

Problem Set #4

Due: Wednesday, Feb. 15

1. **(a)** Find parametric equations for the tangent line to the curve $r(t) = \langle t^3, 5t, t^4 \rangle$ at the point $(-1, -5, 1)$.
(b) At what point on the curve $r(t) = \langle t^3, 5t, t^4 \rangle$ is the normal plane (this is the plane that is perpendicular to the tangent line) parallel to the plane $12x + 5y + 16z = 3$?
2. Find the unit tangent T , unit normal N and unit binormal vectors B for the curve $r(t) = \langle \cos(2t), 2t, \sin(2t) \rangle$. Then calculate the curvature.
3. Find the arc-length of the curve $r(t) = \langle t^2, \ln(t), 2t \rangle$ when $1 \leq t \leq 2$.
4. Find the domain of the following functions and sketch the level curves of the following functions for the listed k values.
 - (a)** $f(x, y) = \frac{x^2 - y^2}{x^2 + y^2}$. $k = 0, 1, 2, 3$.
 - (b)** $g(x, y) = \frac{1}{1 + x^2 + y^2}$. $k = 0, 1, \frac{1}{2}, \frac{1}{5}$.
 - (c)** $h(x, y) = \sqrt{x^2 - y^2}$. $k = 0, 1, 2, 3$.