1. (25 points) Find the second order partial derivative \( \frac{\partial^2 f(x,y)}{\partial x \partial y} \) of the function

\[
f(x, y) = (x + y)^3 \cos(x^2 y^2)
\]

2. (25 points) Let \( f(x, y, z) = zxye^{x^2 y^2} \), and \( x = s^2 + 2t + 1, y = s^2 \cos t, z = 2st + 1 \) and \( s = w^2 + 1, t = w^3 \) find

\[
\frac{\partial f(x, y, z)}{\partial w}
\]

3. (25 points) Find the local extreme values of the function

\[
f(x, y) = x^2 + 14x + y^2 - 12y + 5
\]

4. (25 points) Find the absolute maxima of the function \( f(x, y) = 8x + 10y \) on the closed triangular region with vertices \((0, 0), (1, 0), \) and \((0, 1)\)