

## HW 1

**Cookbook problems.** Solve:

- 1) Problems **3** and **24** from Cookbook-I.
- 2) Problems **27** and **28** from Cookbook-1
- 3) Problems **1** and **5** from Cookbook-2

**Time and state reversal.** Let

$$(*) \quad \dot{\mathbf{x}} = \mathbf{v}(\mathbf{x}), \quad \mathbf{x}(t_0) = \mathbf{x}_0$$

be an autonomous IVP, and as in Lecture 2, let  $(*)_{\text{tr}}$  and  $(*)_{\text{sr}}$  be the time reversal and state reversal of  $(*)$ . Let  $\Omega$  denote the state space of  $(*)$ , and assume that the map  $\mathbf{v}: \Omega \rightarrow \mathbf{R}^n$  is  $\mathcal{C}^1$ .

- 4) Let  $\varphi: (a, b) \rightarrow \mathbf{R}$  be a solution of  $(*)$ ,  $\varphi^{\text{tr}}$  and  $\varphi^{\text{sr}}$  the time and state reversals of  $\varphi$  respectively. Show that  $\varphi^{\text{tr}}$  and  $\varphi^{\text{sr}}$  are solutions of  $(*)_{\text{tr}}$  and  $(*)_{\text{sr}}$  respectively.
- 5) Show that
  - (a)  $(\varphi^{\text{tr}})^{\text{tr}} = \varphi$ .
  - (b)  $(\varphi^{\text{sr}})^{\text{sr}} = \varphi$ .
  - (c)  $(\varphi^{\text{sr}})^{\text{tr}} = (\varphi^{\text{tr}})^{\text{sr}}$ .