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### PROBLEM #1.

Given vector set  $U = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $U$  are eigenvectors?

$$U = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

Proof:

All vectors in  $U$  are eigenvectors.

$$\forall u_i \in U: Tu_i \in \text{Span}(u_i)$$

Therefore all vectors in  $U$  are eigenvectors.

□.

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### PROBLEM #2.

Given vector set  $U = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $U$  are eigenvectors?

$$U = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}$$

both  $u_1$  and  $u_3$ ,

$$Tu_i \in \text{Span}(u_i).$$

$u_2$  is not an eigenvector,

$$Tu_2 \notin \text{Span}(u_2).$$

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### PROBLEM #3.

Given vector set  $U = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $U$  are eigenvectors?

$$U = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

$u_1$  is the only eigen vector

$$Tu_i \in \{u_2, u_3\}: Tu_i \notin \text{Span}(u_i).$$

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#### PROBLEM #4.

Given vector set  $u = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $u$  are eigenvectors?

$$u = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$

Answer is none.

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#### PROBLEM #5.

Given vector set  $u = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $u$  are eigenvectors?

$$u = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

Answer is all.

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#### PROBLEM #6.

Given vector set  $u = \{u_1, u_2, u_3\}$  and the transformation  $T$ , which vectors in  $u$  are eigenvectors?

$$u = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\} \quad T = \begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$$

Answer is only  $u_1$ .