

Homework assignment 3*

Due date: December 4, 2006.

1. Perform phase-plane analysis (including a sketch of the direction field) for the following systems:

$$\begin{aligned}\dot{x} &= x \\ \dot{y} &= -y\end{aligned}$$

and

$$\begin{aligned}\dot{x} &= -x + 2y \\ \dot{y} &= -2x - y\end{aligned}$$

2. Find the Laplace transforms and their domain for the following functions, defined on $[0, +\infty)$:

$$f_1(t) = t^n, \text{ } n \text{ is an arbitrary positive integer, } f_2(t) = \sin(t), \text{ } f_3(t) = \cos(t - 1),$$

$$f_4(t) = \sinh(at), \text{ } a \text{ is an arbitrary real number, } f_5(t) = \begin{cases} t, & t \in [0, 1] \\ -t + 2, & t \in (1, 2] \\ 0, & t > 2 \end{cases}$$

Don't just use the table!

3. Do problems 5.2 # 11 and # 29.
4. Using Laplace transforms, solve the following IVP:

$$\begin{aligned}\dot{x} &= -2x + y, \quad x(0) = 0 \\ \dot{y} &= x - 2y + \sin(t), \quad y(0) = 0\end{aligned}$$

5. Do problem 5.8 # 24 (make sure you understand # 23 first).

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