CBSE Class 10 Maths Notes Chapter 3: In CBSE Class 10 Maths, Chapter 3 talks about Pair of Linear Equations In Two Variables. This chapter helps us solve two equations that involve two different things, like x and y.

We learn different ways to solve these equations, like drawing graphs, substituting numbers, and using elimination.

It is important because we use this knowledge in many real-life situations, such as figuring out costs and profits, or solving problems about age, time, and distance. By understanding this chapter, we get better at solving problems and thinking logically.

CBSE Class 10 Maths Notes Chapter 3 Pair of Linear Equations In Two Variables PDF

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Equation

An equation is a statement that says two mathematical expressions with one or more variables are equal.

Linear Equation

Equations where the powers of all involved variables are one are termed linear equations. The degree of a linear equation is always one.

General Form of a Linear Equation in Two Variables

The standard form of a linear equation in two variables is $ax + by + c = 0$, where both a and b cannot be zero at the same time.

Representing Linear Equations for a Word Problem

To represent a word problem as a linear equation:

1. Identify unknown quantities and denote them by variables.
2. Represent the relationships between quantities in a mathematical form, replacing the unknowns with variables.

Example: Let's consider a word problem where the cost of 5 pens and 7 pencils is Rs.50, and the cost of 7 pens and 5 pencils is Rs. 65. To represent this problem in linear equations:

Solution: Let x represent the cost of 1 pen and y represent the cost of 1 pencil. Given:

1. The cost of 5 pens and 7 pencils is Rs.50. This can be represented as the equation $5x + 7y = 50$.
2. The cost of 7 pens and 5 pencils is Rs.65. This can be represented as the equation $7x + 5y = 65$.

Thus, $5x + 7y = 50$ and $7x + 5y = 65$ are the pairs of linear equations in two variables based on the given word problem.

Solution of a Linear Equation in 2 Variables

In a linear equation in two variables, the solution is a pair of values (x, y) that satisfy the equation, making both sides equal.

For example, in $2x + y = 4$, (0, 4) is a solution since it fulfills the equation. Linear equations in two variables possess infinitely many solutions.

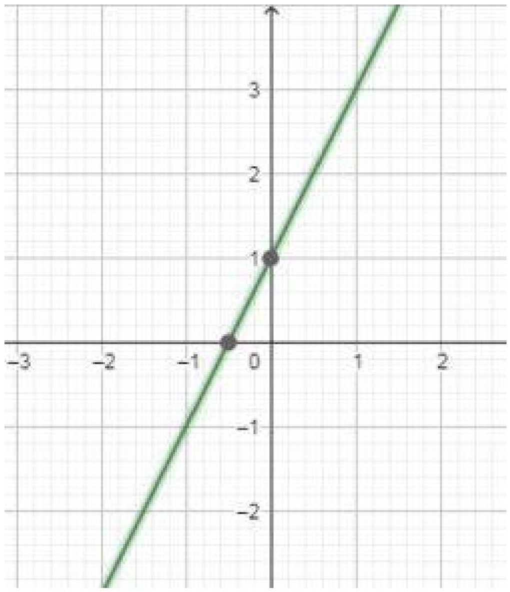
Geometrical Representation of a Linear Equation

Geometrically, a linear equation in two variables can be represented as a straight line. For example, consider the equation $2x – y + 1 = 0$, which can be rewritten as $y = 2x + 1$. Let's plot the graph for this equation.

Step 1: Substitute $x = 0$ to find y. This gives us $y = 1$, so the coordinate (0, 1) is one point on the line.

Step 2: Substitute $x = -1/2$ or 0.5 to find $y = 0$. This gives us the coordinate (-0.5, 0).

By finding more points in a similar manner, we can plot the graph by connecting the points (0, 1) and (-0.5, 0) with a straight line, as shown below.



Graph of y = 2*x*+1

Plotting a Straight Line

The graph of a linear equation in two variables is a straight line. We plot the straight line as follows:

- Take any value for one of the variables($x_1 = 0$) and substitute it in the equation to get the corresponding value of the other variable (y_1).
- Repeat this again (put $y_2 = 0, get\ x_2$) to get two pairs of values for the variables which represent two points on the Cartesian plane. Draw a line through the two points.

Any additional points plotted in this manner will lie on the same line.

For example, in the above section, we have plotted the graph for y = 2x + 1, which shows a straight line passing through the points (0, 1) and (-0.5, 0).

General Form of a Pair of Linear Equations in 2 Variables

A pair of linear equations in two variables can be represented as follows:

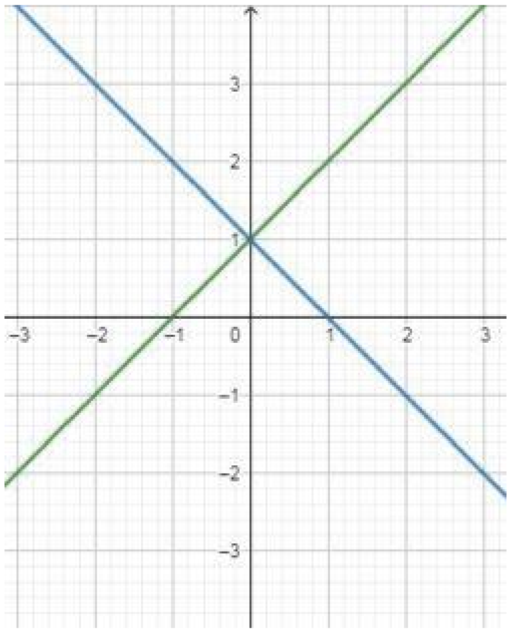
$$a_1x + b_1y + c_1 = 0$$
$$a_2x + b_2y + c_2 = 0$$

The coefficients of x and y cannot be zero simultaneously for an equation.

Nature of 2 Straight Lines in a Plane

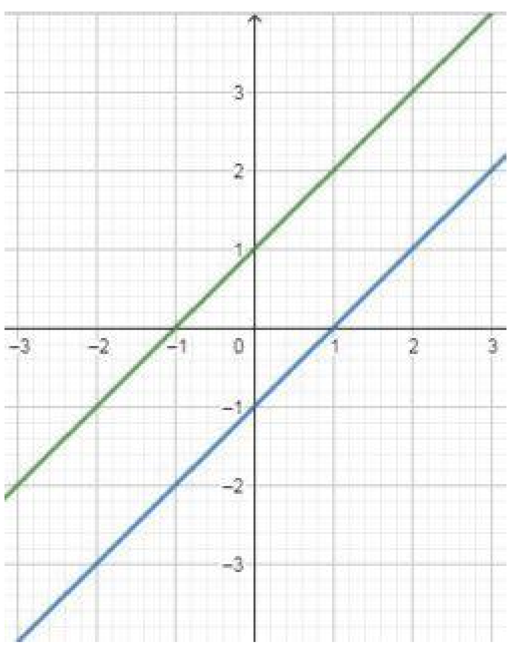
For a pair of straight lines on a plane, there are three possibilities.

i) They intersect at exactly one point



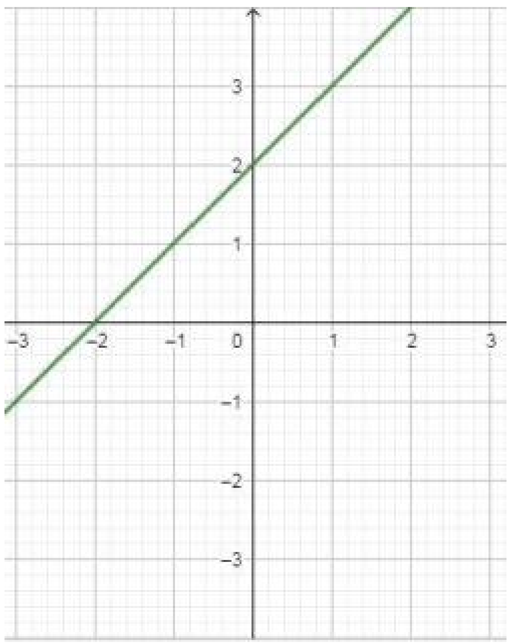
pair of linear equations which intersect at a single point.

ii) They are parallel



pair of linear equations which are parallel.

iii) They are coincident



Representing Pair of LE in 2 Variables Graphically

Graphically, a pair of linear equations in two variables can be represented by a pair of straight lines.

Graphical Method of Finding Solution of a Pair of Linear Equations

The Graphical Method of finding the solution to a pair of linear equations is as follows:

- Plot both the equations (two straight lines)
- Find the point of intersection of the lines.

The point of intersection is the solution.
For example, the graph of two linear equations $2x + y - 6 = 0$ and $4x - 2y - 4 = 0$ is shown below. The point of intersection for the two graphs is (2,2).

Comparing the Ratios of Coefficients of a Linear Equation

i) If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, the pair of equations are said to be **consistent**. Graphs of the two equations intersect at a unique point. The pair of linear equations have **exactly one solution**.
ii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, the equations are said to be **dependent**. One equation can be obtained by multiplying the other equation with a non-zero constant. In this case, graphs of both the equations coincide. Dependent equations are consistent. The pair linear equations have **infinitely many solutions.**
iii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the equations are said to be **inconsistent**. The graphs of the equations are parallel to each other. The pair of linear equations have **no solution**.

Example: On comparing the ratio, (a1/a2) , (b1/b2) , (c1/c2) find out whether 2x – 3y = 8 and 4x – 6y = 9 are consistent, or inconsistent.

Solution: As per the given pair of linear equations, 2x – 3y = 8 and 4x – 6y = 9, we have;

a1 = 2, b1 = -3, c1 = -8

a2 = 4, b2 = -6, c2 = -9

(a1/a2) = 2/4 = 1/2

(b1/b2) = -3/-6 = 1/2

(c1/c2) = -8/-9 = 8/9

Since , (a1/a2) = (b1/b2) ≠ (c1/c2)

So, the given linear equations are parallel to each other and have no possible solution. Hence, the given pair of linear equations is inconsistent.

Algebraic Solution

Finding Solutions for Consistent Pairs of Linear Equations

The solution of a pair of linear equations is of the form (x,y), which satisfies both equations simultaneously. Solution for a consistent pair of linear equations can be found using

i) Elimination method

ii) Substitution Method

iii) Cross-multiplication method

iv) Graphical method

Substitution Method of Finding Solution of a Pair of Linear Equations

Substitution method:

$y - 2x = 1$

$x + 2y = 12$

(i) express one variable in terms of the other using one of the equations. In this case, $y = 2x + 1$.

(ii) substitute for this variable (y) in the second equation to get a linear equation in one variable, x. $x + 2 \times (2x + 1) = 12$

$\Rightarrow 5x + 2 = 12$

(iii) Solve the linear equation in one variable to find the value of that variable.
$5x + 2 = 12$
$\Rightarrow x = 2$

(iv) Substitute this value in one of the equations to get the value of the other variable.

$y = 2 \times 2 + 1$

$\Rightarrow y = 5$

So, (2,5) is the required solution of the pair of linear equations $y - 2x = 1$ and $x + 2y = 12$.

Elimination Method of Finding Solution of a Pair of Linear Equations

Elimination method
Consider $x + 2y = 8$ and $2x - 3y = 2$

Step 1: Make the coefficients of any variable the same by multiplying the equations with constants. Multiplying the first equation by 2, we get,

$2x + 4y = 16$

Step 2: Add or subtract the equations to eliminate one variable, giving a single variable equation.
Subtract the second equation from the previous equation
$2x + 4y = 16$
$2x - 3y = 2$
– + –

$0(x) + 7y = 14$

Step 3: Solve for one variable and substitute this in any equation to get the other variable.

$y = 2$,

$x = 8 – 2y$

$\Rightarrow x = 8 – 4$

$\Rightarrow x = 4$

(4, 2) is the solution.

Cross-Multiplication Method of Finding Solution of a Pair of Linear Equations

For the pair of linear equations

$a_1x + b_1y + c_1=0$

$a_2x + b_2y + c_2=0$,

x and y can be calculated as

$x = (b_1c_2−b_2c_1)/(a_1b_2−a_2b_1)$

$y = (c_1a_2−c_2a_1)/(a_1b_2−a_2b_1)$

Equations Reducible to a Pair of Linear Equations in 2 Variables

In this section, we learn about equations that are not linear but can be reduced to a pair of linear equations using the substitution method. Let's understand this with an example:

$2/x + 3/y = 4$

$5/x − 4/y = 9$

We can make the substitution:

$1/x = u$ and $1/y = v$

The pair of equations reduces to:

$2u + 3v = 4$ …..(i)

$5u − 4v = 9$ ….(ii)

From the first equation, we isolate the value of u:

$u = (4 - 3v)/2$

Now, substitute the value of u in equation (ii):

$5[(4 - 3v)/2] - 4v = 9$

Solving for v, we get:

$v = 2/23$

Now, substitute the value of v in $u = (4 - 3v)/2$, to get the value of u:

$u = 43/23$

Since $u = 1/x$ or $x = 1/u = 23/43$ and $v = 1/y$ or $y = 1/v$, so $y = 23/2$.

Hence, the solutions are $x = 23/43$ and $y = 23/2$.

Benefits of CBSE Class 10 Maths Notes Chapter 3 Pair of Linear Equations In Two Variables

Conceptual Understanding: The notes provide a clear and concise explanation of the concepts related to pair of linear equations in two variables, enhancing students' understanding of the topic.

Simplified Learning: Complex topics are broken down into simpler explanations, making it easier for students to comprehend and retain the information.

Effective Study Aid: The notes serve as an effective study aid for exam preparation, summarizing important concepts and formulas in one place for quick revision.

Improved Recall: By presenting key points and formulas in a structured manner, the notes help improve students' recall of important information during exams.

Efficient Preparation: Students can efficiently prepare for exams by using the notes to review important concepts, solve practice problems, and reinforce their understanding of the topic.