

RH 1.9

MATH 5, Jones

Tejas Patel

Refrigerator Homework

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

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

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

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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 $Ax = 0$

$$CAx = C0 \quad CA = I_n$$

$$I_n x = 0$$

$$x = 0$$

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) $AD = I_m$

$$\mathbf{x} = D\mathbf{b}$$

$$A\mathbf{x} = A(D\mathbf{b})$$

$$(AD)\mathbf{b} = I_m \mathbf{b} \text{ Since } AD = I_m, A\mathbf{x} = \mathbf{b}$$

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, $3b - 2a - 4c$

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

d:

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