

PAIR OF LINEAR EQUATIONS - II

Class: IX, Mathematics.

①

IIT FOUNDATION

SOLUTIONS

TEACHING TASK

01. $(x, y) = (\frac{1}{2}, 1)$ satisfies the given equations

$$\begin{aligned} \frac{12}{2x+3y} + \frac{5}{3x-2y} &= -7 & \frac{8}{2x+3y} + \frac{6}{3x-2y} &= -10 \\ & & & \\ &= \frac{12}{2(\frac{1}{2})+3(1)} + \frac{5}{3(\frac{1}{2})-2(1)} &= \frac{8}{2(\frac{1}{2})+3(1)} + \frac{6}{3(\frac{1}{2})-2(1)} \\ &= \frac{12}{4} + \frac{10}{-1} &= \frac{8}{4} + \frac{12}{-1} \\ &= \frac{12-40}{4} &= \frac{8-48}{4} \\ &= -\frac{28}{4} &= -\frac{40}{4} \\ &= -7 &= -10. \end{aligned}$$

Ans: A

02. $4x + py - 21 = 0$
 $px - 2y - 15 = 0$

$$\frac{4}{p} \neq \frac{p}{-2}$$

$$\Rightarrow p^2 \neq -16$$

$$= p \neq \sqrt{-16}, \text{ which is not real}$$

Ans: D

03.

$$\frac{a+b+c}{2} = a+5 \rightarrow \textcircled{1}$$

$$\frac{a+b+c}{2} = b+3 \rightarrow \textcircled{2}$$

$$\frac{a+b+c}{2} = c+2 \rightarrow \textcircled{3}$$

$$\textcircled{1} + \textcircled{2} + \textcircled{3} \Rightarrow \frac{3(a+b+c)}{2} = (a+b+c) + 10$$

$$\Rightarrow a+b+c = 20$$

Ans: D

04

05

$$\text{Let Rs } 100 \rightarrow x$$

$$\text{Rs } 50 \rightarrow y$$

$$\text{Rs } 10 \rightarrow 13 - x - y$$

$$\text{Given } 10(13 - x - y) + 50y + 100x = 830$$

$$\Rightarrow 9x + 4y = 70 \rightarrow \textcircled{1}$$

Since $x > y$ possible x and y values

$$x = 6, y = 4$$

$$\therefore \text{No. of Rs } 10 \text{ notes} = 13 - 6 - 4 = 3$$

Ans: B

06.

Let the two digit number be xy

$$\text{Given } 9(10x + y) - 17 = 10x$$

$$10x + y = 9(x + y) - 17$$

$$\Rightarrow x - 8y + 17 = 0 \rightarrow \textcircled{1}$$

$$\text{Also } 10x + y = 13(x - y) + 21$$

$$\Rightarrow 3x - 14y + 21 = 0 \rightarrow \textcircled{2}$$

$$\text{solving } x = 7, y = 3$$

$$\text{Required no} = 73$$

Ans: B

07 Let monthly Salary = Rs. x .

Annual increment = Rs. y

(3)

According to given problem

$$x + 6y = 22500 \rightarrow (1)$$

$$x + 11y = 30000 \rightarrow (2)$$

Solving $x = 13,500, y = 1500$

Salary after 8 years = $x + 8y$

$$= 13,500 + 8 \times 1500$$

$$= \text{Rs } 25,500.$$

Ans: B

08 let the fraction be $\frac{x}{y}$

$$\frac{x-1}{y+1} = \frac{1}{2} \Rightarrow x - y - 3 = 0 \rightarrow (1)$$

$$xy + 1$$

$$\frac{x+1}{y-1} = \frac{4}{5} \Rightarrow 5x - 4y + 9 = 0 \rightarrow (2)$$

Solving (1) & (2) $x = 7$

Ans: C

09. Let the speed of the boat in still water = x km/hr

∴ speed of the water = $(10 - x)$ km/hr

Speed of down stream = $x + (10 - x) = 10$ km/hr

" " up stream = $x - (10 - x) = 2x - 10$ km/hr

Let the distance be n Km

According to problem

$$\frac{D}{10} = \frac{40}{100} \times \frac{D}{2x - 10} \Rightarrow x = 7 \text{ km/hr}$$

$$\text{Difference of speeds} = 10 - (2x - 10)$$

$$= 10 - (2 \times 7 - 10)$$

$$= 6 \text{ km/hr}$$

Ans: B



10. Let the brothers be x and sisters be y
 Deepa $y-1=x \Rightarrow x-y-1=0 \rightarrow (1)$ (4)
 Dheeraj $2(x-1)=y \Rightarrow 2x-y-2=0 \rightarrow (2)$
 Solving (1) & (2) $\Rightarrow x=3$.
 Ans: B

11. $x+2y+3=0 \rightarrow (1)$
 $4x+5y+6=0 \rightarrow (2)$
 Solving $x=1, y=-2$
 Ans: B, C

12. $4x-3y=7xy \rightarrow (1)$
 $3x+2y=18xy \rightarrow (2)$
 $x=\frac{1}{3}, y=\frac{1}{4}$ Satisfies above equations
 Ans: B, C

13. Statement I: $2x-3y+6=0 \rightarrow (1)$
 $x+y+7=0 \rightarrow (2)$
 $\therefore \frac{2}{1} \neq \frac{-3}{1}$ i.e. $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
 The two lines intersect each other, hence have
 an unique solution. (True)
Statement II: Conceptual (True)
 Ans: A

14. According to the problem
 $6x+5y+7z=115 \rightarrow (1)$
 $8x+10y+14z=190 \rightarrow (2)$
 $(1) \times 2 \Rightarrow 12x+10y+14z=230$
 $(2) \Rightarrow \underline{8x+10y+14z=190}$
 $\underline{4x=40} \Rightarrow x=10$.
 Cost of Book Can be found uniquely.

Ans:

(5)

$$15 \quad 2x - 3y + 7 = 0$$

$$4x - y + 8 = 0$$

$$\frac{2}{4} \neq \frac{-3}{-1} \quad \text{i.e.} \quad \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

Hence, the lines intersect to each other. Ans: B

16

$$17 \quad A) \quad 2x - 2y + 3 = 0$$

$$x + y - 7 = 0$$

$$\frac{2}{1} \neq \frac{-2}{1} \quad \text{i.e.} \quad \text{The lines intersect each other}$$

Hence, have a Unique solution, Consistent.

$$B) \quad x - y + 8 = 0$$

$$x + y - 8 = 0$$

$$\frac{1}{1} \neq \frac{-1}{1} \quad \text{i.e.} \quad \text{The lines intersect each other}$$

Hence have Unique solution, Consistent.

Ans: D

$$18 \quad a) \quad 2x - 2y + 3 = 0$$

$$x + y - 7 = 0$$

$$\frac{2}{1} \neq \frac{-2}{1} \Rightarrow \text{Lines are intersect, Consistent}$$

$$b) \quad x + y + 3 = 0$$

$$2x + 2y + 6 = 0$$

$$\frac{1}{2} = \frac{1}{2} = \frac{3}{6} \Rightarrow \text{Lines coincide, Consistent}$$

$$c) \quad x + y + 3 = 0$$

$$x + y + 3 = 0$$

$$x - y + 8 = 0$$

$$\frac{1}{1} \neq \frac{1}{-1} \Rightarrow \text{Lines intersect, Consistent.}$$

19. Let A's age = x years

(6)

B's age = y years

$\therefore x + y = 61 \rightarrow (1)$

Given $y - (x - y) = \frac{x}{2} - 4$

$\Rightarrow 3x - 4y - 8 = 0 \rightarrow (2)$

Solving $y = 25$ years

Ans: 25

20. Let length = x , breadth = y

Given $(x+2) \cdot (y+2) = 504 + xy$

$\Rightarrow xy + 2(x+y) + 4 = 504 + xy$

$\Rightarrow 2(x+y) = 500$

Hence perimeter = 50.

Ans: 50

21 a) $2x - 3y = 5$

$(3, a) \Rightarrow 2(3) - 3a = 5$

$\Rightarrow 3a = 1 \Rightarrow a = \frac{1}{3}$

ii) $\begin{cases} x + y - 2 = 0 \\ 2x - y - 1 = 0 \end{cases}$ solving $(x, y) = (1, 1)$

$x - y = 0$ satisfies above ~~at~~ point $(1, 1)$

iii) $3x + 4y - 24 = 0$

Area = $\frac{c^2}{2|ab|} = \frac{(-24)^2}{2 \times 3 \times 4} = \frac{144}{8} \text{ sq. units}$

iv) $2x + 3y - 11 = 0$, $2x - 4y + 24 = 0$

solving $(x, y) = (-2, 5)$

$y = mx + 3 \Rightarrow 5 = -2x + 3 \Rightarrow x = -1$

(i) $2x - 3y + 8 = 0$
 $2x - 3y + 9 = 0$
 parallel lines

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \quad (7)$$

(ii) $x + y + 7 = 0$
 $2x + 2y + 14 = 0 \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Coincidence lines

(iii) $3x - 2y + 7 = 0$
 $2x + 3y + 8 = 0 \Rightarrow a_1 a_2 + b_1 b_2 = 0$

perpendicular lines

(iv) $x + y + 8 = 0$
 $2x + y + 9 = 0 \Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

intersecting lines

22

$$(i) \quad \begin{aligned} 2x - 3y + 8 &= 0 \\ 2x - 3y + 9 &= 0 \end{aligned}$$

parallel lines

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \quad (7)$$

$$(ii) \quad \begin{aligned} x + y + 7 &= 0 \\ 2x + 2y + 14 &= 0 \end{aligned} \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Coincidence lines

$$(iii) \quad \begin{aligned} 3x - 2y + 7 &= 0 \\ 2x + 3y + 8 &= 0 \end{aligned} \Rightarrow a_1 a_2 + b_1 b_2 = 0$$

perpendicular lines

$$(iv) \quad \begin{aligned} x + y + 8 &= 0 \\ 2x + y + 9 &= 0 \end{aligned} \Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

intersecting lines

Q, S, T, P

STUDENTS TABLE

01. Conceptual

Ans: D

02. Conceptual

Ans: C

03. Conceptual

Ans: D

04. Conceptual

Ans: D

05

$$6x - 3y - 3 = 0$$

$$2x - y - 1 = 0$$

$$\frac{6}{2} = \frac{-3}{-1} = \frac{-3}{-1} \quad \text{i.e.} \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Hence the lines have infinite no. of solutions
equations

Ans: C

06.

$$2x - 3y + 7 = 0$$

$$3x + 2y - 8 = 0$$

$$\frac{2}{3} \neq \frac{-3}{2} \quad \therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \quad \text{--- } \textcircled{a_1}$$

$$\text{Also } 2 \times 3 + (-3) \times 2 = a_1 a_2 + b_1 b_2 = 0$$

Ans: D

07

$$A) 2x + y + 7 = 0$$

$$x + y - 7 = 0$$

$$\frac{2}{1} \neq \frac{1}{1} \quad \therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$\therefore$ The equations have unique solution.

Remaining options B and C also satisfy the above condition.

Ans: D

08

option verification method

Take option D: i.e. 35

$$(i) 3 + 5 = 8$$

$$(ii) 35 + 18 = 53, \text{ reverse of } 35.$$

Ans: D

09

let the age of ~~the~~ person and his son be x and y years.

$$\text{Case (i)} \quad x - 4 = 4(y - 4) \rightarrow \textcircled{1}$$

$$\text{Case (ii)} \quad x + 6 = 3(y + 6) + 10 \rightarrow \textcircled{2}$$

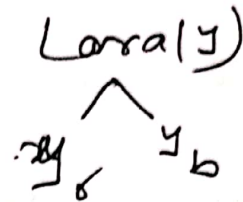
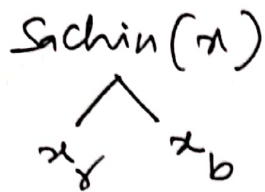
$x = 44, y = 14$ satisfies above equations

Ans: A

JEE MAINS LEVEL QUESTIONS

9

01.



$$x_y = y_b + 10 \rightarrow (1)$$

$$x_b = y_y - 5 \rightarrow (2)$$

Given $x_y + y_y = 105 \rightarrow (3)$

$$x_b = y_b - 10 \rightarrow (4)$$

Solving we get $x_y = 60$

Ans: B

02

Correct question = x,
total questions = 60.

$$\text{Incorrect questions} = 60 - x$$

Given $2x + (60 - x)(-1) = 90$

$$\Rightarrow x = 50$$

Ans: D

03

Krishna $\rightarrow x$ marbles, Sudher $\rightarrow y$ marbles

Case (i) $x + 10 = (y - 10) + 40 \rightarrow (1)$

Case (ii) $x + 40 = 5(y - 40) \rightarrow (2)$

solving (1) & (2) $y = 65$

Ans: A

04.

Correct questions = x, total questions = 70

$\therefore$ Wrong answers = ~~70~~ $70 - x$

Given $x(1) + (70 - x)(-\frac{1}{2}) = 40 \Rightarrow x = 50$

Wrong = 20.

Ans: B



05. Amar (x) Bhawan (y)

(10)

Case (i) $y - 20 = \frac{1}{2}(x + 20) \rightarrow (1)$

Case (ii) $x - 40 = \frac{1}{2}(y + 40) \rightarrow (2)$

Solving (1) and (2) $y = 80$.

Ans: D

06. Let $X = abc = 100a + 10b + c$

After reversing digits

$$cba = 100c + 10b + a$$

Given $cba = abc - 891$

$$\Rightarrow abc - cba = 891$$

$$\Rightarrow 100a + 10b + c - 100c - 10b - a = 891$$

$$\Rightarrow a - c = 9$$

$$\Rightarrow c = a - 9 \quad (\text{or}) \quad a = c + 9$$

$$\Rightarrow a \geq 9$$

$$c \geq 0$$

But $a \leq 9$

$$\Rightarrow a = 9, \quad c = 0$$

Ans: A

07. Given $abc = cba + 792$

$$\Rightarrow 100a + 10b + c = 100c + 10b + a + 792$$

$$\Rightarrow a - c = 8$$

$$\Rightarrow a = c + 8$$

$$c \geq 0 \quad a \geq 8$$

If $c = 0$, ~~$a = 8$~~ $A = 8 \text{ or } 9$

Ans: C



08. Steps involved: A, D, B, C

(11)

09. present age: Shiva $\rightarrow x$ years
Ram $\rightarrow y$ years

Case (i) $x = 3y \rightarrow (1)$

Case (ii) $x + 10 < 2(y + 10)$

$$\Rightarrow 3y + 10 < 2y + 20$$

$$\Rightarrow y < 10$$

$$\Rightarrow 3y < 30$$

$$\Rightarrow x < 30 \quad x = 29 \text{ years}$$

Ans: D

10. Let 25 paise $\rightarrow x$

50 paise $\rightarrow y$

Rs. Coins $\rightarrow 220 - (x + y)$

Given $25x + 50y + 100(220 - x - y) = 110 \times 100 \rightarrow (1)$

Case (ii) 25 paise $\rightarrow y$

50 paise $\rightarrow x$

Rs. $\rightarrow 100 - (x + y)$

Given $25y + 50x + 100(100 - x - y) = 8000 \text{ paise} \rightarrow (2)$

Solving (1) & (2) $x + y = 200$

11. $x = 4, y = 3$ Satisfies the given equations

Ans: A, B



12

$$\frac{3}{2}x + 2y = 1$$

$$\Rightarrow 3x + 4y - 2 = 0 \rightarrow (1)$$

$$\frac{x}{4} - \frac{y}{2} = 1$$

$$x - 2y - 4 = 0 \rightarrow (2)$$

(12)

Solving (1) & (2) $x = 2, y = -1$

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

13

$$2x - 3y - 18 = 0 \rightarrow (1)$$

$$4x - y - 16 = 0 \rightarrow (2)$$

Solving (1) & (2) $x = 3, y = -4$

$$5x - py - 23 = 0$$

$$\Rightarrow 5(3) - p(-4) - 23 = 0$$

$$\Rightarrow p = 2 \text{ (True)}$$

Statement II: Conceptual (True)

Ans: A

14.

Statement I: Mother $\rightarrow x$ years

Son $\rightarrow y$ years

case (i) $x + y = 2x(x - 12) \rightarrow (1)$

Also ~~case~~ (ii) $(x + 9) + (y + 9) = 3x(x - 14) \rightarrow (2)$

Solving (1) & (2) $y = 12$ years (given statement False)

Statement II: Conceptual (True)

Ans: D

15.

$x = \frac{17}{5}, y = \frac{33}{5}$ satisfies the given equation

Ans: D

16.

$$(3, 4) \Rightarrow Kx + y - 7 = 0$$

$$3K + 4 - 7 = 0$$

$$3K - 3 = 0$$

$$K = 1$$

Ans: A



17. Option verification method

(13)

option: C: $x = -\frac{1}{24}, y = \frac{7}{24}$

$$\frac{2}{x+y} - \frac{1}{x-y} = 11$$

$$\Rightarrow \frac{2}{-\frac{1}{24} + \frac{7}{24}} - \frac{1}{-\frac{1}{24} - \frac{7}{24}}$$

$$= \frac{48}{6} + \frac{24}{8}$$

$$= 8 + 3$$

$$= 11$$

Ans: C

18. $\frac{1}{2x+y} = m, \frac{1}{3x+y} = n$

Ans: C

19. $173x + 197y = 149$
 $197x + 173y = 221$

$$\hline 370(x+y) = 370$$

$$\Rightarrow x+y = 1$$

Ans: 1

20. Cows $\rightarrow x$, hens $\rightarrow y$

$$4x + 2y = 92 \rightarrow (1)$$

$$x + y = 29 \rightarrow (2)$$

Solving eqn (1) & (2) $x = 17$

Ans: 17

21. (i) $2x + 3y - 10 = 0 \rightarrow (1)$
 $3x + 2y - 5 = 0 \rightarrow (2)$

(14)

Solving (1), (2) $x = -1, y = 4 \Rightarrow x + y = 3$

(ii) $2x - 3y = 0$ | $2x + 3y = 2\left(\frac{3y}{2}\right) + 3y$
 $\Rightarrow 2x = 3y$ | $= 6y$
 $\Rightarrow x = \frac{3y}{2}$

(iii) $\frac{x}{a} + \frac{y}{b} = 1 \Rightarrow bx + ay - ab = 0$
 $\frac{x}{b} + \frac{y}{a} = 1 \Rightarrow ax + by - ab = 0$

Inconsistent $\Rightarrow \frac{b}{a} = \frac{a}{b} \neq \frac{-ab}{-ab}$

$\Rightarrow a^2 - b^2 = 0$

$\Rightarrow (a+b)(a-b) = 0 \Rightarrow a+b = 0$

(iv) $x + y = 10 \Rightarrow x = 7, y = 3$
 $x - y = 4$

Ans: Q, P, St

22 (i) $a + b = c$
 $a - b = d$
 $\underline{+}$
 $2b = c - d$
 $b = \frac{c-d}{2}$

(ii) $x + y = 2 \rightarrow (1)$
 $x - y = 3 \rightarrow (2)$

Solving (1), (2) $\Rightarrow x = \frac{5}{2}, y = -\frac{1}{2}$
 $x^2 + y^2 = 6$

(iii) $x + y = 0, x - y = 0$ Not possible

(iv) $3x + 2y = 20 \Rightarrow 3(a+b) + 2(a-b) = 20$
 $4x - 5y = 42 \Rightarrow 4(a+b) - 5(a-b) = 42$
 Solving $b = \frac{1}{2}$

Ans: $t, P, 2, 8$