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Determinants Quiz Answer Key PDF

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Which operation does NOT change the determinant of a matrix?

a. Swapping two rows

b. Multiplying a row by a scalar

c. Adding a multiple of one row to another ✓

d. Transposing the matrix

What is the determinant of the identity matrix of size $n \times n$?

a. 0

b. 1 ✓

c. n

d. n!

What is the determinant of a 2x2 matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$?

a. a + d

b. ad - bc ✓

c. ab + cd

d. ac - bd

Explain why the determinant of a matrix is important in determining whether a matrix is invertible.

A matrix is invertible if and only if its determinant is non-zero. A zero determinant indicates that the matrix is singular and does not have an inverse.

Explain the process of calculating the determinant of a 3x3 matrix using cofactor expansion.

To calculate the determinant using cofactor expansion, choose a row or column, multiply each element by its cofactor, and sum the results. The cofactor is calculated as $(-1)^{i+j}$ times the

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determinant of the minor matrix obtained by removing the element's row and column.

Which of the following matrices has a determinant of zero?

a. Identity matrix

b. Diagonal matrix with all non-zero elements

c. Matrix with two identical rows ✓

d. Upper triangular matrix with non-zero diagonal elements

What does a determinant of zero indicate about a matrix?

a. The matrix is invertible

b. The matrix is not invertible ✓

c. The matrix is symmetric

d. The matrix is orthogonal

Which method is commonly used to calculate the determinant of a 3x3 matrix?

a. Gaussian elimination

b. Rule of Sarrus ✓

c. Matrix inversion

d. Eigenvalue decomposition

Which of the following is true about the determinant of a matrix product (AB)?

a. $\det(AB) = \det(A) + \det(B)$

b. $\det(AB) = \det(A) \times \det(B)$ ✓

c. $\det(AB) = \det(A) - \det(B)$

d. $\det(AB) = \det(A) / \det(B)$

Which of the following properties are true for determinants? (Select all that apply)

a. Determinants are only defined for square matrices. ✓

b. Swapping two rows of a matrix multiplies the determinant by -1. ✓

c. Adding a scalar to a row changes the determinant.

d. The determinant of a matrix is always positive.

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Which operations will result in a determinant of zero? (Select all that apply)

a. Making two rows identical ✓

b. Adding a multiple of one row to another

c. Having a row of zeros ✓

d. Transposing the matrix

For which of the following matrices is the determinant equal to the product of its diagonal elements? (Select all that apply)

a. Diagonal matrix ✓

b. Upper triangular matrix ✓

c. Lower triangular matrix ✓

d. Symmetric matrix

Which of the following statements about determinants are correct? (Select all that apply)

a. The determinant of a matrix is a scalar. ✓

b. Determinants can be used to find eigenvalues. ✓

c. The determinant of a matrix product is the sum of the determinants.

d. Determinants are used in Cramer's Rule. ✓

What are the consequences of a zero determinant? (Select all that apply)

a. The matrix is invertible.

b. The matrix has full rank.

c. The matrix is singular. ✓

d. The system of equations has no unique solution. ✓

Which of the following are methods to calculate the determinant of a matrix? (Select all that apply)

a. Cofactor expansion ✓

b. Gaussian elimination ✓

c. Matrix multiplication

d. Rule of Sarrus ✓

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Describe the geometric interpretation of the determinant of a 2x2 matrix.

The determinant of a 2x2 matrix represents the area of the parallelogram formed by its column vectors. A zero determinant indicates that the vectors are linearly dependent and lie on the same line.

How does the determinant relate to the volume of a parallelepiped in three-dimensional space?

The absolute value of the determinant of a 3x3 matrix represents the volume of the parallelepiped formed by its column vectors. A zero determinant indicates that the vectors are coplanar.

What is the significance of the determinant in solving systems of linear equations using Cramer's Rule?

Cramer's Rule uses determinants to find the solution of a system of linear equations. It requires that the determinant of the coefficient matrix is non-zero to ensure a unique solution.

Discuss how row operations affect the determinant of a matrix and provide examples.

Swapping two rows multiplies the determinant by -1, multiplying a row by a scalar multiplies the determinant by that scalar, and adding a multiple of one row to another does not change the determinant.

In a triangular matrix, the determinant is equal to:

a. The sum of the diagonal elements

b. The product of the diagonal elements ✓

c. Zero

d. The sum of all elements

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