Calculus Exercises (11.6)

1. Find an equation of the tangent plane to the surface \( x^2z^3 + yz = 1 - 4x \) at the point \((1, 2, -1)\).

2. Find the directional derivative of the function \( f(x, y) = x^2y + 3xy^2 \) at the point \((1, -1)\) in the direction \( \mathbf{v} = \langle 3, 1 \rangle \).

3. Figure 1 below shows the contour map of \( g \).
   (1) Draw an arrow to indicate the direction of the gradient vector \( \nabla g(-1, 4) \).
   (2) Determine whether the following partial derivatives are positive or negative:
      (a) \( g_x(-1, 4) : \)______  (b) \( g_y(-1, 4) : \)______

4. Use Figure 2 to estimate \( D_u f(3, 1) \).