1. Either evaluate the following limit, or show that it does not exist:

\[
\lim_{{(x,y) \to (-2,1)}} \frac{(x+2)(y-1)}{2(x+2)^2 + 3(y-1)^2}.
\]

2. Find the gradient of:

\[ u = \exp \left( \frac{2x}{y^2 + xz} \right) \]

3. Find \( \frac{\partial^2 f}{\partial y \partial x} \) for \( f(x, y) = \int_{xy}^{y^2} e^t \, dt \).
4. Show that \( u = e^{4t} \cosh(2x) + e^{-9t} \sin(3x) \), satisfies the partial differential equation \( u_{xx} = u_t \).

5. Given \( f(1, -3) = 8 \), \( f_x = \cos(y + 3) - 3x^2y \), and \( f_y = -x \sin(y + 3) - x^3 + 2y \), estimate the value of \( f(0.98, -2.99) \).

6. Let \( z = F(x, y) \), where \( x = s \cos(t), \ y = s \sin(t) \). Find simplified expressions for \( z_s \) and \( z_t \) in terms of \( F_x \) and \( F_y \).

7. Find \( D_\nu f \) for the function \( f(x, y) = y^3e^{x+y^2} \) at the point (1,1) in the direction of \( \nu = 2\hat{i} + 5\hat{j} \).
8. Let \( f(x, y) = e^y(y^2 - 2x^2) \).

Show that the critical points are \((0,0)\) and \((0,-2)\) and classify them using the Second Derivative Test.
9. Use Lagrange Multipliers to find the extrema of $x^2 + 2y^2$ on the line $2x - 4y + 5 = 0$. 

15 points