SUCCESS KEY

TEST SERIES

CLASS

10

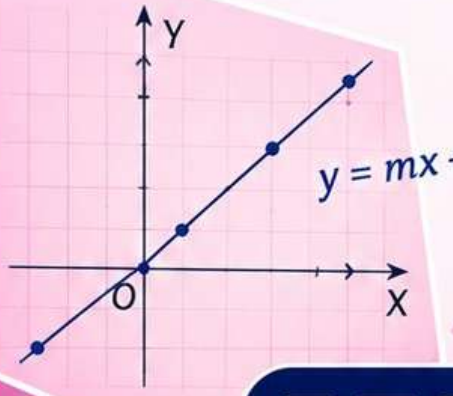
MATHEMATICS

PART - 1

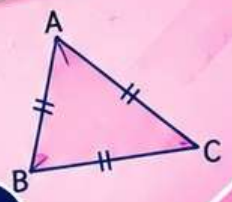
ENGLISH & SEMI ENGLISH MEDIUM

(MAHARASHTRA BOARD)

Smart Way of Learning



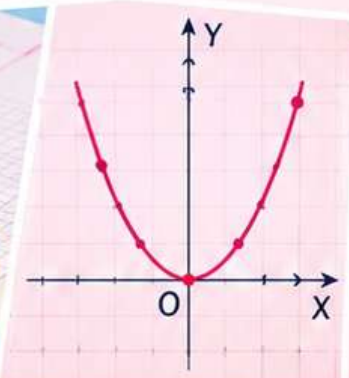
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

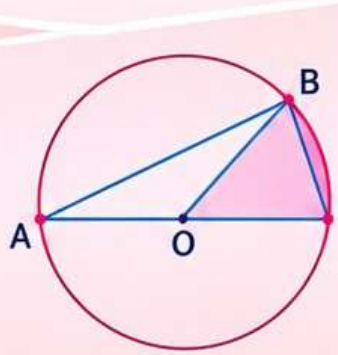


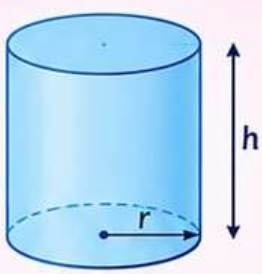












Volume
$V = \pi r^2 h$

- Chapterwise Notes
- Important Points
- Formulas & Theorems
- Diagrams & Tables
- Exam Oriented

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CHAPTER 01

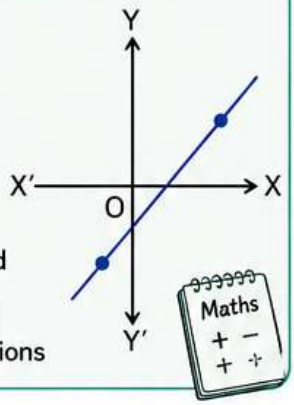
Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

Success Key Test Series

THIS CHAPTER INCLUDES

- ✓ Simultaneous Linear Equations
- ✓ Graphical Method of Solving Simultaneous Equations
- ✓ Determinants
- ✓ Cramer's Rule
- ✓ Equations that can be transformed in linear equation in two variables
- ✓ Application of simultaneous equations



DEFINITION

Linear Equation in Two Variables

An equation which contains two variables and the degree of each term containing a variable is one, is called a linear equation in two variables.

MUST REMEMBER

- ★ Degree of each variable in every term = 1
- ★ It contains two variables.
- ★ The graph of a linear equation in two variables is always a straight line.
- ★ General form : $ax + by + c = 0$

GENERAL FORM

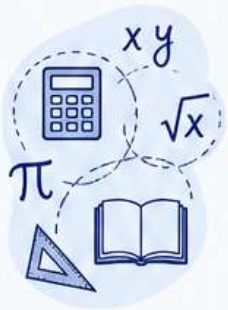
$$ax + by + c = 0$$

where,

- a, b, c are real numbers.
- a and b are not simultaneously zero.

Example : $3x - 4y + 12 = 0$

CONCEPT MAP



Linear Equation in Two Variables
↓
General Form $ax + by + c = 0$
↓
Graph (Straight Line)
↓
Simultaneous Linear Equations
↓
Elimination Method | Graphical Method | Cramer's Rule

BOARD EXAM ALERT

Questions frequently asked in Board Exams

- ✓ Identify whether an equation is linear or not.
- ✓ Write the general form of a linear equation.
- ✓ Find ordered pairs.
- ✓ Draw the graph of a linear equation.
- ✓ Solve simultaneous linear equations.
- ✓ Activity based questions.

LINEAR OR NOT LINEAR ?

No.	Equation	Linear Equation in Two Variables ?
1	$4m + 3n = 12$	Linear
2	$3x^2 - 7y = 13$	Not Linear
3	$2x - 5y = 16$	Linear
4	$0x + 6y - 3 = 0$	Linear
5	$0.3x + 0y - 36 = 0$	Linear
6	$\frac{4}{x} + \frac{5}{y} = 4$	Not Linear
7	$4xy - 5y - 8 = 0$	Not Linear

QUICK REVISION

- Contains two variables.
- Degree of each variable = 1
- Graph is always a straight line.
- General form : $ax + by + c = 0$
- Foundation for Graphical Method and Cramer's Rule.

CHAPTER 01

Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

Success Key Test Series

MUST LEARN

Simultaneous Linear Equations

When two linear equations in two variables are considered at the same time, they are called simultaneous linear equations.

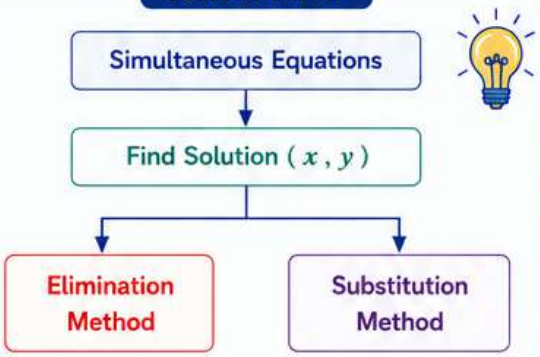
General Form

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

Textbook Point :

The values of x and y satisfying both equations are called the solution of the simultaneous equations.

CONCEPT MAP



ELIMINATION METHOD (Standard Steps)

1. Make coefficients of one variable equal.
2. Add or subtract the equations.
3. Find the value of one variable.
4. Substitute this value in any one equation.
5. Find the value of the other variable.
6. Write the solution as ordered pair (x, y).

SOLVED MODEL (Textbook Example)

Solve : $5x - 3y = 8$ ...(1)
$3x + y = 2$ ...(2)

Solution :

Step 1 Given Equations

$5x - 3y = 8$ ...(1)
$3x + y = 2$ ...(2)

Step 2 Multiply equation (2) by 3.

$3(3x + y) = 3(2)$
$9x + 3y = 6$ ...(3)

Step 3 Add equations (1) and (3).

$$\begin{array}{rl} & 5x - 3y = 8 \\ + & 9x + 3y = 6 \\ \hline & 14x = 14 \end{array}$$

$x = 1$

Step 4 Substitute $x = 1$ in equation (2).

$3x + y = 2$
$3(1) + y = 2$
$3 + y = 2$
$y = -1$

Answer : $x = 1,\ y = -1$ or $(x, y) = (1, -1)$

SMART BOARD TIP

Special Type Questions

When coefficients are interchanged :

$15x + 17y = 21$
$17x + 15y = 11$

- First ADD the equations.
- Then SUBTRACT the equations.
- This reduces calculations and saves time.

BOARD EXAM ALERT

Frequently Asked in Board Exams

- Solve simultaneous equations.
- Find the value of x and y.
- Verify the obtained solution.
- Activity based elimination questions.
- Complete the missing steps.

COMMON MISTAKES

- Wrong sign while adding or subtracting equations.
- Incorrect substitutions.
- Writing only x or y and forgetting ordered pair.

Correct Answer Format

$x = \ldots$
$y = \ldots$
$(x, y) = (\quad, \quad)$

QUICK REVISION

1. Two equations in two variables.
2. Common solution satisfies both equations.
3. Elimination Method is the standard method.
4. Substitution Method is also used in simple cases.
5. Final answer must be written as ordered pair (x, y).

CHAPTER 01

Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

Success Key Test Series

LET'S RECALL

- The graph of a linear equation in two variables is a straight line.
- The ordered pair which satisfies the equation is a solution of that equation.
- The ordered pair represents a point on that line.

ORDERED PAIR

An ordered pair is written as (x, y).

Example : $(2, 0)$

x–coordinate $= 2$
y–coordinate $= 0$

KEY CONCEPT

Every point on the graph satisfies the equation. More points obtained from the equation give the same straight line.

SOLVED MODEL (Textbook Example)

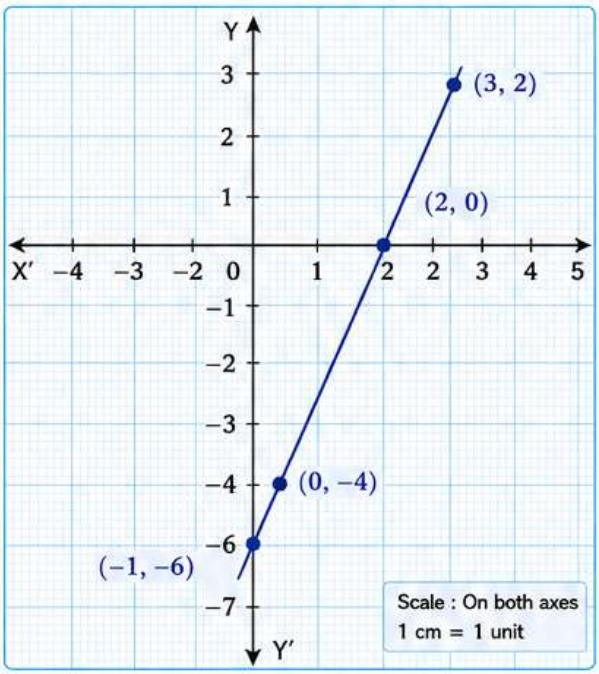
Draw graph of $2x - y = 4$

Step 1 : Find ordered pairs.

x	0	2	3	-1
y	-4	0	2	-6
Ordered Pair (x, y)	$(0, -4)$	$(2, 0)$	$(3, 2)$	$(-1, -6)$

Step 2 : Plot the points on the graph paper.

Step 3 : Join the points. We get a straight line.



GRAPH DRAWING STEPS

Step 1 — Find at least 4 ordered pairs.

Step 2 — Draw X–axis and Y–axis.

Step 3 — Plot all the points.

Step 4 — Check that all points lie on one straight line.

SMART GRAPH TIP

Why should we take 4 points?

- ★ Two points are sufficient to represent a line.
- ★ But if one point is plotted incorrectly, the graph becomes wrong.
- ★ Using four points helps to verify the correctness of the graph.

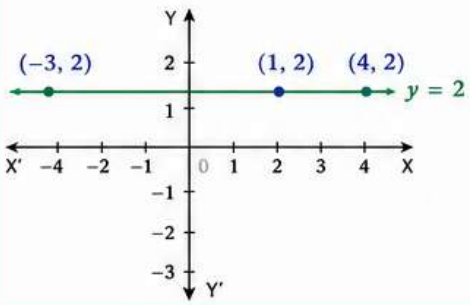
BOARD EXAM ALERT

- ★ Draw graph of a linear equation.
- ★ Find ordered pairs.
- ★ Plot the points correctly.
- ★ State the nature of the graph.
- ★ Identify the graph parallel to X–axis or Y–axis.

SPECIAL CASES

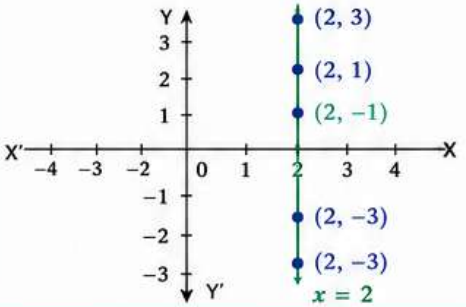
Case 1 : $y = 2$ (or $0x + y = 2$)

Graph is parallel to X–axis.



Case 2 : $x = 2$ (or $x + 0y = 2$)

Graph is parallel to Y–axis.



COMMON MISTAKES

- Taking wrong value of y.
- Plotting coordinates in reverse order.

Correct : $(2, 3)$ ✓
Wrong : $(3, 2)$ ✗

- Joining points with broken line.

Always draw a straight line.

SUCCESS KEY EXAM TIP

Easiest method to get ordered pairs

First put $x = 0$ — Then find y.

Next put $y = 0$ — Then find x.

These two steps quickly give two important points for drawing the graph.

QUICK REVISION

- ✓ Graph of linear equation is a straight line.
- ✓ Ordered pair is a solution of the equation.
- ✓ Use minimum 4 points for accurate graph.
- ✓ x = constant → Graph is parallel to Y–axis.
- ✓ y = constant → Graph is parallel to X–axis.

CHAPTER 01

Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

Graphical Method of Solving Simultaneous Equations

Success Key Test Series

MUST LEARN

Graphical Method

The solution of two simultaneous equations can be obtained by drawing their graphs.

The coordinates of the point of intersection of the two lines give the solution of the equations.

(Textbook Concept)

VISUAL CONCEPT

First Equation Draw Graph

↓

Second Equation Draw Graph

↓

Intersection Point

↓

Solution (x , y)

KEY CONCEPT

Consider :

$x + y = 4$ ... (1)

$2x - y = 2$ ... (2)

After plotting both graphs, the two lines intersect at (2 , 2).

Therefore,

$x = 2$, $y = 2$

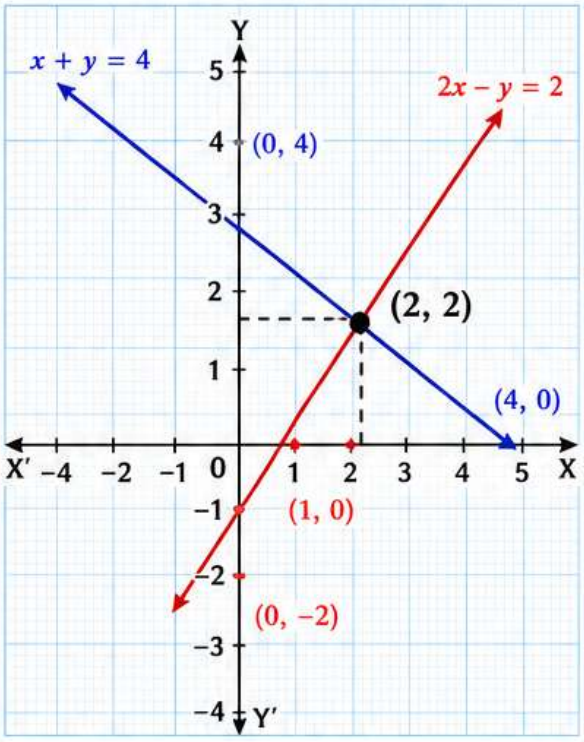
is the solution.

(Textbook Example)

GRAPHS OF THE EQUATIONS

$x + y = 4$ (Blue Line)

$2x - y = 2$ (Red Line)



Intersection Point = (2, 2)

Therefore, $x = 2$, $y = 2$ is the solution.

EXAMINER'S EXPECTED ANSWER

Solution by Graphical Method

- **Step 1** Draw both graphs.
- **Step 2** Locate intersection point.
- **Step 3** Write coordinates of intersection point.
- **Step 4** State the solution.

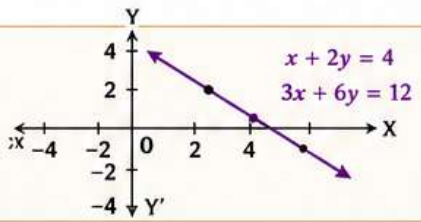
Example : Intersection Point = (2, 2)

Therefore, $x = 2$, $y = 2$

TEXTBOOK OBSERVATION

For $x + 2y = 4$ and $3x + 6y = 12$

- Both graphs represent the same line.
- Hence every point on that line satisfies both equations.
- Therefore, there are **Infinite Solutions.**



SUCCESS KEY GRAPH TRICK

Nature of Lines	Solution
Intersecting Lines	One unique solution
Coincident Lines (Same line)	Infinite solutions
Parallel Lines	No solution

TYPES OF SOLUTIONS

Case 1 Intersecting Lines

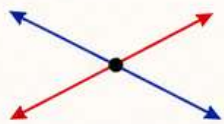
Graphs meet at one point.

⇒ One unique solution.

Example :

$x + y = 4$

$2x - y = 2$



Case 2 Coincident Lines

Both graphs lie on the same line.

⇒ Infinite solutions

Example :

$x + 2y = 4$

$3x + 6y = 12$



Case 3 Parallel Lines

Graphs never intersect.

⇒ No solution

Example :

$x - 2y = 4$

$2x - 4y = 12$



BOARD EXAM ALERT

- State the number of solutions.
- Identify the type of graphs.
- Write the coordinates of the intersection point.
- Compare graphical method answers with elimination method answers.
- Activity-based graphical questions are very important.

COMMON MISTAKES

- Reading wrong coordinates.
- Considering nearby point instead of exact intersection.
- Drawing graph with wrong scale.

Remember

Always write the solution as an ordered pair (x , y).

QUICK REVISION

- Graphical Method gives solution by intersection point.
- Intersecting lines → One solution.
- Coincident lines → Infinite solutions.
- Parallel lines → No solution.
- Solution is written as ordered pair (x , y).
- Always draw graphs accurately.

CHAPTER 01

Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

DETERMINANTS & CRAMER'S RULE

Success Key Test Series

MUST LEARN

DETERMINANT

A determinant of order 2 is written as

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$$

Its value is

$$ad - bc$$

(Textbook Formula)

FORMULA BOX

DETERMINANT FORMULA

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

SUCCESS KEY MEMORY TRICK

Cross Multiplication Trick

a b

c d

$(ad) - (bc)$

Remember :

First Diagonal – Second Diagonal

$$ad - bc$$

This is only a memory aid for the textbook formula.

SOLVED MODEL

Find $\begin{vmatrix} 5 & 3 \\ 7 & 9 \end{vmatrix}$

Solution :

$= (5 \times 9) - (3 \times 7)$

$= 45 - 21$

$= \boxed{24}$

(Textbook Example)

CRAMER'S RULE

For equations

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

DETERMINANTS

$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$ (Nothing changes)

$D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}$ (Replace x-column by constants)

$D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}$ (Replace y-column by constants)

MASTER FORMULAE

$$x = \frac{D_x}{D}$$

$$y = \frac{D_y}{D}$$

SUCCESS KEY EXAM TRICK

Remember D, D_x, D_y

Determinant	What changes?
D	Nothing
D_x	Replace x-column by constants
D_y	Replace y-column by constants

⚠ Students often lose marks here. This table helps avoid confusion.

CRAMER'S RULE FLOWCHART

Write equations in form $ax + by = c$

↓

Find D

↓

Find D_x

↓

Find D_y

↓

$x = \frac{D_x}{D}$, $y = \frac{D_y}{D}$

↓

Write Solution (x, y)

BOARD EXAM ALERT

Frequently Asked Questions

- ★ Find value of determinant.
- ★ Solve using Cramer's Rule.
- ★ Find D, D_x and D_y.
- ★ Fill missing determinant values.
- ★ Complete activity-based questions.

COMMON MISTAKES

- ✗ Writing wrong determinant.
- ✗ Replacing wrong column in D_x.
- ✗ Replacing wrong column in D_y.
- ✗ Forgetting final ordered pair (x, y).



QUICK REVISION

- ✓ Determinant $= ad - bc$
- ✓ $D \rightarrow$ Original coefficients
- ✓ $D_x \rightarrow$ Replace x-column
- ✓ $D_y \rightarrow$ Replace y-column

$x = \frac{D_x}{D}$ $y = \frac{D_y}{D}$

EXAMPLE USING CRAMER'S RULE

Solve : $2x + 3y = 8$

$3x - y = 1$

Solution :

$D = \begin{vmatrix} 2 & 3 \\ 3 & -1 \end{vmatrix} = (2 \times (-1)) - (3 \times 3) = -2 - 9 = -11$

$D_x = \begin{vmatrix} 8 & 3 \\ 1 & -1 \end{vmatrix} = (8 \times (-1)) - (3 \times 1) = -8 - 3 = -11$

$D_y = \begin{vmatrix} 2 & 8 \\ 3 & 1 \end{vmatrix} = (2 \times 1) - (8 \times 3) = 2 - 24 = -22$

$x = \frac{D_x}{D} = \frac{-11}{-11} = 1$

$y = \frac{D_y}{D} = \frac{-22}{-11} = 2$

∴ Solution : $(1, 2)$

CHAPTER 01

Linear Equations in Two Variables

CLASS 10 | MATHEMATICS PART 1

Success Key Test Series — Success Key — School & Colleges

COMPLETE CHAPTER REVISION

1 LINEAR EQUATION IN TWO VARIABLES

- General form :

$$ax + by + c = 0$$

(a, b not both zero)

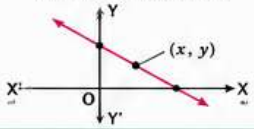
- Slope $(m) = -\frac{a}{b}$ (if $b \neq 0$)
- Intercepts :

x–intercept $= -\frac{c}{a}$ (if $a \neq 0$)

y–intercept $= \frac{-c}{b}$ (if $b \neq 0$)

GRAPH

Always a straight line.



2 SIMULTANEOUS LINEAR EQUATIONS

Two linear equations in two variables considered together.

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

- Solution (x, y) satisfies both equations.

METHODS

1. Elimination Method
2. Substitution Method

TYPES OF SOLUTION

- Unique solution → Intersecting lines
- Infinite solutions → Coincident lines
- No solution → Parallel lines

3 GRAPH OF A LINEAR EQUATION

- **Step 1** Find at least 4 ordered pairs.
- **Step 2** Plot the points.
- **Step 3** Join the points.
- **Step 4** Get a straight line.

SPECIAL CASES

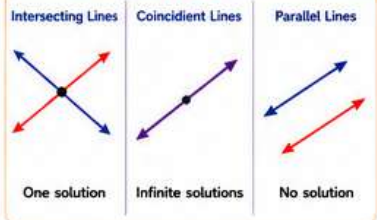
- $y = k$ → Parallel to X–axis
- $x = k$ → Parallel to Y–axis
- $ax + by + c = 0$

If $\frac{a}{b}$ = constant $\neq 0$ → Lines are parallel.

4 GRAPHICAL METHOD OF SOLVING SIMULTANEOUS EQNS.

- Draw graphs of both equations.
- The point of intersection gives the solution.

TYPES

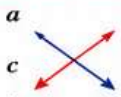


DETERMINANTS & CRAMER'S RULE

DETERMINANT (Order 2)

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

Cross Multiplication Trick



For Equations

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

Determinants

$$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$$

$$D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}$$

$$D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}$$

Cramer's Rule

$$x = \frac{D_x}{D}$$

$$y = \frac{D_y}{D}$$

$(D \neq 0)$

6 EQUATIONS REDUCIBLE TO LINEAR EQUATIONS

1 Some Important Reducible Forms

- $\frac{ax + by + c}{px + qy + r} = k$ → Linear
- $\frac{ax + by + c}{px + qy + r} = \frac{lx + my + n}{px + qy + r}$ → Linear
- $\sqrt{ax + by + c} = \sqrt{lx + my + n}$ → Linear

2 Steps to Reduce

i. Clear denominators (Cross multiply).
ii. Remove square roots (Square both sides).
iii. Collect like terms.
iv. Rearrange in form $ax + by = c$.

SOLVED MODEL (Important)

Q. Solve the following equations :
$2x + 3y = 8$ and $3x - y = 1$

Solution (Elimination Method)

Multiply (1) by 1 : $2x + 3y = 8$ ...(1)
Multiply (2) by 3 : $9x - 3y = 3$ ...(2)
Add (1) and (2) : $11x = 11$
$x = 1$

Substitute in (1) : $2(1) + 3y = 8$
$2 + 3y = 8$
$3y = 6$
$y = 2$

$\therefore$ Solution $(x, y) = (1, 2)$

BOARD EXAM EXPECTED QUESTIONS

Very Short Answer Type (1 Mark)

1. Find x and y if : $2x + y = 7$, $x - y = 1$
2. Find the graph of : $2x - 3y = 6$
3. If lines $2x + 3y = 6$ and $4x + ky = 12$ are parallel, find k.
4. Find D, D_x and D_y for :
$3x + 2y = 5$, $2x - y = 4$
5. Find the equation of a line passing through $(2, 3)$ and parallel to $3x + 4y = 5$.

Short Answer Type (2 Marks)

1. Solve graphically : $2x + y = 7$, $x - y = 1$
2. Solve by Cramer's Rule :
$x + 2y = 7$, $3x - y = 5$
3. Reduce and solve : $\frac{3x + 5y - 4}{x - y + 1} = 2$
4. Find the ratio in which the line $3x + 2y = 7$ divides the line segment joining $(2, 1)$ and $(6, 5)$.

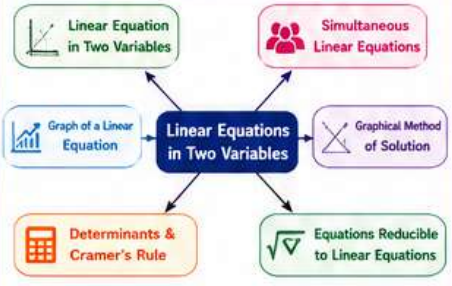
COMMON ERRORS

- Wrong signs while adding or subtracting equations.
- Incorrect substitution after elimination.
- Plotting incorrect points while drawing graph.
- Assuming parallel lines as intersecting.
- Wrong columns replaced in D_x or D_y.
- Forgetting to write the final answer as ordered pair (x, y).

LAST MINUTE RRVISION

- Linear equation → Straight line
- Two linear equations → 3 possible cases
- Graphical solution → Intersection point
- Determinant (Order 2) $= ad - bc$
- Cramer's Rule → $x = \frac{D_x}{D}$, $y = \frac{D_y}{D}$
- Practice basic questions → Score more

CHAPTER MIND MAP



ONE PAGE FORMULA REVISION

1. Linear Equation : $ax + by + c = 0$
2. Slope $(m) = -\frac{a}{b}$
3. x–intercept $= -\frac{c}{a}$, y–intercept $= -\frac{c}{b}$
4. Simultaneous Equations :
$a_1x + b_1y = c_1$, $a_2x + b_2y = c_2$
5. Determinant : $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
6. $D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$
7. $D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}$, $D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}$
8. Cramer's Rule : $x = \frac{D_x}{D}$, $y = \frac{D_y}{D}$
9. Conditions : $D \neq 0$ (Unique Solution)
$D = 0$, $D_x = 0$, $D_y = 0$ (Infinite Solutions)
$D = 0$, ($D_x \neq 0$ or $D_y \neq 0$) (No Solution)

SUCCESS KEY GOLDEN TIPS

- Practice elimination and substitution regularly.
- Draw graphs neatly and accurately.
- Learn determinants and Cramer's Rule by heart.
- Solve previous year board papers.

REMEMBER

Concept + Practice + Revision
= 100% Success in Board Exams

ALL THE BEST!
You can do it!