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# Linear Algebra Review

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## Contents

1 Vocabulary Review . . . . .	3
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# 1 Vocabulary Review

Short-answer, multiple-choice, and select-all questions about key vocabulary.

**Question 1** A linear system of equations is inconsistent if the system has no solutions and consistent if the system does have solutions.

**Question 2** A matrix  $E$  is in (row) echelon form if two conditions hold.

- (a) The first nonzero entry in each row of  $E$  is equal to 1. This leading entry 1 is called a pivot.
- (b) A pivot in the  $(i + 1)^{st}$  row of  $E$  occurs in a column to the right of the column where the pivot in the  $i^{th}$  row occurs.

Note: A consequence of this definition is that all rows in an echelon form matrix that are identically zero occur at the bottom of the matrix.

**Question 3** Two  $m \times n$  matrices are row equivalent if one can be transformed to the other by a sequence of elementary row operations.

**Question 4** A matrix  $E$  is in reduced echelon form if

- (a)  $E$  is in echelon form, and
- (b) in every column of  $E$  having a pivot, every entry in that column other than the pivot is 0.

**Question 5** Let  $A$  be an  $m \times n$  matrix that is row equivalent to a reduced echelon form matrix  $E$ . Then the rank of  $A$  is the number of nonzero rows in  $E$ .

## 1 Vocabulary Review

**Question 6** A mapping  $L : \mathbb{R}^n \rightarrow \mathbb{R}^m$  is linear if

(a)  $L(x + y) = \text{\span style="border: 1px solid black; padding: 0 2px;">}L(x) + L(y)\text{\span style="border: 1px solid black; padding: 0 2px;}}$  for all  $x, y \in \mathbb{R}^n$ .

(b)  $L(cx) = \text{\span style="border: 1px solid black; padding: 0 2px;">}cL(x)\text{\span style="border: 1px solid black; padding: 0 2px;}}$  for all  $x \in \mathbb{R}^n$  and all scalars  $c \in \mathbb{R}$ .

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**Question 7** Let  $j$  be an integer between 1 and  $n$ . The  $n$ -vector  $e_j$  is the vector that has a 1 in the  $j^{\text{th}}$  entry and a 0 in every other entries.

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**Question 8** The  $n \times n$  matrix  $A$  is invertible if there is an  $n \times n$  matrix  $B$  such that  $AB = I_n$  and  $BA = I_n$ . The matrix  $B$  is called an inverse of  $A$ . If  $A$  is not invertible, then  $A$  is noninvertible or singular.

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**Question 9** The determinant of the  $2 \times 2$  matrix  $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$  is  $\det(A) = \text{\span style="border: 1px solid black; padding: 0 2px;">}ad - bc\text{\span style="border: 1px solid black; padding: 0 2px;}}$ .

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