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

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 \( \vec{A} = \hat{i} - \hat{j} + \hat{k} \).

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 of \( f \) if
   a.) point \( P \) moves a distance of \( ds = 0.15 \) in the direction of vector \( \vec{A} = 3 \hat{i} - 4 \hat{j} \).
   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 \( \vec{A} = -\hat{i} - 2 \hat{j} + 2 \hat{k} \).

8.) Consider the function given by \( f(x, y) = xy^2 - x^2y \) and the point \( P = (1, -1) \). Compute
   a.) the exact change of \( f \) and
   b.) use a differential to estimate the exact change of \( f \) if point \( P \) moves in a straight line to point \( Q = (1.5, -0.7) \).

9.) Consider the function given by \( f(x, y) = \ln(3x + 4y^2) \) and the point \( P = (5, 2) \). Compute
a.) the exact change of \( f \) and 
b.) use a differential to estimate the exact change of \( f \)

if point \( P \) moves a distance of \( ds = 1.4 \) in the direction of vector \( \vec{A} = 5 \vec{i} + 12 \vec{j} \).

“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