

## Eigenvalues and Eigenvectors Quiz PDF

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**Which method is commonly used to find eigenvalues of large matrices?**

- Simplex method
- Power iteration
- Gaussian elimination
- Newton's method

**A matrix A is diagonalizable if it can be expressed as:**

- $A = PDP^{-1}$
- $A = P + D + P^{-1}$
- $A = DPD^{-1}$
- $A = P^{-1}DP$

**What is the geometric multiplicity of an eigenvalue?**

- The number of times an eigenvalue appears in the characteristic polynomial
- The number of linearly independent eigenvectors for an eigenvalue
- The determinant of the matrix
- The trace of the matrix

**In which field is Principal Component Analysis (PCA) commonly used?**

- Sorting algorithms
- Principal Component Analysis
- Network routing
- Encryption

**Explain how eigenvalues are used to determine the stability of a dynamical system.**

**Explain what an eigenvector is and how it relates to an eigenvalue.**

**Describe the process of deriving the characteristic equation for a 2x2 matrix.**

**What are true statements about the algebraic multiplicity of an eigenvalue? (Select all that apply)**

- It is always equal to the geometric multiplicity.
- It can be greater than the geometric multiplicity.
- It is the number of times an eigenvalue appears as a root.
- It is always less than the geometric multiplicity.

**In stability analysis, a system is considered stable if all eigenvalues have:**

- Positive real parts
- Negative real parts
- Zero real parts
- Imaginary parts only

**Complex eigenvalues indicate which of the following in a system? (Select all that apply)**

- Oscillatory behavior
- Stability
- Rotational dynamics
- Linear growth

**Which numerical methods are used to compute eigenvalues and eigenvectors? (Select all that apply)**

- QR algorithm
- Power iteration
- Gradient descent
- Simplex method

**Why are eigenvectors often normalized?**

- To simplify calculations
- To ensure they have a unit length
- To change their direction
- To make them orthogonal

**Discuss the difference between algebraic and geometric multiplicity of an eigenvalue.**

**What conditions must be met for a matrix to be diagonalizable?**

**What is an eigenvalue?**

- A vector that does not change direction under a linear transformation
- A scalar that scales an eigenvector under a linear transformation
- A matrix that transforms a vector
- A determinant of a matrix

**Eigenvalues and eigenvectors are used in which of the following fields? (Select all that apply)**

- Quantum mechanics
- Image processing
- Weather forecasting
- Financial modeling

**How are eigenvalues and eigenvectors used in Principal Component Analysis (PCA)?****Which equation is used to find eigenvalues?**

- $A\mathbf{v} = \lambda\mathbf{v}$
- $\det(A - \lambda I) = 0$
- $A = PDP^{-1}$
- $\mathbf{v} = \lambda A\mathbf{v}$

**Which components are used to derive the characteristic equation? (Select all that apply)**

- Matrix A
- Identity matrix I
- Eigenvalue  $\lambda$
- Eigenvector v

**Which of the following statements are true about eigenvectors? (Select all that apply)**

- They can be zero vectors.
- They change direction under a linear transformation.
- They can be scaled to have a unit length.
- They correspond to eigenvalues.