

Mathematics 21a Fall 2006
In class problems. Oct. 31

1. Let $f(x, y) = x^2 + y^2$. Calculate ∇f at the point $(3, 4)$ and find the line through $(3, 4)$ perpendicular to the level curve $f(x, y) = 25$. Now fix $a, b \in \mathbb{R}$ and let $\vec{l}_{a,b}(t) = \langle 3 + at, 4 + bt \rangle$ be a line through $(3, 4)$. For which values of a and b the function $g(t) = f(3 + at, 4 + bt)$ is increasing? Can you express your answer in terms of the dot product $\nabla f \cdot \langle a, b \rangle$?

2. Consider the elliptic paraboloid $z = 4x^2 + y^2$ and the line $l(t) = \langle t, t, 5t \rangle$. Find the tangent planes to the paraboloid at points where the line intersect it. Find the angles between the line and the paraboloid at points of intersection.