**LAHORE UNIVERSITY OF MANAGEMENT SCIENCES**
**Department of Electrical Engineering**

**EE212 Mathematical Foundations for Machine Learning and Data Science**
**Quiz 01**

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**Name:** _____

**Campus ID:** _____

**Total Marks:** 10
**Time Duration:** 15 minutes

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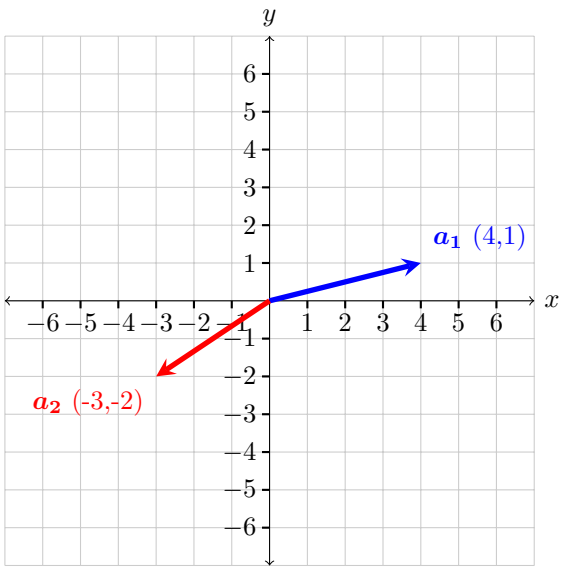
## Question 1 (4 marks)

Let $a_1$ and $a_2$ be two vectors in $\mathbb{R}^2$ as shown below:




The linear combination of the given vectors is of form $\beta_1 a_1 + \beta_2 a_2$ where $\beta_1$ and $\beta_2$ are scalar coefficients of the linear combination.
For the given vectors, express the following combinations on the plot and give ranges for $\beta$ values:

(a) [2 marks] An affine combination.

(b) [2 marks] A convex combination.

## Question 2 (4 marks)

Suppose the 100-vector $x$ represents the distribution of ages in some population of people, with $x_i$ being the number of $i$-1 year olds, for $i = 1, \ldots 100$. (You can assume that $x$ is not 0 and there is no one in the population over age 99.) Find expressions, using vector notation, for the following quantities.

(a) [2 marks] The total number of people in the population.

(b) [2 marks] The average age of the population. (You can use ordinary division of numbers in your expression.)

## Question 3 (2 marks)

Standardize the following vector:

$$x = \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}$$