

# Differentialgeometrie I

## Exercise sheet 10

**Exercise 1.**

Determine a formula for the first variation of the length, i.e. prove Theorem 6.20 from the lecture.

**Exercise 2.**

Prove Lemma 6.26 and Lemma 6.27 from lecture.

**Exercise 3.**

The sectional curvature of a surface coincides with the Gaussian curvature.

**Exercise 4.**

Determine the Riemannian curvature tensor  $R$ , the Ricci curvature  $Ric$ , the scalar curvature  $Scal$ , and the sectional curvature  $K$  of a surface and express them by each other.

**Exercise 5.**

Compute the various curvatures of  $\mathbb{R}^n$ ,  $S^n$ , and  $\mathbb{H}^n$ , describe all geodesics in these spaces, and analyze the exponential map.