Finding Eigen Stuff: Warm-up Exercises

Linear Algebra

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1. Consider the matrix

$$A = \begin{bmatrix} -4 & 4 \\ -12 & 10 \end{bmatrix} \tag{1}$$

   (a) Show that $\vec{v_1} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ is an eigenvector of A with an eigenvalue of $\lambda_1 = 4$.

   (b) Is $\begin{bmatrix} 2 \\ 4 \end{bmatrix}$ an eigenvector of A with $\lambda_1 = 4$?

   (c) omg. How many eigenvectors are there with an eigenvector of $\lambda_1 = 4$?

   (d) Is this a problem?

   (e) Describe the set of all vectors that are eigenvectors of A with eigenvalues $\lambda_1 = 4$. (Is this set a subspace?)

2. The equation $A\vec{x} = \vec{0}$ has a non-zero solution $\vec{x}$ if _____.

3. Let $\vec{v} = \begin{bmatrix} 3 \\ -4 \end{bmatrix}$. Let I be the 2×2 identity matrix.

   (a) What is $I\vec{v}$?

   (b) What is λI?

   (c) What is $\lambda I\vec{v}$?

   (d) What is $A - \lambda I$?

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Find the eigenvectors and eigenvalues for the following matrices:

$$A = \begin{bmatrix} -5 & 2 \\ -7 & 4 \end{bmatrix} \tag{2}$$

$$B = \begin{bmatrix} 4 & 2 & 3 \\ 0 & -2 & -1 \\ 0 & 0 & 3 \end{bmatrix} \tag{3}$$

$$F = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \tag{4}$$

1.