

**DIFFERENTIAL TOPOLOGY**  
**PROBLEM SHEET 14**

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**Problem 1** (10, [Gaussian curvature](#)). Compute the Gaussian curvature at the point zero for the general paraboloid given by the equation  $Z = aX^2 + bXY + cY^2$  where  $a, b, c$  are real numbers.

**Problem 2** (10, [Euler characteristic](#)). Let  $M^m, N^m$  for  $m \geq 1$  be two closed connected manifolds. Compute the Euler characteristic of their connected sum in terms of their own Euler characteristic.

**Problem 3** (10, [transition function](#)). Show that for any vector bundle for any two vector bundle charts with non-empty overlap the transition function is continuous.

**Problem 4** (10, [line bundles on  \$\mathbb{R}\$](#) ). Find up to isomorphism all line bundles on  $\mathbb{R}$ .

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*Date:* Please hand in before the lecture by **28th of May 2023**. For all exercises the results need to be proven using results from this lecture and the lectures before, provided you give a reference.