MAT2130: Engineering Mathematical Analysis 1

Tutorial Problems For Thu Oct 27

Example. Let $f(x, y, z) = xy + xz + yz$. Find the rate of change of f at the point $P = (1, 1, 0)$, in the direction of the curve

$$\mathbf{r}(t) = \left(\frac{1}{2}t^2 - 1, |1 - t|, \frac{\sqrt{5}}{6}(t^3 - 8) \right).$$

Example. Let $\mathcal{C}$ be the curve formed by the intersection of the surfaces $z = \sqrt{y^2 - x^2}$ and $x^2 + 3y^2 + z^2 = 4$ in 3D space. Find the unit tangent vector to $\mathcal{C}$ at the point $P = \left(\frac{\sqrt{3}}{2}, -1, \frac{1}{2} \right)$, pointing in the direction of increasing x.

Example. Consider the surface $x^2 + y^2 + (z - 5)^2 = 1$ in 3D space. Find all points (x, y, z) on this surface such that the line through (x, y, z) and the origin is tangent to the surface.

Example. Consider the surface

$$\frac{(x - 4)^2}{4} + \frac{(y + 3)^2}{9} + (z - 5)^2 = 1$$

in 3D space. Find all points (x, y, z) on this surface such that the tangent plane to the surface is parallel to the plane $x + y + z = 0$.