

Homework 2. Due September 20

Problem 1. 7 points. For 1D motion consider a linear map

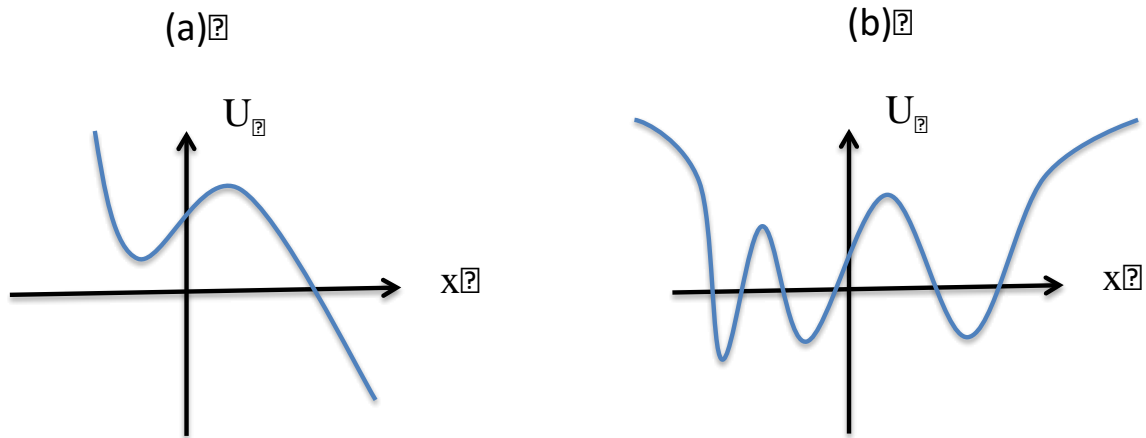
$$\begin{bmatrix} x' \\ p' \end{bmatrix} = M \begin{bmatrix} x \\ p \end{bmatrix}; M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

- (a) Find how a circle in  $\{x,p\}$  phase-plane is transformed into  $\{x',p'\}$  phase-plane? What is the area inside this figure?
- (b) Find in what shape an unit square e.g. with corners at  $(0,0)$ ,  $(0,1)$ ,  $(1,0)$  and  $(1,1)$  is transformed? What is the area inside this figure?

Problem 2. 8 points. For 1D motion with a Hamiltonian

$$H = \frac{p^2}{2} + U(x)$$

draw qualitatively correct for two potentials shown in two figures below including direction of motion in each



Note: start from separatrices and then add typical trajectories between and around them.