

1 Theoretical questions to examination.

1. Give an example of a system of ODEs in \mathbb{R}^2 having some solutions $\varphi(t, \xi)$ that do not have ω or α limit sets.
2. Show that the ω - limit set Ω_ξ for solutions $\varphi(t, \xi)$ having closure of the orbit $O_+(\xi)$ compact, must be non-empty.
3. Sketch a trajectory illustrating the definition of ω - limit set.
4. Suppose a monodromy matrix M is given for a periodic linear system in \mathbb{R}^2 with period T . Can one calculate exact values $\varphi(t, \xi)$ of the solution with initial data ξ for $t = T, 3T, 5T$?
5. How long time it could take for a solution $\varphi(t, \xi)$ to the equation $x' = f(x)$ with $f : G \rightarrow \mathbb{R}^n$ to reach:
 - a) an asymptotically stable equilibrium point
 - b) the boundary ∂G of the domain G in case $\varphi(t, \xi) \rightarrow \partial G$ as t tends to $\sup I_\xi$.