
On the front of your blue book, write your name, the names of your lecturer (or lecture session number) and your TA (or recitation section number). Draw also a grading grid.

There are FOUR problems (some with subparts a, b, ...). YOU MUST WORK ALL FOUR PROBLEMS. Each full problem is worth 25 points. Start each problem on a new page. With the exception of problem 4 (which require only the answers), show all your work in your bluebook. Box all your answers. Calculators, books or any notes are NOT permitted. No 'crib sheets' are allowed.

1. Solve the initial value problem $x'' = 2e^x$ with initial conditions $x(0) = 0$, $x'(0) = -2$.

2. Consider the ODE $x'' = \frac{4}{t}x' - \frac{4}{t^2}x$.
 - a. Check that $x_1(t) = t$ is a solution.
 - b. Find the general solution.

3.
 - a. Find the general solution to the ODE $x'' + 4x = 0$.
 - b. Using the method of undetermined coefficients, find one particular solution to the inhomogeneous ODE $x'' + 4x = t$. Then write down the general solution to it.
 - c. Use instead variation of parameters to find a particular solution to $x'' + 4x = t$.

Please turn over for Problem 4. ⇨ ⇨ ⇨ ⇨ ⇨

4. The figures along the right edge of this page are labeled a - e. They show the direction field and phase plane trajectories for five ODEs (the axis are x horizontally and x' vertically). Below, labeled α - ϵ are, in a scrambled order, the five ODEs that led to these plots.

$\alpha.$ $x'' + x' + \frac{5}{4}x = 0$

$\beta.$ $x'' + \frac{1}{4}x = 0$

$\gamma.$ $x'' - \frac{7}{2}x' + \frac{3}{2}x = 0$

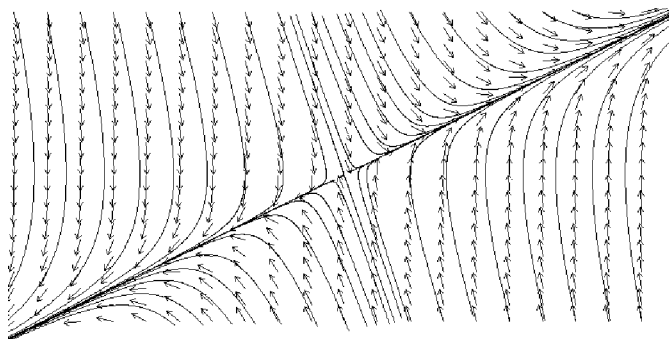
$\delta.$ $x'' + \frac{5}{2}x' - \frac{3}{2}x = 0$

$\epsilon.$ $x'' + \frac{7}{2}x' + \frac{3}{2}x = 0$

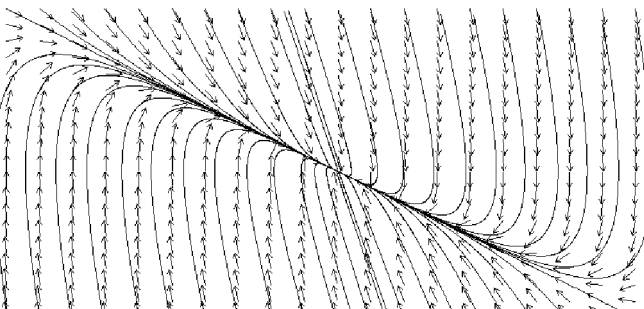
Complete the table below. In the second column, place the labels a - e and in the third column the labels α - ϵ so that, for each row, description, figure, and ODE match.

Description	Figure	ODE
sink		
source		
saddle		
spiral sink		
center		

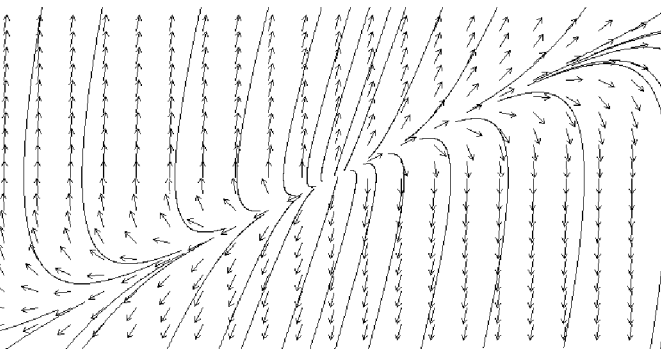
a.



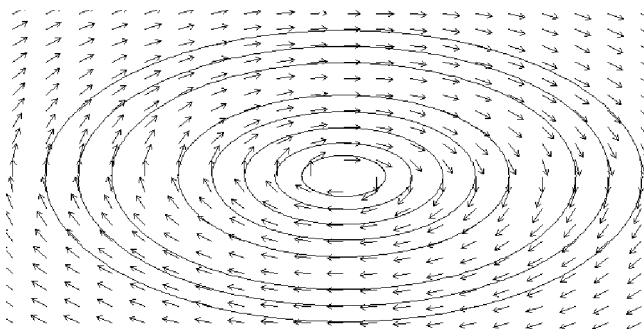
b.



c.



d.



e.

