

1. a) Find the directional derivative of $f(x, y) = x^2 + 2xy - y^3$ at $(2,1)$ in the direction of the origin.

b) What is the maximum rate of increase at $(2,1)$ and what is its direction?

2. a) Find the equation of the tangent plane to $x^2 + 2xyz + y^2 + 3z^2 = 3$ at $P(1, -1, 1)$.

b) Find the equation of the normal line at this point.