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### E1.2.5 Sample Question 5

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5. Let  $A = \begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix}$  and  $L_A : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ , the linear transformation defined by  $L(x) = Ax$ .

(a) Find the vector  $x$  such that  $L_A(x) = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ .

(b) Find the vector  $y$  such that  $L_A(y) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$ .

(c) Find the vector  $z$  such that  $L_A(z) = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ .

### Answer Video


Handwritten solution for problem 5(b) and 5(c):

(b) Find the vector  $y$  such that  $L_A(y) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$ .  
 $L_A(e_1) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$        $y = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$


(c) Find the vector  $z$  such that  $L_A(z) = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ .  
 $L_A(z) = \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ -1 \end{pmatrix}$   
 $= L_A\left(\begin{pmatrix} 1 \\ 0 \end{pmatrix}\right) + L_A\left(\begin{pmatrix} 0 \\ 1 \end{pmatrix}\right)$   
 $z = e_0 + e_1 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$  ✓


X 1.6

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