

Problem 1

Find the general solution of each of the following linear systems

$$X' = \begin{pmatrix} 1 & 2 \\ 3 & 6 \end{pmatrix} X \quad X' = \begin{pmatrix} -1 & -3 \\ 0 & 2 \end{pmatrix} X.$$

Problem 2

Draw the direction fields for the systems of the previous problem. What can you say about the qualitative behavior of solutions from the direction field? (Hint: display graphically what happens as $t \rightarrow \pm\infty$ for solutions that correspond to several different initial conditions.)

Problem 3

Give an example of a linear system for which $(t, 1)$ is a solution. Sketch the direction field for this system. What is its general solution?

Problem 4 The following two systems are decoupled and therefore can be solved explicitly. What is the behavior of their solutions? Draw several representative solution curves to demonstrate your conclusion.

$$X' = \begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix} X \quad X' = \begin{pmatrix} -1 & 0 \\ 0 & 2 \end{pmatrix} X.$$