Interview Question 0: Linear Algebra

Candidate Name

Interview Date

1 Question

Topic: Linear Algebra
Difficulty: Easy
Question: Given a 2x2 matrix A = [[a, b], [c, d]], calculate the determinant of A.

2 Answer

To calculate the determinant of a 2x2 matrix A = [[a, b], [c, d]], we need to follow the formula det(A) = ad - bc. The determinant is a scalar value that is a characteristic of the matrix and can be used to determine if the matrix is invertible or not. In the case of a 2x2 matrix, the determinant can be easily calculated using the mentioned formula. Here's a step-by-step breakdown of the solution:

1. Identify the elements of the matrix A: a, b, c, and d.
2. Apply the determinant formula for a 2x2 matrix: det(A) = ad - bc.
3. Calculate the product of the diagonal elements: ad.
4. Calculate the product of the off-diagonal elements: bc.
5. Subtract the product of the off-diagonal elements from the product of the diagonal elements: ad - bc.
6. The result is the determinant of the matrix A.

In conclusion, the determinant of a 2x2 matrix A = [[a, b], [c, d]] can be calculated using the formula det(A) = ad - bc. This value can provide insights into the properties of the matrix, such as whether it is invertible or not. If the determinant is non-zero, the matrix is invertible, and if it is zero, the matrix is singular and not invertible.

3 Grading Rubric

- Part 1: Identify the elements of the matrix A: a, b, c, and d.
  - Score 0: Fails to identify the elements or identifies them incorrectly.
  - Score 1: Correctly identifies the elements of the matrix A.
- Part 2: Apply the determinant formula for a 2x2 matrix: det(A) = ad - bc.
  - Score 0: Does not mention or incorrectly applies the determinant formula.
  - Score 1: Correctly applies the determinant formula for a 2x2 matrix.
- Part 3: Calculate the product of the diagonal elements: ad.
  - Score 0: Fails to calculate the product of the diagonal elements or calculates it incorrectly.
  - Score 1: Correctly calculates the product of the diagonal elements.
- Part 4: Calculate the product of the off-diagonal elements: bc.
  - Score 0: Fails to calculate the product of the off-diagonal elements or calculates it incorrectly.
  - Score 1: Correctly calculates the product of the off-diagonal elements.
- Part 5: Subtract the product of the off-diagonal elements from the product of the diagonal elements: ad - bc.
  - Score 0: Fails to perform the subtraction or performs it incorrectly.
  - Score 1: Correctly performs the subtraction to find the determinant.
- Part 6: Conclusion and interpretation of the determinant value.
  - Score 0: Fails to provide a conclusion or provides an incorrect conclusion about the determinant value.
  - Score 1: Correctly provides a conclusion and interpretation of the determinant value, including its implications on invertibility.

4 Feedback

- Solution Number 0
  - Remarks: The candidate correctly applied the determinant formula for a 2x2 matrix (Part 2), but failed to identify the elements of the matrix A (Part 1), calculate the product of the diagonal elements (Part 3), calculate the product of the off-diagonal elements (Part 4), perform the subtraction to find the determinant (Part 5), and provide a conclusion and interpretation of the determinant value (Part 6).
  - Score: 1 / 6