

Course 1: Linear Algebra for Machine Learning & Data Science

Overview

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1 System of linear equations: 2 variables

1.1 System of sentences

1.1.1 What is a system of sentences?

- A system of sentences is just a group of sentences
- Example 1: A system of 2 sentences

System 1	System 2	System 3
The dog is Black	The dog is Black	The dog is Black
The cat is Orange	The dog is Black	The dog is White

- Example 2: A system of 3 sentences

System 1	System 2	System 3	System 4
The dog is Black	The dog is Black	The dog is Black	The dog is Black
The cat is Orange	The dog is Black	The dog is Black	The dog is White
The bird is Red	The bird is Red	The dog is Black	The bird is Red

1.1.2 New concepts

1. Complete, Redundant, Contradictory

- **Complete:** when *number of pieces of information = number of sentences*
Example: Ex1 - System 1, Ex2 - System 1
- **Redundant:** when there are same sentences
Example: Ex1 - System 2, Ex2 - System 2, Ex2 - System 3
- **Contradictory:** when there are sentences contradict each other
Example: Ex1 - System 3, Ex2 - System 4

2. Singular & non-Singular

- **Singular:** when the system is Complete
- **non-Singular:** when the system is not Complete

1.2 System of equations

1.2.1 From sentences to equations

Sentences	Sentences with numbers	Equations
The dog is black	The price of an apple and a banana is \$10	$a + b = 10$

1.2.2 Systems of equations

System 1	System 2	System 3
$a + b = 10$ $a + 2b = 12$	$a + b = 10$ $2a + 2b = 20$	$a + b = 10$ $2a + 2b = 24$
Unique Solution	Infinite solutions	No solution
$a = 8$ $b = 2$	$a = 8, 7, 6, \dots$ $b = 2, 3, 4, \dots$	
Complete	Redundant	Contradictory
<i>Non-singular</i>	<i>Singular</i>	<i>Singular</i>

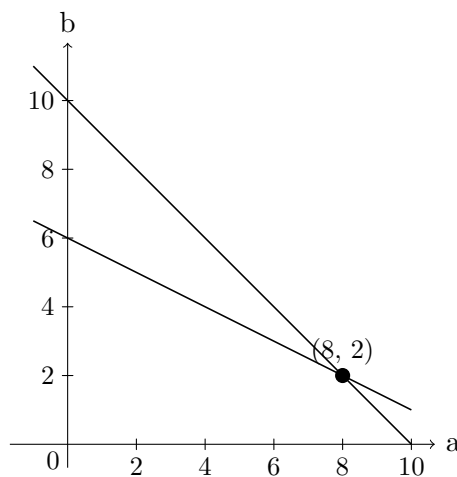
1.2.3 What is a linear equation?

Linear	non-Linear
$a + b = 10$	$a^2 + b^2 = 20$
$3.4a - 48.99b + 2c = 122.5$	$ab^2 + \frac{b}{a} - \frac{3}{b} - \log c = 4^a$

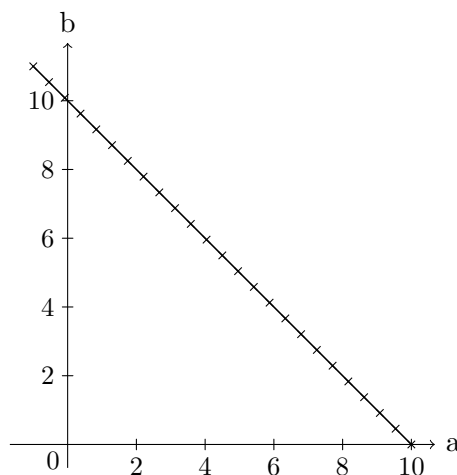
→ Linear Algebra is the study of Linear equations

1.3 System of equations as lines

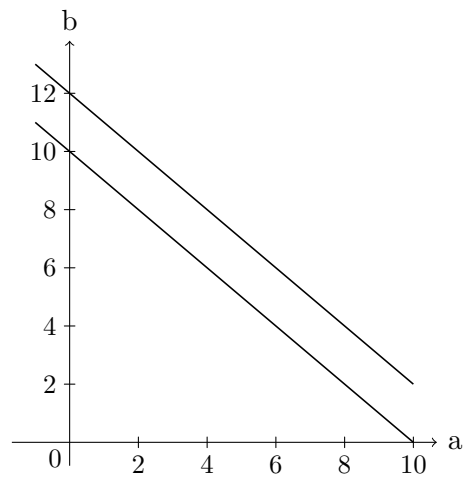
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Hình 1: System 1



Hình 2: System 2



Hình 3: System 3

2 System of linear equations: 3 variables