Pair of Linear Equations in Two Variables

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Comprehensive study notes for

Pair of Linear Equations in Two Variables

by

Ajay Yadav

(Math King of Katargam). Master every concept with clear explanations, solved examples, and practice problems.

Key Concepts

Linear Equations in Two Variables

A pair of linear equations has the form: a&sub1;x + b&sub1;y + c&sub1; = 0 and a&sub2;x + b&sub2;y + c&sub2; = 0. Their graphs are straight lines in the same plane.

Types of Solutions

Intersecting lines:

Unique solution (consistent).

Coincident lines:

Infinitely many solutions (consistent/dependent).

Parallel lines:

No solution (inconsistent).

Condition for Solutions

Let a&sub1;/a&sub2; = b&sub1;/b&sub2; = c&sub1;/c&sub2; => coincident (infinite). a&sub1;/a&sub2; != b&sub1;/b&sub2; => intersecting (unique). a&sub1;/a&sub2; = b&sub1;/b&sub2; != c&sub1;/c&sub2; => parallel (none).

Substitution Method

(1) Express one variable in terms of the other from one equation. (2) Substitute into the other equation. (3) Solve for one variable. (4) Back-substitute to find the other.

Elimination Method

(1) Multiply equations to make coefficients of one variable equal. (2) Add or subtract to eliminate that variable. (3) Solve for the remaining variable. (4) Back-substitute.

Cross-Multiplication Method

For a&sub1;x + b&sub1;y + c&sub1; = 0 and a&sub2;x + b&sub2;y + c&sub2; = 0: x/(b&sub1;c&sub2; - b&sub2;c&sub1;) = y/(c&sub1;a&sub2; - c&sub2;a&sub1;) = 1/(a&sub1;b&sub2; - a&sub2;b&sub1;).

Equations Reducible to Linear Form

Equations like a/x + b/y = c can be reduced to linear form by substitution: let u = 1/x and v = 1/y.

Important Formulas

Intersecting

a&sub1;/a&sub2; != b&sub1;/b&sub2; (unique solution)

Coincident

a&sub1;/a&sub2; = b&sub1;/b&sub2; = c&sub1;/c&sub2; (infinite)

Parallel

a&sub1;/a&sub2; = b&sub1;/b&sub2; != c&sub1;/c&sub2; (no solution)

Cross Multiplication

x/(b&sub1;c&sub2;-b&sub2;c&sub1;) = y/(c&sub1;a&sub2;-c&sub2;a&sub1;) = 1/(a&sub1;b&sub2;-a&sub2;b&sub1;)

Solved Examples

Example 1:

Solve: x + y = 5 and 2x - y = 4.

Solution:

Adding: 3x = 9 => x = 3. Then y = 5 - 3 = 2.

(3, 2)

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Example 2:

Solve using substitution: 2x + y = 7, x - y = 2.

Solution:

From second: x = y + 2. Substitute: 2(y+2) + y = 7 => 3y + 4 = 7 => y = 1, x = 3.

(3, 1)

.

Example 3:

Check consistency: 2x + 3y = 8, 4x + 6y = 16.

Solution:

a&sub1;/a&sub2; = 2/4 = 1/2. b&sub1;/b&sub2; = 3/6 = 1/2. c&sub1;/c&sub2; = 8/16 = 1/2. All equal, lines are coincident, infinitely many solutions.

Practice Questions

Solve: 2x + y = 8 and x - y = 1.

For what value of k do 3x + ky = 6 and 6x + 9y = 18 have infinitely many solutions?

Solve: 2/x + 3/y = 13, 5/x - 4/y = -2. (Hint: Let u = 1/x, v = 1/y)

A boat travels 30 km upstream and 44 km downstream in 10 hours. In 13 hours, it goes 40 km upstream and 55 km downstream. Find speeds.

Check whether 2x - 3y = 7 and 4x - 6y = 9 are consistent.

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