

# Differential Topology

1st Problem Set  
Due Mehr 19th, 1397

- Problems 13, 17 and 18, page 7 from [GP].
- Problems 11 and 12, page 12 from [GP].
- Problems 2, 9 and 10, pages 18-19 from [GP].
- Suppose that  $M \subset \mathbb{R}^d$  is a smooth  $m$ -dimensional manifold, and  $U$  is an open set in  $\mathbb{R}^d$  such that  $U \cap M \neq \emptyset$ . Assume that  $f : U \rightarrow \mathbb{R}$  is a smooth function such that  $f$  is constant on  $U \cap M$ . Show that the gradient vector  $\nabla f$  is perpendicular to  $T_p M$  at  $p \in M \cap U$ .

## REFERENCES

[GP]      Guillemin, V., Pollack, A., *Differential topology*, Prentice Hall.