MA2071 Linear Algebra
C Term, Sections C01-C04
W. J. Martin
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PRACTICE ONLY – DO NOT HAND IN

20 minutes

Linear Algebra Quiz 2

For each of the following sets of vectors $S = \{\mathbf{v}_1, \ldots, \mathbf{v}_p\}$ and target vector $\mathbf{b}$, determine whether or not $\mathbf{b}$ is in the span of S. If so, express $\mathbf{b}$ in terms of the members of S.
[NOTE: For this problem, you are not absolutely required to use row reduction, but always explain your answers.]

(a) In $\mathbb{R}^2$, $\quad S = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ 3 \end{bmatrix} \right\}, \quad \mathbf{b} = \begin{bmatrix} 0 \\ 4 \end{bmatrix}.$

(b) In $\mathbb{R}^2$, $\quad S = \left\{ \begin{bmatrix} 3 \\ -5 \end{bmatrix}, \begin{bmatrix} -6 \\ 10 \end{bmatrix}, \begin{bmatrix} 15 \\ -25 \end{bmatrix} \right\}, \quad \mathbf{b} = \begin{bmatrix} 1 \\ 4 \end{bmatrix}.$

(c) In $\mathbb{R}^3$, $\quad S = \left\{ \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ -2 \\ 1 \end{bmatrix} \right\}, \quad \mathbf{b} = \begin{bmatrix} 1 \\ 4 \\ 5 \end{bmatrix}.$

(d) In $\mathbb{R}^3$, $\quad S = \left\{ \begin{bmatrix} 9/4 \\ -5/2 \\ 1/8 \end{bmatrix}, \begin{bmatrix} -29/13 \\ 5/16 \\ -1/17 \end{bmatrix}, \begin{bmatrix} 14/5 \\ 12/7 \\ -2/3 \end{bmatrix} \right\}, \quad \mathbf{b} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}.$