MthSc 208 (Fall 2010) Worksheet 9

MthSc 208: Differential Equations (Fall 2010) In-class Worksheet 9: Systems of differential equations (repeated eigenvalues)

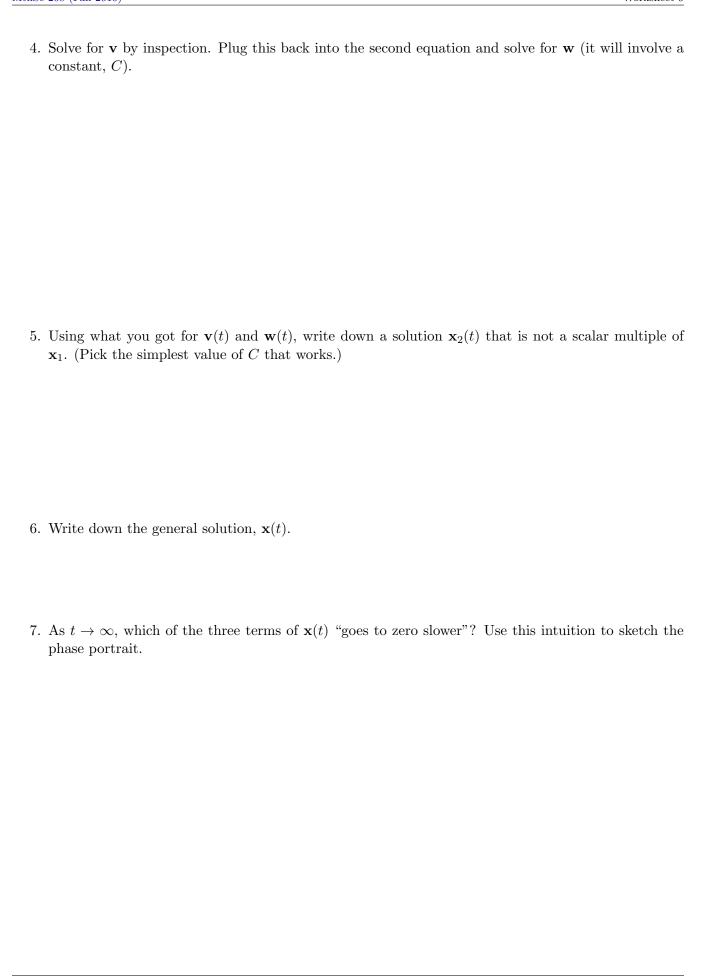
NAME:

Consider the system of differential equations: $\begin{cases} x_1' = -x_1 - x_2 \\ x_2' = x_1 - 3x_2 \end{cases}$

- 1. Write this in matrix form, $\mathbf{x}' = \mathbf{A}\mathbf{x} + \mathbf{b}$.
- 2. Knowing that **A** has a repeated eigenvalue, $\lambda_{1,2} = -2$, and one eigenvector, $\mathbf{v}_1 = (1,1)$, write down a solution $\mathbf{x}_1(t)$ to $\mathbf{x}' = \mathbf{A}\mathbf{x}$.
- 3. To find a second solution, assume that $\mathbf{x}_2(t) = te^{\lambda t}\mathbf{v} + e^{\lambda t}\mathbf{w}$. Plug this back into $\mathbf{x}' = \mathbf{A}\mathbf{x}$ and equate coefficients (of $te^{-\lambda t}$ and $e^{\lambda t}$) to get a system of two equations, involving \mathbf{v} , \mathbf{w} , and \mathbf{A} .

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