3. Pair of linear equations in two variables
(Key Points)

- An equation of the form ax + by + c = 0, where a, b, c are real nos ($a \neq 0$, $b \neq 0$) is called a linear equation in two variables x and y.

  Ex : (i) x – 5y + 2 =0

  (ii) $\frac{3}{2}$x – y =1

- The general form for a pair of linear equations in two variables x and y is

  $a_1x + b_1y + c_1 = 0$

  $a_2x + b_2y + c_2 = 0$

  where a_1, b_1, c_1, a_2, b_2, c_2 are all real nos and $a_1 \neq 0$, $b_1 \neq 0$, $a_2 \neq 0$, $b_2 \neq 0$.

  Examples: $x + 3y - 6 = 0$

  $2x - 3y - 12 = 0$

- Graphical representation of a pair of linear equations in two variables:

  $a_1x + b_1y + c_1 = 0$

  $a_2x + b_2y + c_2 = 0$

  (i) will represent intersecting lines if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

  i.e. unique solution. And this type of equations are called consistent pair of linear equations.

  Ex: x – 2y = 0

  3x + 4y – 20 = 0

  (ii) will represent overlapping or coincident lines if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

  i.e. Infinitely many solutions, consistent or dependent pair of linear equations

  Ex: 2x + 3y – 9 = 0

  4x + 6y – 18 = 0

  (iii) will represent parallel lines if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

  i.e. no solution and called inconsistent pair of linear equations

  Ex: x + 2y – 4 = 0

  2x + 4y – 12 = 0

  (iv) Algebraic methods of solving a pair of linear equations:

(i) Substitution method

(ii) Elimination Method

(iii) Cross multiplication method

(Level - 1)

1. Find the value of ‘a’ so that the point(3,9) lies on the line represented by 2x-3y=5

   Ans: a= $\frac{1}{3}$

2. Find the value of k so that the lines 2x – 3y = 9 and kx-9y =18 will be parallel.

   Ans: k= 6

3. Find the value of k for which x + 2y =5, 3x+ky+15=0 is inconsistent

Ans: k= 6

4. Check whether given pair of lines is consistent or not 5x – 1 = 2y, y = $\frac{-1}{2} + \frac{5}{2}x$

Ans: consistent

5. Determine the value of 'a' if the system of linear equations 3x+2y -4 =0 and 9x – y – 3 = 0 will represent intersecting lines.

Ans: a $\neq \frac{-3}{2}$

6. Write any one equation of the line which is parallel to $\sqrt{2}$x – $\sqrt{3}$y =5

Ans: $5\sqrt{2}x - 5\sqrt{3}y = 5\sqrt{5}$

7. Find the point of intersection of line -3x + 7y =3 with x-axis

Ans: (-1, 0)

8. For what value of k the following pair has infinite number of solutions.

   (k-3)x + 3y = k

   k(x+y)=12

Ans: k= 6

9. Write condition so that $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ have unique solution.

Ans: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

(Level - 2)

1. 5 pencils and 7pens together cost Rs. 50 whereas 7 pencils and 5 pens together cost Rs. 46. Find the cost of one pencil and that of one pen.

Ans: Cost of one pencil = Rs. 3

Cost of one pen = Rs. 5

2. Solve the equations:

   3x – y = 3

   7x + 2y = 20

Ans: x=2, y=3

3. Find the fraction which becomes to 2/3 when the numerator is increased by 2 and equal to 4/7 when the denominator is increased by 4

Ans: 28/45

4. Solve the equation:

   px + qy = p – q

   qx – py = p + q

Ans: x = 1, y = -1

(Level - 3)

1. Solve the equation using the method of substitution:

$3x - 5y = -1$

$x - y = -1$

Ans. $x = -2,\ y = -1$

2. Solve the equations:

$\frac{1}{2x} - \frac{1}{y} = -1$

$\frac{1}{x} + \frac{1}{2y} = 8$ Where, x≠ $0, y \neq 0$

Ans. $x = \frac{1}{6}, y = \frac{1}{4}$

3. Solve the equations by using the method of cross multiplication:

$x + y = 7$

5x + 12y =7

Ans. $x = 11, y = -4$

4. A man has only 20 paisa coins and 25 paisa coins in his purse, If he has 50 coins in all totaling Rs. 11.25, how many coins of each kind does he have.

Ans. 25 coins of each kind

5. For what value of k, will the system of equations

$x + 2y = 5$

$3x + ky - 15 = 0$ has a unique solution.

Ans. $k \neq 6$

(level - 4)

1. Draw the graphs of the equations

4x – y = 4

4x + y = 12

Determine the vertices of the triangle formed by the lines representing these equations and the x-axis. Shade the triangular region so formed

Ans: (2,4)(1,0)(3,0)

2. Solve Graphically

x – y = -1 and

3x + 2y = 12

Calculate the area bounded by these lines and the x- axis ,

Ans: x = 2, y = 3 and area = 7.5 unit ^{2}

3. Solve :- $\frac{10}{x+y} + \frac{2}{x-y} = 4$

$\frac{15}{x+y} + \frac{5}{x-y} = -2$

Ans: x = 3 , y = 2

4. Ritu can row downstream 20 km in 2 hr , and upstream 4 km in 2 hr . find her speed of rowing in still water and the speed of the current. (HOTS)

Ans: Speed of the rowing is still water = 6 km/hr

Speed of the current = 4 km/hr .

5. In a Δ ABC ,$\angle C$ = 3 ,∠B = 2 (∠A +∠B) find the these angle. (HOTS)

Ans: ∠a = 20^0 , ∠b = 40^0 , ∠c = 120^0 .

6. 8 men and 12 boys can finish a piece of work in 10 days while 6 men and 8 boys can finish it in 14 days. Find the time taken by 1 man alone and that by one boy alone to finish the work . (HOTS)

Ans: One man can finish work in 140 days

One boys can finish work in 280 days

7. Find the value of K for which the system of linear equations 2x+5y = 3 , (k +1)x + 2(k + 2) y = 2K Will have infinite number of solutions.

(HOTS)

Ans: K = 3

(SELF EVALUTION/HOTS)

1. Solve for x and y:

   x + y = a + b

   ax – by= $a^2 - b^2$

2. For what value of k will the equation x +5y-7=0 and 4x +20y +k=0 represent coincident lines?

3. Solve graphically: 3x +y +1=0

   2x -3y +8=0

4. The sum of digits of a two digit number is 9. If 27is subtracted from the number, the digits are reversed. Find the number.

5. Draw the graph of x + 2y – 7 =0 and 2x – y -4 = 0. Shade the area bounded by these lines and Y-axis.

6. Students of a class are made to stand in rows. If one student is extra in a row, there would be 2 rows less. If one student is less in a row there would be 3 rows more. Find the number of the students in the class.

7. A man travels 370 km partly by train and partly by car. If he covers 250 km by train and the rest by the car it takes him 4 hours, but if he travels 130 km by train and the rest by car, he takes 18 minutes longer. Find the speed of the train and that of the car

8. Given linear equation 2x +3y-8=0, write another linear equation such that the geometrical representation of the pair so formed is (i) intersecting lines, (ii) Parallel Lines.