HOMEWORK 2. DUE OCTOBER 1

(1) Guillemin & Pollack, Section 1.3, problems 1, 2, 8.

(2) Consider the map from $\mathbb{R}^2$ to $\mathbb{R}^3$ given by

$$f(\theta, t) = (\cos\theta, \sin\theta, t).$$

Show f is an immersion and show that the image of f is a cylinder in $\mathbb{R}^3$. Write the image $f(\mathbb{R}^2)$ in terms of the coordinates x_1, x_2, x_3 of $\mathbb{R}^3$.

(3) Consider the map from $\mathbb{R}^2$ to $\mathbb{R}^3$ given by

$$g(\theta, t) = (t\cos\theta, t\sin\theta, t)$$

is an immersion at (θ, t) if and only if $t \neq 0$. Show that the image of g is the cone $x_3^2 = x_1^2 + x_2^2$ in $\mathbb{R}^3$. Show that the inverse image of the vertex of the cone $g^{-1}(0,0,0)$ is the line $\{t = 0\}$.