Math 227   Queen's University, Department of Mathematics

Vector Analysis, Homeworkz 4

October 2014

1. Consider the spiral curve which in polar coordinates is given by the equation $r = \theta$.

a) Find a vector parameterization for this curve in rectangluar coordinates.

b) Compute the curvature at the points of the curve where $r = \frac{\pi}{2}, \pi, \frac{3\pi}{2}$.

2. For the function $f(x, y) = 2x^2 + y^2$

a) Compute the family of flow lines for the gradient field $\vec{F}(x, y) = -\nabla f(x, y)$.

b) Sketch some of the level curves of the function $f(x, y)$ together with some of the lines of steepest descent for this function.

3. Evaluate the integral by changing coordinates with the suggested transformation. The region **R** is the parallelogram with vertices (-1,3), (1,-3),(3,-1) and (1,5).

$$\int \int_{\mathbf{R}} (4x + 8y)dA, \qquad x = \frac{1}{4}(u + v), \qquad y = \frac{1}{4}(v - 3u)$$