GLOBAL ANALYSIS I - WS 2017/2018

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Exercise sheet 9 - due Wednesday 20-12 -2017

Please hand in the exercises stapled or paperclipped together, with name AND Matrikelnr. If you work in groups, one sheet per group suffices (at most 3 people per group).

1. Exercise (Cf. Exercise 9-3 of *Introduction to smooth manifolds*)**.** Compute the flow of the following vector fields on $\mathbb{R}^2$

(1) $y\frac{\partial}{\partial x} + \frac{\partial}{\partial y}$
(2) $x\frac{\partial}{\partial x} + 2y\frac{\partial}{\partial y}$
(3) $x\frac{\partial}{\partial x} - y\frac{\partial}{\partial y}$
(4) $x\frac{\partial}{\partial x} + y\frac{\partial}{\partial y}$

2. Exercise (Cf. Exercise 9-4 of *Introduction to smooth manifolds*)**.** For $n \geq 1$ define a flow on the odd-dimensional sphere $\mathbb{S}^{2n-1} \subset \mathbb{C}^n$ by $\theta(t, z) := e^{it}z$. Show that the infinitesimal generator of θ is a smooth non-vanishing vector field on $\mathbb{S}^{2n-1}$.

3. Exercise (Cf. Exercise 9-8 of *Introduction to smooth manifolds*)**.** Let M be a smooth manifold and let $S \subset M$ be a compact embedded submanifold. Suppose $V \in \mathscr{X}(M)$ is a smooth vector field that is nowhere tangent to S. Show that there exists $\varepsilon > 0$ such that the flow of V restricts to a smooth embedding $(-\varepsilon, \varepsilon) \times S \to M$.