Problem 1. Show that if $u(x, y)$ is harmonic, then also $v(s, t) = u(s + t, s - t)$ is harmonic.

Problem 2. Let $f(x, y) = xe^y$. Calculate the directional derivative at the point $(2, -1)$ in the direction of the vector $v = (2, 3)$. 
Problem 3. Let $\psi(x, y, z) = \sin(x) + \cos(y) + 2z$. Find the direction in which the function $\psi$ decreases most rapidly at the point $(0, \pi, 2016)$.

Problem 4. Let $f(x, y)$ be a function with continuous partial derivatives $f_x$ and $f_y$. Let $u = (\sqrt{2}/2, \sqrt{2}/2)$, $v = (-\sqrt{2}/2, \sqrt{2}/2)$. Given that $D_u f(3, -7) = 8$, $D_v f(3, -7) = -1$ find $\nabla f(3, -7)$. 