

**Instructions:** Show all work. Use exact answers unless otherwise asked to round.

1. Solve the following systems of differential equations. Write the general solution for each in real-valued terms, and then plot the eigenvectors (when real) and give several sample trajectories.

- a.  $\vec{x}'(t) = \begin{pmatrix} -7 & 6 \\ -3 & 2 \end{pmatrix} \vec{x}$

- b.  $\vec{x}'(t) = \begin{pmatrix} -4 & 6 \\ -3 & 2 \end{pmatrix} \vec{x}$

2. Solve the second order problem  $y'' - 7y' - 18y = 0$  for the general solution using the characteristic equation.