RH 2.2

MATH 5, Jones

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Refrigerator Homework

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$AB = \begin{bmatrix} 8+15 & 5k-10 \\ -12+3 & 15+k \end{bmatrix} = \begin{bmatrix} 23 & 5k-10 \\ -9 & k+15 \end{bmatrix}$

$BA = \begin{bmatrix} 8+15 & 20-5 \\ 6-3k & 15+k \end{bmatrix} = \begin{bmatrix} 23 & 15 \\ 6-3k & k+15 \end{bmatrix}$

$\boxed{6-3k=-9 \to k=5}$

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$\begin{bmatrix} 1 & -2 \\ -2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \begin{bmatrix} -1 \\ 6 \end{bmatrix}$

$1x-2y=-1$ and $-2x+5y=6$ Solving the system with wolfram the result is $\mathbf{b_1} = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$

$\begin{bmatrix} 1 & -2 \\ -2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \begin{bmatrix} 2 \\ -9 \end{bmatrix}$

$1x-2y=2$ and $-2x+5y=-9$ solving the system with Wolfram the result is $\mathbf{b_2} = \begin{bmatrix} -8 \\ -5 \end{bmatrix}$

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Since there exists a nonzero vector $\mathbf{b_n}$ such that $A\mathbf{b_n} = \mathbf{0}$, this confirms that the columns of A are linearly dependent.
Since A is linearly dependent, A is not invertible, and its columns do not form a basis for the space.

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Suppose $Ax=0$
$CAx=C0 \quad CA=I_n$
$I_nx=0$
$x=0$
If A had more columns than rows it would have free variables, which would lead to more than the trivial solution being a solution

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Suppose (since Ax=b has a solution) $AD=I_m$
$\mathbf{x}=D\mathbf{b}$
$A\mathbf{x}=A(D\mathbf{b})$
$(AD)\mathbf{b}=I_m\mathbf{b}$ Since $AD=I_m$, $A\mathbf{x}=\mathbf{b}$
If A had more rows than columns it would be overdetermined, and there would be more equations than unknowns.

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a: $3b - 2a - 4c$
b: Same as a, $3b - 2a - 4c$
c: $uv^T = \begin{bmatrix} -2 \\ 3 \\ -4 \end{bmatrix} \begin{bmatrix} a & b & c \end{bmatrix} = \begin{bmatrix} (-2)(a) & (-2)(b) & (-2)(c) \\ (3)(a) & (3)(b) & (3)(c) \\ (-4)(a) & (-4)(b) & (-4)(c) \end{bmatrix} = \begin{bmatrix} -2a & -2b & -2c \\ 3a & 3b & 3c \\ -4a & -4b & -4c \end{bmatrix}$
d:

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