \Delta y = 0.1 \) to estimate the partial derivatives \( f_x(1, 2) \) and \( f_y(1, 2) \);
   (b) find the same partial derivatives exactly.
9. Given the function \( f(x, y) = xe^{-2y} \) and the point (1, 0),
   (a) find the differential at this point
   (b) write down the equation of the tangent plane to the graph of the function at the given point
   (c) compute the linear approximation to the value of the function at point (1.01, -0.02)
10. Given the function \( f(x, y) = \ln(1/x - \sin y) \) and the point (1, 0),
    (a) find the gradient at this point
    (b) the directional derivative at this point in the direction of the vector \( \vec{v} = 2\vec{i} + 3\vec{j} \).
11. (a) Consider the equation \( x^2 - 3xy + z^3 - xz = 1 \) as an equation of a level surface of a function \( g(x, y, z) \) of the three variables \( x \), \( y \), and \( z \). What is your function \( g(x, y, z) \) and what is the level?
    (b) Show that the point \( A = (1, 0, -1) \) is on this surface.
    (c) Find the gradient of the function \( g(x, y, z) \) at the point \( A \).
    (d) Find the directional derivative of the function \( g(x, y, z) \) at the point \( A \) in the direction of the vector \( \vec{v} = 2\vec{i} - \vec{k} \).
    (e) Find an equation of the tangent plane to the surface at point \( A \).