📘 CHAPTER 3: PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

1-Mark Questions

Question 1: Write the general form of a pair of linear equations in two variables.

Question 2: How many solutions can a pair of linear equations have?

Question 3: What is meant by a consistent pair of linear equations?

Question 4: If two lines intersect at one point, how many solutions are possible?

Question 5: If two lines are parallel, how many solutions are possible?

2-Mark Questions

Question 6: Write the condition for a pair of linear equations to have
(a) unique solution
(b) no solution

Question 7: Check whether the pair of equations
$2x + 3y = 11$
$4x + 6y = 22$
has infinitely many solutions or not.

Question 8: Find the value of k for which the system

$kx + y = 4$

$6x + 2y = 8$

has infinitely many solutions.

Question 9: Write the condition for a pair of linear equations to be inconsistent.

Question 10: What is the graphical representation of two coincident lines?

Question 11: Solve using **substitution method**

$x + y = 7$

$x - y = 1$

Question 12: Solve using **elimination method**

$2x + 3y = 13$

$x + y = 5$

Question 13: Solve using **substitution method**

$2x - y = 4$

$x + y = 5$

Question 14: Find k for which the pair has **no solution**

$kx + 2y = 5$

$3x + ky = 10$

Question 15: Solve **graphically**

$x + y = 6$

$x - y = 2$

Question 16: Solve by **elimination method**

$3x - 2y = 5$

$2x + y = 4$

Question 17: Solve by **substitution method**

$x = y + 3$

$2x + y = 11$

Question 18: Solve by **elimination method**

$5x - y = 9$

$3x + 2y = 7$

Question 19: Solve

$4x - 3y = -5$

$2x + y = 7$

Question 20: Solve

$x + 2y = 10$

$2x - y = 1$

PYQ / CASE-BASED / HIGH WEIGHTAGE

Question 21: The sum of two numbers is 27 and their difference is 3. Find the numbers.

Question 22: The larger of two numbers is 5 more than the smaller. Their sum is 25. Find the numbers.

Question 23: Solve

$2x + 5y = 14$

$4x + 10y = 28$

Question 24: Solve

$3x + y = 8$

$6x + 2y = 16$

Question 25: Find k for which the pair has **no solution**

$kx + y = 2$

$3x + 3y = 6$

Question 26: Solve by elimination

$7x - 3y = 5$

$3x + y = 11$

Question 27: Solve by substitution

$x - 2y = 4$

$2x + y = 1$

Question 28: Solve graphically

$2x + y = 6$

$x - y = 1$

Question 29: Solve

$3x + 4y = 10$

$2x - y = 1$

Question 30: Solve

$x + y = 8$

$2x - y = 1$

Question 31: The sum of two numbers is 20 and their difference is 4. Find the numbers.

Question 32: Two numbers differ by 6 and their sum is 24. Find the numbers.

Question 33: Find the value of k for which the pair of equations has **infinitely many solutions**
$kx + 4y = 8$
$2x + ky = 4$

Question 34: Find the value of k for which the pair of equations has **no solution**
$kx + y = 5$
$3x + 3y = 9$

Question 35
(A) If α, β are the zeroes of the polynomial
$3x^2 - 5x + 2$, find the value of $\alpha^2 + \beta^2$. **(3)**
OR
(B) Find a quadratic polynomial whose sum of zeroes is 6 and product is 8. Also find its zeroes. **(3)**

Question 36

(A) If α, β are the zeroes of $4x^2 + 7x - 5$, find $\alpha^2 + \beta^2$. **(3)**

OR

(B) Find a quadratic polynomial whose sum of zeroes is -1 and product is -12. Also find its zeroes. **(3)**

Question 37

(A) If α, β are the zeroes of $2x^2 - 9x + 4$, find the value of $(\alpha + \beta)^2 - 2\alpha\beta$. **(3)**

OR

(B) Find a quadratic polynomial whose zeroes are 3 and -5. **(3)**

Question 38

(A) If α, β are the zeroes of $5x^2 - 3x - 1$, find $\alpha^2 + \beta^2$. **(3)**

OR

(B) Find a quadratic polynomial whose sum of zeroes is 2 and product is -15. Also find its zeroes. **(3)**

Question 39

(A) If α, β are the zeroes of $x^2 - 6x + 1$, find the value of $1/\alpha + 1/\beta$. **(3)**

(B) Find a quadratic polynomial whose zeroes are -2 and 7. **(3)**

Question 40

(A) If α, β are the zeroes of
$2x^2 - 5x - 7$, find $(\alpha - \beta)^2$. **(3)**

OR

(B) Find a quadratic polynomial whose zeroes are $1/2$ and 3. **(3)**

Question 41

(A) If α, β are the zeroes of
$5x^2 + x - 6$, find $1/\alpha^2 + 1/\beta^2$. **(3)**

OR

(B) Find a quadratic polynomial whose sum of zeroes is 1 and product is -6.
Also find its zeroes. **(3)**

HINTS/SOLUTIONS

Solution 1:

A pair of linear equations in two variables is written as:

$a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

where a_1, b_1, a_2, b_2 are not zero simultaneously.

Solution 2:

A pair of linear equations can have **three types of solutions**:

1. **One solution** (unique solution)
2. **Infinitely many solutions**
3. **No solution**

Solution 3:

A pair of linear equations is called **consistent** if it has

- **one solution** or
- **infinitely many solutions**

That is, at least one solution exists.

Solution 4:

If two lines intersect at **one point**, then the pair of linear equations has **only one solution**.

Solution 5:

If two lines are **parallel**, they never intersect.
So, the pair of linear equations has **no solution**.

Solution 6:

Consider the pair of linear equations:

$a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

(a) Condition for unique solution:

$a_1 \div a_2 \neq b_1 \div b_2$

(Is case me lines intersect karti hain)

(b) Condition for no solution:

$a_1 \div a_2 = b_1 \div b_2 \neq c_1 \div c_2$

(Is case me lines parallel hoti hain)

Solution 7:

Given equations:

$2x + 3y - 11 = 0$

$4x + 6y - 22 = 0$

Q8 (Infinitely many solutions)

Given:

kx + y = 4

6x + 2y = 8

Standard form:

kx + y − 4 = 0

6x + 2y − 8 = 0

Condition:

$a_1 / a_2 = b_1 / b_2 = c_1 / c_2$

$$\frac{k}{6} = \frac{1}{2} = \frac{-4}{-8}$$
$$\frac{k}{6} = \frac{1}{2}$$
$$k = 3$$

✅ **Answer: k = 3**

Q9 (Inconsistent condition)

Pair of linear equations is **inconsistent** if:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

)Parallel lines, no solution)

Q10 (Coincident lines)
Two coincident lines overlap completely and have **infinitely many solutions**.

Q11 (Substitution method)
x + y = 7
x − y = 1
From first equation:

$$y = 7 - x$$

Substitute in second:

$$x - (7 - x) = 1$$
$$2x = 8$$
$$x = 4$$
$$y = 3$$

✅ **Answer:** $(4, 3)$

Q12 (Elimination method)
2x + 3y = 13
x + y = 5
Multiply second by 2:
2x + 2y = 10
Subtract:

$$y = 3$$
$$x = 2$$

✅ **Answer:** $(2, 3)$

Q13 (Substitution method)
2x − y = 4
x + y = 5

$$y = 5 - x$$
$$2x - (5 - x) = 4$$
$$x = 3, y = 2$$

✅ **Answer:** (3, 2)

Q14 (No solution)
kx + 2y = 5
3x + ky = 10
Condition for no solution:

$$\frac{k}{3} = \frac{2}{k} \neq \frac{5}{10}$$
$$k^2 = 6$$
$$k = \sqrt{6}, \quad -\sqrt{6}$$

✅ **Answer:** $k = \pm\sqrt{6}$

Q15 (Graphical)
x + y = 6
x − y = 2
Intersection point:

$$x = 4, \ \ y = 2$$

Solution 16

Given:

3x – 2y = 5 ……(1)

2x + y = 4 ……(2)

Multiply equation (2) by 2:

4x + 2y = 8 ……(3)

Add (1) and (3):

7x = 13

$$x = \frac{13}{7}$$

Put value of x in (2):

$$2\left(\frac{13}{7}\right) + y = 4$$

$$y = \frac{2}{7}$$

Answer:

$$x = \frac{13}{7},\ y = \frac{2}{7}$$

Solution 17

Given:

x = y + 3 ……(1)

2x + y = 11 ……(2)

Put value of x from (1) into (2):

2(y+3)+y=11

$$3y = 5$$
$$y = \frac{5}{3}$$

Now,

$$x = y + 3 = \frac{5}{3} + \frac{9}{3} = \frac{14}{3}$$

Answer:

$$x = \frac{14}{3},\ y = \frac{5}{3}$$

Solution 18

(Elimination Method)

Given:

5x – y = 9 ……(1)

3x + 2y = 7 ……(2)

Multiply (1) by 2:

10x – 2y = 18 ……(3)

Add (2) and (3):

13x = 25

$$x = \frac{25}{13}$$

Put x in (1):

$$5\left(\frac{25}{13}\right) - y = 9$$

y=138

Answer:

$$x = \frac{25}{13},\ y = \frac{8}{13}$$

Solution 19

Given:

4x − 3y = −5 ……(1)

2x + y = 7 ……(2)

Multiply (2) by 3:

6x + 3y = 21 ……(3)

Add (1) and (3):

10x = 16

$$x = \frac{8}{5}$$

Put x in (2):

$$2\left(\frac{8}{5}\right) + y = 7$$

$$y = \frac{19}{5}$$

Answer:

$$x = \frac{8}{5},\ y = \frac{19}{5}$$

Solution 20

Given:

x + 2y = 10 ……(1)

2x – y = 1 ……(2)

Multiply (2) by 2:

4x – 2y = 2 ……(3)

Add (1) and (3):

5x = 12

$$x = \frac{12}{5}$$

Put x in (1):

$$\frac{12}{5} + 2y = 10$$

$y = \frac{19}{5}$

Answer:

$$x = \frac{12}{5},\ y = \frac{19}{5}$$

Solution 21 (PYQ)

Let numbers be x and y

x + y = 27 ……(1)

x – y = 3 ……(2)

Add (1) and (2):

2x = 30

$$x = 15$$

$$y = 12$$

Solution 22 (PYQ)

Let smaller number = x

Larger number = x + 5

x + (x + 5) = 25

$$2x = 20$$
$$x = 10$$

Larger number = 15

Answer:

Numbers are **10 and 15**

Solution 23 (PYQ)

Given:

2x + 5y = 14 ……(1)

4x + 10y = 28 ……(2)

Multiply (1) by 2:

4x + 10y = 28

This is same as equation (2)

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Infinite solutions

Solution 24

Given:

3x + y = 8 ……(1)

6x + 2y = 16 ……(2)

Multiply (1) by 2:

6x + 2y = 16

Equation (2) and new equation are same

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Answer:

Pair has **infinitely many solutions**

Solution 25

Given:

kx + y = 2 ……(1)

3x + 3y = 6 ……(2)

Rewrite (2):

x + y = 2 ……(3)

For **no solution**:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

From (1) and (3):

$$\frac{k}{1} = \frac{1}{1} \Rightarrow k = 1$$

But

$$\frac{2}{2} = 1$$

So equations become coincident

👉 To make **no solution**, coefficients same but constants different

Hence **no value of k**

Answer:

❌ **No such value of k**

Solution 26

(Elimination Method)

Given:

$7x - 3y = 5$ ……(1)

$3x + y = 11$ ……(2)

Multiply (2) by 3:

$9x + 3y = 33$ ……(3)

Add (1) and (3):

$16x = 38$

$$x = \frac{19}{8}$$

Put x in (2):

$$3\left(\frac{19}{8}\right) + y = 11$$

$$y = \frac{31}{8}$$

Answer:

$$x = \frac{19}{8},\ y = \frac{31}{8}$$

Solution 27

(Substitution Method)

Given:

$x - 2y = 4$ ……(1)

$2x + y = 1$ ……(2)

From (1):

$$x = 4 + 2y$$

Put in (2):

$$2(4 + 2y) + y = 1$$

$$5y = -7 \Rightarrow y = -\frac{7}{5}$$

$$x = \frac{6}{5}$$

Answer:

$$x = \frac{6}{5},\ y = -\frac{7}{5}$$

Solution 28

(Graphical Method)

Equations:

2x + y = 6

x – y = 1

Convert to y form:

$$y = 6 - 2x$$
$$y = x - 1$$

Intersection point:

$$x = \frac{7}{3},\ y = \frac{4}{3}$$

Answer:

Solution = $\left(\frac{7}{3},\ \frac{4}{3}\right)$

Solution 29

Given:

3x + 4y = 10 ……(1)

2x – y = 1 ……(2)

Multiply (2) by 4:

8x – 4y = 4 ……(3)

Add (1) and (3):

11x = 14

$$x = \frac{14}{11}$$

Solution 30

Given:

$x + y = 8$ ......(1)

$2x - y = 1$ ......(2)

Add (1) and (2):

$3x = 9$

$$x = 3$$
$$y = 5$$

Answer:

$$x = 3,\ y = 5$$

Solution 31

Let the two numbers be **x** and **y**

Given:

$x + y = 20$ ......(1)

$x - y = 4$ ......(2)

Add (1) and (2):

$2x = 24$

$x=12$

Put $x = 12$ in (1):

$$12 + y = 20 \Rightarrow y = 8$$

Answer:

Numbers are **12 and 8**

Solution 32

Let the two numbers be **x** and **y**

Given:

x − y = 6 ……(1)

x + y = 24 ……(2)

Add (1) and (2):

2x = 30

$$x = 15$$

Put x = 15 in (2):

$$15 + y = 24 \Rightarrow y = 9$$

Answer:

Numbers are **15 and 9**

Solution 33

Given equations:

kx + 4y = 8 ……(1)

2x + ky = 4 ……(2)

For **infinitely many solutions**:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\frac{k}{2} = \frac{4}{k} = \frac{8}{4}$$

$$\frac{8}{4} = 2$$

So,

2k=2⇒k=4

Check:

$$\frac{4}{2} = \frac{4}{4} = 2$$

✓condition satisfied

Answer:

$$k = 4$$

Solution 34

Given equations:

kx + y = 5 ……(1)

3x + 3y = 9 ……(2)

Rewrite (2):

x + y = 3 ……(3)

For **no solution**:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

From (1) and (3):

$$\frac{k}{1} = \frac{1}{1} \Rightarrow k = 1$$

But,

$$\frac{5}{3} \neq 1$$

✓condition satisfied

Answer:

$$k = 1$$

Solution 35 (A)

Given polynomial:

$3x^2 - 5x + 2$

If α, β are zeroes, then

$\alpha + \beta$ = coefficient of x (with sign changed) upon coefficient of x^2

$$\alpha + \beta = \frac{5}{3}$$

$\alpha\beta$ = constant term upon coefficient of x^2

$$\alpha\beta = \frac{2}{3}$$

We know,

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

Substitute values:

$$\alpha^2 + \beta^2 = \left(\frac{5}{3}\right)^2 - 2\left(\frac{2}{3}\right)$$

$$= \frac{25}{9} - \frac{4}{3}$$

$$= \frac{25}{9} - \frac{12}{9}$$

$$= \frac{13}{9}$$

Answer:

$$\alpha^2 + \beta^2 = \frac{13}{9}$$

Solution 35 (B)

Given:

Sum of zeroes = 6

Product of zeroes = 8

Let the zeroes be α and β.

Standard quadratic polynomial:

$$x^2 - (sum)x + (product)$$

So required polynomial is:

$$x^2 - 6x + 8$$

Now find its zeroes:

$$x^2 - 6x + 8 = 0$$

Factorization:

$$(x-2)(x-4) = 0$$
$$x = 2,\ 4$$

Answer:

Quadratic polynomial: **$x^2 - 6x + 8$**

Zeroes are **2 and 4**

Question 36 (A)

Given polynomial:

$4x^2 + 7x - 5$

$\alpha + \beta = -7$ upon 4

$\alpha\beta = -5$ upon 4

Formula:

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$$= \left(\frac{-7}{4}\right)^2 - 2\left(\frac{-5}{4}\right)$$
$$= \frac{49}{16} + \frac{10}{4}$$
$$= \frac{49}{16} + \frac{40}{16}$$
$$= \frac{89}{16}$$

Answer: 89 upon 16

Question 36 (B)

Sum of zeroes = -1
Product of zeroes = -12
Quadratic polynomial:

$$x^2 - (sum)x + (product)$$
$$x^2 + x - 12$$

Factorization:

$$(x + 4)(x - 3) = 0$$

Zeroes: **−4 and 3**

Question 37 (A)

Given polynomial:
$2x^2 - 9x + 4$

α + β = 9 upon 2
αβ = 2
Expression given:
(α + β)² − 2αβ

$$= \left(\frac{9}{2}\right)^2 - 2(2)$$
$$= \frac{81}{4} - 4$$
$$= \frac{81 - 16}{4}$$
$$= \frac{65}{4}$$

Answer: 65 upon 4

Question 37 (B)

Zeroes are: 3 and −5
Sum = −2
Product = −15
Quadratic polynomial:

$$x^2 - (-2)x + (-15)$$
$$x^2 + 2x - 15$$

Question 38 (A)

Given polynomial:

$5x^2 - 3x - 1$

$\alpha + \beta = 3$ upon 5

$\alpha\beta = -1$ upon 5

Formula:

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$$= \left(\frac{3}{5}\right)^2 - 2\left(\frac{-1}{5}\right)$$

$$= \frac{9}{25} + \frac{2}{5}$$

$$= \frac{9}{25} + \frac{10}{25}$$

$$= \frac{19}{25}$$

Answer: 19 upon 25

Question 38 (B)

Sum of zeroes = 2

Product = −15

Quadratic polynomial:

$$x^2 - 2x - 15$$

Factorization:

$$(x-5)(x+3)=0$$

Zeroes: **5 and −3**

Question 39 (A)

Given polynomial:

$x^2 - 6x + 1$

$\alpha + \beta = 6$

$\alpha\beta = 1$

Formula:

$$\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha\beta}$$
$$=\frac{6}{1}$$
$$=6$$

Answer: 6

Question 39 (B)

Zeroes: −2 and 7

Sum = −2 + 7 = 5

Product = −14

Quadratic polynomial:

$$x^2-(sum)x+(product)$$
$$x^2-5x-14$$

Answer: $x^2 - 5x - 14$

Question 40 (A)

Given polynomial:

$2x^2 - 5x - 7$

$\alpha + \beta = 5$ upon 2

$\alpha\beta = -7$ upon 2

Formula:

$$(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$$

$$= \left(\frac{5}{2}\right)^2 - 4\left(\frac{-7}{2}\right)$$

$$= \frac{25}{4} + 14$$

$$= \frac{25}{4} + \frac{56}{4} \qquad = \frac{81}{4}$$

Question 40 (B)

Zeroes: 1 upon 2 and 3

Sum = 1 upon 2 + 3 = 7 upon 2

Product = 3 upon 2

Quadratic polynomial:

$$x^2 - \frac{7}{2}x + \frac{3}{2}$$

Multiply by 2 to remove fraction:

$$2x^2 - 7x + 3$$

Answer: $2x^2 - 7x + 3$

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Question 41(A)

Given polynomial:

$5x^2 + x - 6$

$\alpha + \beta = -1$ upon 5

$\alpha\beta = -6$ upon 5

Formula:

$$\frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{(\alpha\beta)^2}$$

$$= \frac{\left(\frac{-1}{5}\right)^2 - 2\left(\frac{-6}{5}\right)}{\left(\frac{-6}{5}\right)^2}$$

$$= \frac{\frac{1}{25} + \frac{12}{5}}{\frac{36}{25}}$$

$$= \frac{\frac{61}{25}}{\frac{36}{25}}$$

$$= \frac{61}{36}$$