Linear Equations in Algebra: What is Linear Equation in Maths? (For CBSE, ICSE, IAS, NET, NRA 2022)

Title: Linear Equations in Algebra

- Linear algebra is a subject of great breadth. Its spectrum ranges from the abstract through numerical techniques to applications.
- Linear algebra is used in many various fields such as fractal geometry, differential equations, difference equations, relativity, archaeology, demography and many more.
- In daily life, we come across various situations where we need to frame the problems into equations to solve them.

What is Linear Equation in Math'S?

- The statement of equality of two algebraic expressions involving one or more variables is known as equation.
- Linear equations are equations of the first order. These equations are defined for lines in the coordinate system. An equation for a straight line is called a linear equation.
- An equation in which the highest power of the variable is one is known as linear equation.
- Linear equations are those equations that are of the first order. These equations are defined for lines in the coordinate system.
- An algebraic equation that can be written in the form $ax + b = 0$ or $ax + by + c = 0$, where a, b and c are real numbers and x and y are variables with highest power one.

Standard Form of a Linear Equation

Consider $a, b, c, a_1, a_2, b_1, b_2$ and d are real numbers and x, y, z are variables.

Terms	Definition	Standard Form	Example
Linear Equations in One Variable	An equation has only one variable.	$ax + b = 0$	$2x-3 = 0$
Linear Equation in two Variables	An equation has only two variables.	$ax + by + c = 0$	$3x + 7y + 4 = 0$
Linear Equation in Three Variables	An equation has three variables.	$ax + by + cz + d = 0$	$x + 7y + 4z - 1 = 0$
Linear Equations	Equation containing	$\frac{a}{x} + \frac{b}{y} = c$	$\frac{2}{x} - \frac{3}{y} = 5$

with Fractions	fractional terms.		and $\frac{3}{x} = \frac{1}{y} + 1$
Slope Intercept Form	Equation in the form: y = mx + c.	$y = \text{mx} + c$, where $'m'$ = slope and $'c'$ = $y-$ intercept	$y = 3x + 10$
Point Slope Form	Equation passing through a point (x_1, y_1) .	$y - y_1 = m(x - x_1)$ where m = slope	$y-3 = 10(x-5)$; Line passing through point (3,5)
Pair of linear equations in two variables	Set of two or more linear equations containing same number of variables	Pair of 2 equations: $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$	$3x + 4y = 4$ and $5x + 7y = 3$

Standard Form of a Linear Equation

Some Examples

Linear Equation in One variable	Linear Equation in Two variable	Linear Equation in Three variable
$3x + 5 = 0$ $32x + 7 = 0$ $98x = 49$	$y + 7x = 3$ $3a + 2b = 5$ $6x + 9y - 12 = 0$	$x + y + z = 0$ $a-3b = c$ $3x + 12y = \frac{1}{2}z$

Some Examples

In general:

A general system of m linear equations with n unknowns

$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n = b_1$

$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n = b_2$

$\cdots a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{\text{mn}}x_n = b_m$

System of Linear Equations

Where $x_1, x_2, x_3, \cdots, x_n$ variables and

$b_1, b_2, \cdots, b_m$ Constant terms and

$a_{11}, a_{12}, \cdots, a_{\text{mn}}$ Coefficients of any system of linear equations

Solution of Linear Equations

Linear equations can be used to solve any arithmetic equations and determine the exact value/root of the variable which satisfies the equation.

Solving Linear Equation in One Variable

The basic principle used in solving any linear equation is that any operation performed on one side of the equation must also be performed on the other side of the equation.

Following are important rules to solve linear equations:

- Additional rule
- Subtraction rule
- Multiplication rule
- Division rule

Solving Systems of Linear Equations

- How to solve linear Equations in two variables? Linear Equations of two variables can be solved by different methods as listed below.
- For the equations involving two variables, we need to have two equations having the same variables to find the roots.

Methods to Solve

- Method of substitution
- Cross multiplication method
- Method of elimination
- Matrix method
- Determinant methods