1.) Compute the derivative of \( f(x, y) = x^2 + xy \) at the point \( P = (1, -1) \) in the direction of vector \( \vec{A} = i - 2j \).

2.) Compute the derivative of \( f(x, y, z) = x - y^2 + z^3 \) at the point \( P = (2, 0, -1) \) in the direction of vector \( \vec{A} = i - j + k \).

3.) Consider the function \( f(x, y) = xy^3 \) and the point \( P = (2, 1) \). Determine all unit vectors \( \vec{u} \) so that \( D_{\vec{u}} f(2, 1) \) is
   a.) as large as possible.
   b.) as small as possible.
   c.) equal to zero.
   d.) equal to 1.

4.) Consider the surface given by \( x^2 + 2y^2 + 3z^2 = 3 \) and the point \( P = (1, -1, 0) \) on the surface. Find equations for
   a.) the plane tangent to the surface at point \( P \).
   b.) the line normal (perpendicular) to the surface at point \( P \).

5.) Consider the surface (hyperbolic paraboloid or saddle) given by \( f(x, y) = 3x^2 - 2y^2 + 5 \) and the point \( P = (2, 3, -1) \) on the surface. Find equations for
   a.) the plane tangent to the surface at point \( P \).
   b.) the line normal (perpendicular) to the surface at point \( P \).

6.) Consider the function \( f(x, y) = xe^{xy} \) and the point \( P = (0, 1) \). Use a differential to estimate the change in the values of \( f \) if
   a.) point \( P \) moves a distance of \( ds = 0.15 \) in the direction of vector \( \vec{A} = 3i - 4j \).
   b.) point \( P \) moves in a straight line to point \( Q = (1, 0) \).

7.) Consider the function \( f(x, y, z) = xy^2 + yz - x^3z \) and the point \( P = (1, -1, 2) \). Use a differential to estimate the change in the values of \( f \) if point \( P \) moves a distance of \( ds = 0.2 \) in the direction of vector \( \vec{A} = -i - 2j + 2k \).

8.) Find and classify critical points as determining relative maximums, relative minimums, or saddle points.
   a.) \( z = 3x^2 - 6xy + y^2 + 12x - 16y + 1 \)
   b.) \( z = x^2y - x^2 - 2y^2 \)
   c.) \( z = x^2 - 8 \ln(xy) + y^2 \)
   d.) \( z = 3x^2y - 6x^2 + y^3 - 6y^2 \)

“An education isn’t how much you have committed to memory, or even how much you know. It’s being able to differentiate between what you know and what you don’t.” – Anatole France