

These problems from do Carmo:

- 2-2 #1
- 2-2 #7
- 2-2 #16
- 2-3 #2

As well as:

1.

- a. Define $\alpha : (-\pi, \pi) \rightarrow \mathbb{R}^2$ by $\alpha(t) = (\sin(t), \sin(t) \cos(t), 0)$. Sketch the trace of the curve α plane.
- b. Show that α is injective.
- c. Define $\sigma(u, v) : (-\pi, \pi) \times \mathbb{R} \rightarrow \mathbb{R}^3$ by $\sigma(u, v) = (\sin(u), \sin(u) \cos(u), v)$. Show that σ is an injective regular patch.
- d. Show that the trace of σ is not a surface.

2.

Give a careful proof that the one sheeted hyperboloid defined by $x^2 + y^2 - z^2 = 1$ is diffeomorphic to the cylinder $x^2 + y^2 = 1$.