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M20580 L.A. and D.E. Tutorial
Worksheet 3
Sections 1.5, 1.7–1.9

1. Determine if the system has a non-trival solution. If yes, describe all solutions in parametric form.

(a) $\begin{aligned} x_1 - 2x_2 + x_3 &= 0 \\ 2x_1 + 4x_2 + x_3 &= 0 \\ 3x_1 + 2x_2 + x_3 &= 0 \end{aligned}$ (b) $\begin{aligned} x_1 - 2x_2 &= 0 \\ 2x_1 + 4x_2 + x_3 &= 0 \\ 3x_1 + 2x_2 + x_3 &= 0 \end{aligned}$ (c) $x_1 + x_2 + x_3 = 0$

2. Describe all solutions of $A\mathbf{x} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, where $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & 4 & 1 \\ 3 & 2 & 1 \end{bmatrix}$.

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3. Let $A = \begin{bmatrix} 1 & 3 & 0 & 3 \\ -1 & -1 & -1 & 1 \\ 0 & -4 & 2 & -8 \\ 2 & 0 & 3 & -1 \end{bmatrix}$.

(a) How many rows of A contain a pivot position? Does the equation $A\mathbf{x}=\mathbf{b}$ have a solution for each $\mathbf{b}$ in $\mathbb{R}^4$?

(b) Do the columns of A span $\mathbb{R}^4$?

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4. Determine if the vectors are linearly independent.

(a) $\begin{bmatrix}1\\0\\0\\0\end{bmatrix}, \begin{bmatrix}0\\2\\0\\0\end{bmatrix}, \begin{bmatrix}0\\0\\3\\0\end{bmatrix}, \begin{bmatrix}0\\0\\0\\4\end{bmatrix}$

(b) $\begin{bmatrix}1\\3\\2\end{bmatrix}, \begin{bmatrix}2\\7\\5\end{bmatrix}, \begin{bmatrix}3\\10\\7\end{bmatrix}$