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MTH 317: Linear Algebra
Professor Sussan
April 12th, 2025
Homework #7 - 3.16(a) & 3.19 (a)

(a) $\begin{pmatrix} 2 & 1 \\ 3 & 1 \end{pmatrix}$ $^{(a)}$ $A^\top = \begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix}$

✓ 3.19 Decide if the vector is in the column space of the matrix.

(a) $\begin{pmatrix} 2 & 1 \\ 2 & 5 \end{pmatrix}$, $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

$^{a)}$ $A = \begin{bmatrix} 2 & 1 & | & 1 \\ 2 & 5 & | & -3 \end{bmatrix}$ $\xrightarrow{\frac{1}{2}R_1 \to R_1}$ $\begin{bmatrix} 1 & \frac{1}{2} & | & \frac{1}{2} \\ 2 & 5 & | & -3 \end{bmatrix}$ $\xrightarrow{R_2 - 2R_1 \to R_2}$ $\begin{bmatrix} 1 & \frac{1}{2} & | & \frac{1}{2} \\ 0 & 4 & | & -4 \end{bmatrix}$

$\xrightarrow{\frac{1}{4}R_2 \to R_2}$ $\begin{bmatrix} 1 & \frac{1}{2} & | & \frac{1}{2} \\ 0 & 1 & | & -1 \end{bmatrix}$ $\xrightarrow{R_1 - \frac{1}{2}R_2 \to R_1}$ $\begin{bmatrix} 1 & 0 & | & 1 \\ 0 & 1 & | & -1 \end{bmatrix}$ ✓

Vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$ is in the column
space of matrix $\begin{pmatrix} 2 & 1 \\ 2 & 5 \end{pmatrix}$. ✓

$\boxed{\vec{v} = \begin{bmatrix} 1 \\ -3 \end{bmatrix} \in Col(A)}$