

# Suggested exercises for Problem Solving Session 1

MAT 4551 Spring 2019

HW  $x$  = Homework number  $x$  in the book by Canas da Silva.

- HW 1, Problems 1-9.
- The exercise in Section 2.4: Show that  $f_{\#}$  is a diffeomorphism.
- Let  $\phi: S^1 \times \mathbb{R} \rightarrow \mathbb{R}^2 \setminus \{0\}$  be the diffeomorphism defined by

$$\phi(\theta, s) = (e^s \cos(\theta), e^s \sin(\theta)).$$

Show that the induced symplectomorphism

$$\phi_{\#}: T^*S^1 \times T^*\mathbb{R} \rightarrow T^*(\mathbb{R}^2 \setminus \{0\}) \simeq \mathbb{C}^2 \setminus i\mathbb{R}^2$$

is given by

$$\phi_{\#}(\theta, \tau, t, s) = \begin{pmatrix} e^s \cos(\theta) + i(te^{-s} \cos(\theta) - \tau e^{-s} \sin(\theta)) \\ e^s \sin(\theta) + i(te^{-s} \sin(\theta) + \tau e^{-s} \cos(\theta)) \end{pmatrix}.$$

Here we let  $(\theta, \tau)$  denote the coordinates on  $T^*S^1$  and  $(t, s)$  denote the coordinates on  $T^*\mathbb{R}$ .

- HW 3, Problems 1-4.
- HW 6, Problems 1 and 3.