

Assignment 5 (Due on the week October 12 – 17)

1. Compute the directional derivative of the function $z = xy^2 - xy + x^3y$ at a point $M(4; -2)$ in the direction $\left(\frac{1}{\sqrt{10}}; \frac{3}{\sqrt{10}}\right)$
2. Find the derivative of the function $z = 1 - \left(\frac{x^2}{a^2} + \frac{y^2}{b^2}\right)$ at a point $M\left(\frac{a}{\sqrt{2}}; \frac{b}{\sqrt{2}}\right)$ in the direction of the inward normal line at the point M to the curve line defined by $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
3. Using the Chain Rule calculate $\frac{dz}{dt}$ at $t = 0$ if $z = \frac{5t^2 + 3xy}{2w^2y}$, $x = t^2 + 1$, $y = \sqrt{t^2 + 1}$ and $w = e^t + 1$.
4. Calculate all partial derivatives of the first order with respect to x and y , if $u = f(\xi, \eta, \zeta)$, where $\xi = x^2 + y^2$, $\eta = x^2 - y^2$, $\zeta = 2xy$.
5. Calculate the gradient function and Hesse matrix for the following functions:
 - (a) $f(x, y) = xy - \ln(x^2 + 2y^2)$,
 - (b) $f(x, y) = ax^2 + 2bxy + cy^2$.