

MATH 308. Differential Equations

Homework 11

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Deadline: FRIDAY Nov 25, 11:00 pm

Task 1. (4+2+4 pts) (a) Classify the linear systems $x' = Ax$ with

(1) $A = \begin{pmatrix} 0 & 2 \\ -8 & 0 \end{pmatrix}$

(2) $A = \begin{pmatrix} 0 & 2 \\ 8 & 0 \end{pmatrix}$

(3) $A = \begin{pmatrix} -5 & 3 \\ -1 & -1 \end{pmatrix}$

(4) $A = \begin{pmatrix} 2 & 1 \\ 2 & 4 \end{pmatrix}$

as saddle, node (sink/source), spiral sink/source, and center.

(b) Determine in which of the cases (1)-(4) all solutions tend to zero as $t \rightarrow +\infty$.

You are not required to solve these equations; you can either use (a) or plot the phase curves using e.g. Streamplot in wolframalpha.

(c) Using the eigenvalue method, find the general solution of the equation $x' = Ax$ with $A = \begin{pmatrix} 2 & 1 \\ -2 & 4 \end{pmatrix}$.

THERE WAS A MISPRINT IN THIS PROBLEM. NOW IT IS FIXED BUT THE MATRIX IS DIFFERENT FROM (4). I AM SORRY FOR MY MISTAKE.