

Applied Linear Algebra in Data Analysis: January 2026

Quiz 1 | Duration: 10min | Marks: 10

1. Consider the following linear equation with 100 unknown variables,

$$a_1x_1 + a_2x_2 + \cdots + a_{100}x_{100} = b$$

What spaces do the row view and column view of this equation correspond to? [Marks: 1]

What are the different possible solutions for this equation? [Marks: 1]

Explain the complete set of conditions for the different types of solutions for this equation? [Marks: 2]

If the above equation is solvable, explain the procedure for obtaining the solution if it had a unique solution, else explain how you can generate any of the infinitely many solutions. [Marks: 2]

2. Choose the most appropriate answer. What is vector space? [Marks: 1]

- a) A quantity with magnitude and direction.
- b) A set with no elements.
- c) A set containing the zero element.
- d) A set closed under linear combination of its elements.

3. Choose the correct answer: What is linear independence? [Marks: 1]

- a) A set of vectors.
- b) An operation on a set of vectors.
- c) A property of a set of vectors.
- d) A geometric operation on a set of vectors.

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Quiz 2 | Duration: 20min | Marks: 10

1. Consider a system of p equations with q unknowns. What space does the **row view** correspond to? [Marks: 0.5]

- a) \mathbb{R}^p
- b) \mathbb{R}^q
- c) \mathbb{R}^1
- d) \mathbb{R}^2

What space does the **column view** correspond to? [Marks: 0.5]

- a) \mathbb{R}^p
- b) \mathbb{R}^q
- c) \mathbb{R}^1
- d) \mathbb{R}^2

2. Consider a system of p equations with q unknowns. In the column view interpretation, what question are we asking in this problem? [Marks: 1]

- a) Where is the intersection of the hyperplanes represented by the p equations?
- b) Where is the intersection of the lines represented by the p unknowns?
- c) What linear combination of the q vectors from \mathbb{R}^p give us the vector \mathbf{b} ?
- d) What linear combination of the p vectors from \mathbb{R}^q give us the vector \mathbf{b} ?

3. (True or False) The set of all n unit vectors of \mathbb{R}^n form a vector space. Note: *Explain your answer. Answers without an explanation will not be credited* [Marks: 2]

4. (True or False) The set of all n unit vectors of \mathbb{R}^n form a linearly independent set. Note: *Explain your answer. Answers without an explanation will not be credited* [Marks: 2]

5. (True or False) The set of all points from \mathbb{R}^n satisfying the following equation form a subspace of \mathbb{R}^n . Note: *Explain your answer. Answers without an explanation will not be credited* [Marks: 2]

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \in \mathbb{R}^n, \text{ such that } x_1 + x_2 + \cdots + x_n = 0$$

6. Shows that the set of solutions to the following two equations forms a subspace of \mathbb{R}^3 . [Marks: 1]

$$\begin{aligned} x_1 + x_2 + x_3 &= 0 \\ x_1 + x_2 - x_3 &= 0 \end{aligned}$$

What is the dimension of this subspace? [Marks: 1]