E2.3.1 Questions 1-2

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Exam 2 due Dec 3, 2023 04:42 IST Completed

E2.3.1 Questions 1-2

Question 1

10.0/10.0 points (graded)
(10 points)

Let $L_A : \mathbb{R}^3 \to \mathbb{R}^3$ and $L_B : \mathbb{R}^3 \to \mathbb{R}^3$ be linear transformations with

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

and

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

(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

$B =$

1 ✔ Answer: 1	1 ✔ Answer: 1	3 ✔ Answer: 3
1 ✔ Answer: 1	1 ✔ Answer: 1	1 ✔ Answer: 1
-2 ✔ Answer: -2	1 ✔ Answer: 1	2 ✔ Answer: 2

(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?

3 ✔ Answer: 3 by 3 ✔ Answer: 3

$C =$

1 ✔ Answer: 1	0 ✔ Answer: 0	0 ✔ Answer: 0
0 ✔ Answer: 0	1 ✔ Answer: 1	0 ✔ Answer: 0
0 ✔ Answer: 0	0 ✔ Answer: 0	1 ✔ Answer: 1

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Calculator

$A^{-1} =$

1 ✔	1 ✔	3 ✔
Answer: 1	Answer: 1	Answer: 3
1 ✔	1 ✔	1 ✔
Answer: 1	Answer: 1	Answer: 1
-2 ✔	1 ✔	2 ✔
Answer: -2	Answer: 1	Answer: 2

1. (10 points) Let $L_A : \mathbb{R}^3 \to \mathbb{R}^3$ and $L_B : \mathbb{R}^3 \to \mathbb{R}^3$ be linear transformations with

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

and

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

(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

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

Answer: The columns of B equal the vectors that result from evaluating $L_B(x)$ with the unit basis vectors.

(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? 3×3
- $C = \begin{pmatrix}1 & 0 & 0\\0 & 1 & 0\\0 & 0 & 1\end{pmatrix}$

  Answer: $L_C(\begin{pmatrix}1\\0\\0\end{pmatrix}) = L_A(L_B(\begin{pmatrix}1\\0\\0\end{pmatrix})) = L_A(\begin{pmatrix}1\\1\\-2\end{pmatrix}) = \begin{pmatrix}1\\0\\0\end{pmatrix}$. The other columns of C can be computed similarly.

- $A^{-1} = B$

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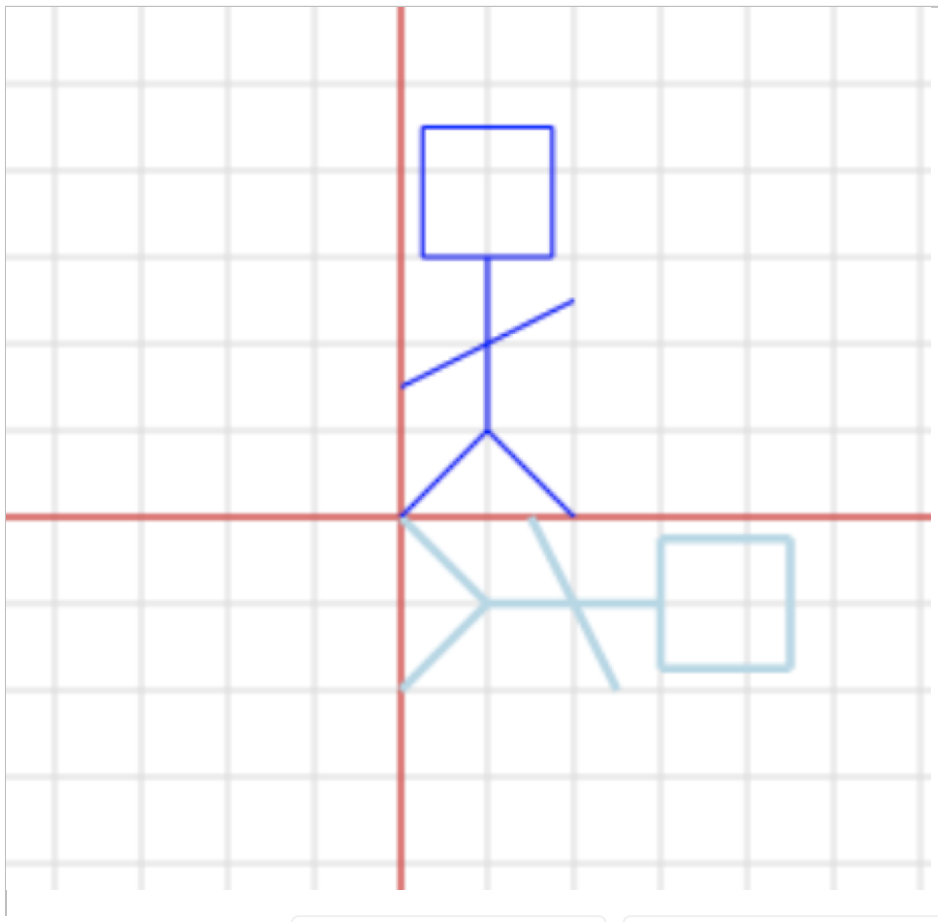
Answers are displayed within the problem

Calculator

Question 2

10.0/10.0 points (graded)

Consider the following picture of “Timmy":



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