Show all work clearly and in order. Please box your answers. 10 minutes.

1. (a) Let $S = \left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right)$ be the standard basis of $\mathbb{R}^2$. Let $X = \left(\begin{bmatrix} 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \end{bmatrix} \right)$ be a basis of $\mathbb{R}^2$ (you do not need to show this). Let $F{:}\mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation given by the matrix (with respect to the basis S)

$$_S F_S = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}.$$

Find the matrix $_X F_X$.

(b) Show that F is an isomorphism. (Hint: use either $_X F_X$ or $_S F_S$).