Q-3) Find the directional derivative of z in the direction of $(5, 12)$ at the point $(x, y) = (-1, 1)$ if z is defined as a differentiable function of x and y at the point $(x, y, z) = (-1, 1, 0)$ by the equation $x^2 y + e^{yz} + 2xz = 2$.

Solution:

By implicit differentiation you first find $z_x = -2$ and $z_y = 1$ at the point $(-1, 1, 0)$. Then the required directional derivative is $(-2, 1) \cdot (5/13, 12/13) = 2/13$.