Exercises to prepare the Seminar Test

1) Find the flow of $\dot{x} = -3(x-21)$.

2) a) Find a solution of the form $x_p = a\cos t + b\sin t$ of $x'' + x' + x = 2\cos t$.

b) Find the unique solution of the IVP

$x'' + x' + x = 2\cos 2t$, $x(0) = 0$, $x'(0) = 0$.

3) Find a polynomial solution of $x' = -2x + 7t^2$.

4) Find the general solution of

a) $x' + \frac{1}{t}x = e^{-3t}$; b) $x' + 3t^2 x = -1$.

5) We consider the scalar dyn. system $\dot{x} = x - 2x^3$.
Find its equilibria and study their stability using the linearization method. Represent the phase portrait.
Find $\varphi(t, 0)$. Describe the properties of $\varphi(t, 0.2)$ and $\varphi(t, 20)$.

6) Specify the type and stability of the linear system

$\dot{x} = x + y$, $\dot{y} = -2x + 4y$.

7) Find a global first integral of $\dot{x} = -7y$, $\dot{y} = 9x$.
Represent its phase portrait.

8) Find the equilibria and study their stability for

$\dot{x} = -x + xy$, $\dot{y} = -2y + 3y^2$.

+ similar exercises from the lists uploaded in Teams.