Name (Last, First): _____

Student ID: _____

1. Consider the matrix
$$A = \begin{pmatrix} 5 & 5 \\ -13 & -3 \end{pmatrix}.$$

Use a change of basis to represent A as a rotation and scaling transformation. In other words, find a real matrix
$$C = \begin{pmatrix} a & -b \\ b & a \end{pmatrix}$$

and an invertible real matrix P such that $A = PCP^{-1}$.

2. Inside of $\mathbb{R}^4$, consider the vectors

$$v_1 = \begin{pmatrix} 0 \\ 1 \\ 1 \\ 1 \end{pmatrix}, \quad v_2 = \begin{pmatrix} 1 \\ 0 \\ 1 \\ 1 \end{pmatrix}, \quad v_3 = \begin{pmatrix} 1 \\ 1 \\ 0 \\ 1 \end{pmatrix}.$$

Find all vectors that are simultaneously orthogonal to $v_1, v_2,$ and v_3 with respect to the dot product.