
1. (6 pts.) Define each of the following terms. Use complete sentences and appropriate notation.

(a) Eigenvector

(b) Eigenvalue

(c) A is similar to B

2. (8 pts.) (a) Compute the change of basis matrix, $P_{C \leftarrow B}$, when B and C are two ordered bases of \mathbb{R}^2 . (4 pts.) Suppose

$$B = \{ \mathbf{b}_1, \mathbf{b}_2 \}, \text{ with } \mathbf{b}_1 = \begin{bmatrix} -1 \\ 2 \end{bmatrix} \text{ and } \mathbf{b}_2 = \begin{bmatrix} -2 \\ 1 \end{bmatrix},$$

$$\text{and } C = \{ \mathbf{c}_1, \mathbf{c}_2 \}, \text{ with } \mathbf{c}_1 = \begin{bmatrix} -3 \\ 1 \end{bmatrix} \text{ and } \mathbf{c}_2 = \begin{bmatrix} -1 \\ 3 \end{bmatrix},$$

are the two bases in doing this.

(b) What is the equation satisfied by P for all \mathbf{x} in \mathbb{R}^2 ??
 (2 pts.) $C \leftarrow B$

(c) How are P and P related???
 (2 pts.) $C \leftarrow B$ $B \leftarrow C$

3. (6 pts.) Find the eigenvalue(s), determine the corresponding eigenspaces, and obtain a basis for each eigenspace for the following matrix. (**Notation:** Eigenvalue: λ ; corresponding eigenspace: E_λ ; corresponding basis: B_λ .)

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 6 & 0 \\ 3 & -9 & 1 \end{bmatrix}.$$