

Linear Nonhomogeneous System

Given numbers $a_{11}, \dots, a_{mn}, b_1, \dots, b_m$, consider the **nonhomogeneous system** of m linear equations in n **unknowns** x_1, x_2, \dots, x_n

$$(1) \quad \begin{aligned} a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n &= b_1, \\ a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n &= b_2, \\ &\vdots \\ a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n &= b_m. \end{aligned}$$

Constants a_{11}, \dots, a_{mn} are called the **coefficients** of system (1). Constants b_1, \dots, b_m are collectively referenced as the **right hand side, right side** or **RHS**.

Linear Homogeneous System

Given numbers a_{11}, \dots, a_{mn} consider the **homogeneous system** of m linear equations in n **unknowns** x_1, x_2, \dots, x_n

$$(2) \quad \begin{aligned} a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n &= 0, \\ a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n &= 0, \\ &\vdots \\ a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n &= 0. \end{aligned}$$

Constants a_{11}, \dots, a_{mn} are called the **coefficients** of system (2).

Definition 2 (Parametric Equations)

The terminology **parametric equations** refers to a set of equations of the form

$$(3) \quad \begin{aligned} x_1 &= d_1 + c_{11}t_1 + \cdots + c_{1k}t_k, \\ x_2 &= d_2 + c_{21}t_1 + \cdots + c_{2k}t_k, \\ &\vdots \\ x_n &= d_n + c_{n1}t_1 + \cdots + c_{nk}t_k. \end{aligned}$$

The numbers $d_1, \dots, d_n, c_{11}, \dots, c_{nk}$ are *known constants* and the variable names t_1, \dots, t_k are **parameters**. The symbols t_1, \dots, t_k are therefore allowed to take on any value from $-\infty$ to ∞ .