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E1.2.1 Sample Question 1

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1. Let $L_A : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ and $L_B : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be linear transformations with

$$L_B \left(\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, L_B \left(\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} -2 \\ -1 \\ 1 \end{pmatrix}, L_B \left(\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}$$

and

$$L_A \left(\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, L_A \left(\begin{pmatrix} -2 \\ -1 \\ 1 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ 1 \end{pmatrix}, L_A \left(\begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \right) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

(a) Let B equal the matrix that represents the linear transformation L_B . (In other words, $Bx = L_B(x)$ for all $x \in \mathbb{R}^3$). Then

$$B =$$

(b) Let C equal the matrix such that $Cx = L_A(L_B(x))$ for all $x \in \mathbb{R}^3$.

- What are the row and column sizes of C ?

- Then

$$C =$$

Answer Video

1. Let $L_A : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ and $L_B : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be linear transformations with

$$L_B \left(\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, L_B \left(\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} -2 \\ -1 \\ 1 \end{pmatrix}, L_B \left(\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}$$

and

$$L_A \left(\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \right) = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, L_A \left(\begin{pmatrix} -2 \\ -1 \\ 1 \end{pmatrix} \right) = \begin{pmatrix} 0 \\ 1 \end{pmatrix}, L_A \left(\begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \right) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

(a) Let B equal the matrix that represents the linear transformation L_B . (In other words, $Bx = L_B(x)$ for all $x \in \mathbb{R}^3$). Then

$$B = \begin{pmatrix} 3 & -2 & 0 \\ 1 & -1 & 1 \\ 0 & 1 & 2 \end{pmatrix}$$

(b) Let C equal the matrix such that $Cx = L_A(L_B(x))$ for all $x \in \mathbb{R}^3$.

- What are the row and column sizes of C ?

2×3

- Then

$$C = \begin{pmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$$

2×3

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