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## MATH 2400: Suggested Homework 5

In each of the following problems find the general solution of the given  $2 \times 2$  linear system  $\dot{x} = Ax$ . Also, sketch the phase portrait of the system in the  $x_1 - x_2$ -plane. Determine the type of the equilibrium at the origin (saddle, center, ...) and its stability (stable, asymptotically stable, unstable).

1. $\dot{\mathbf{x}} = \begin{pmatrix} 3 & -2 \\ 2 & -2 \end{pmatrix} \mathbf{x}.$	2. $\dot{\mathbf{x}} = \begin{pmatrix} 1 & -2 \\ 3 & -4 \end{pmatrix} \mathbf{x}.$	3. $\dot{\mathbf{x}} = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \mathbf{x}.$
4. $\dot{\mathbf{x}} = \begin{pmatrix} 5/4 & 3/4 \\ 3/4 & 5/4 \end{pmatrix} \mathbf{x}.$	5. $\dot{\mathbf{x}} = \begin{pmatrix} 3 & -2 \\ 4 & -1 \end{pmatrix} \mathbf{x}.$	6. $\dot{\mathbf{x}} = \begin{pmatrix} 1 & -4 \\ 1 & -1 \end{pmatrix} \mathbf{x}.$
7. $\dot{\mathbf{x}} = \begin{pmatrix} 2 & -5 \\ 1 & -2 \end{pmatrix} \mathbf{x}.$	8. $\dot{\mathbf{x}} = \begin{pmatrix} 1 & 2 \\ -5 & -1 \end{pmatrix} \mathbf{x}.$	9. $\dot{\mathbf{x}} = \begin{pmatrix} 1 & \sqrt{3} \\ \sqrt{3} & -1 \end{pmatrix} \mathbf{x}.$

Additional problems on repeated roots

10. $\dot{\mathbf{x}} = \begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix} \mathbf{x}.$	11. $\dot{\mathbf{x}} = \begin{pmatrix} -3 & 5/2 \\ -5/2 & 2 \end{pmatrix} \mathbf{x}.$	12. $\dot{\mathbf{x}} = \begin{pmatrix} -3/2 & 1 \\ -1/4 & -1/2 \end{pmatrix} \mathbf{x}.$
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