LINEAR EQUATIONS ①

Class: IX, Mathematics

IIT FOUNDATION

TEACHING TASK

01. $a+b-3=0$

$3a+3b-9=0$

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2} \Rightarrow \frac{1}{3}=\frac{1}{3}=\frac{(-3)}{(-9)}=\frac{1}{3}$

The system has infinite solutions.

Hence, consistent.

Ans: A

02 $px+qy+r=0$

$kpx+kqy+kr=0$

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2} \Rightarrow \frac{\cancel{p}}{k\cancel{p}}=\frac{\cancel{q}}{k\cancel{q}}=\frac{\cancel{r}}{k\cancel{r}}=\frac{1}{k}.$

Dependent equations

Ans: A

03 $4x+py-12=0$

$qx+3y-6=0.$

$\frac{4}{q}=\frac{p}{3}=\frac{-12}{-6}=2$

$\therefore q=\frac{4}{2}=2$ & $\frac{p}{3}=2 \Rightarrow p=6$

Ans: B

04 $\frac{x}{a}+\frac{y}{b}-1=0 \Rightarrow bx+ay-ab=0$

$\frac{x}{b}+\frac{y}{a}-1=0 \Rightarrow ax+by-ab=0$

Inconsistent $\Rightarrow \frac{b}{a}=\frac{a}{b} \Rightarrow a^2-b^2=0$

$\Rightarrow a+b=0$ or $a-b=0$

~~a≠b~~ If $a-b=0$ i.e. $a=b$

(2)

Both the equations becomes same, has infinite solutions. i.e. Consistent.

Hence $a+b=0$.

Ans : D

05	$a+2b+3c=20 \Rightarrow (1)$ $2a+4b+c=25 \Rightarrow (2)$ $(1)\times 2 \Rightarrow 2a+4b+6c=40$ $\Rightarrow 2a+4b=40-6c$ Now, $40-6c+c=25$ $\Rightarrow 15=5c \Rightarrow c=3$ Ans: D
06	$\frac{11}{a+b}+2(a-b)=11$ option verification: $(a,b)=(8,3)$ $\therefore \frac{11}{8+3}+2(8-3)$ $=\frac{11}{11}+2(5)=1+10=11.$ Ans: C
07	Let the fraction be $\frac{x}{x+8}$ $\frac{x-1}{x+8-1}=\frac{3}{7}$ $\Rightarrow \frac{x-1}{x+7}=\frac{3}{7} \Rightarrow 7x-7=3x+21$ $\Rightarrow x=7$ $\therefore$ Required fraction $=\frac{7}{7+8}=\frac{7}{15}$ Ans: C
08	$2x+4y-8=0 \rightarrow (1)$ $(1)\times 3 \Rightarrow 6x+12y-24=0$ Infinite solutions Ans: C

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09 $Kx+2y-5=0$

$3x+y-1=0$

Zero Solutions $\Leftrightarrow$ The lines are parallel

i.e. $\frac{a_1}{a_2}=\frac{b_1}{b_2} \Rightarrow \frac{K}{3}=\frac{2}{1} \Rightarrow K=6$ Ans: A

10 Unique solution $\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow \frac{p}{4} \neq \frac{3}{p}$

$\Rightarrow p^2 \neq 12$

$\Rightarrow p \neq \pm 2\sqrt{3}$ Ans: C

11. $px+qy+r=0 \rightarrow (1)$

$qx+py+r=0 \rightarrow (2)$

$(1)-(2) \Rightarrow (p-q)x+(q-p)y=0$

$\Rightarrow (p-q)(x-y)=0$

$\Rightarrow p-q=0$ or $x-y=0$

$\Rightarrow \boxed{p=q}$

$(1) \Rightarrow px+py+r=0$

$\Rightarrow p(x+y)+r=0$

$\Rightarrow x+y=-\frac{r}{p}$

$(1) \Rightarrow qx+qy+r=0$

$\Rightarrow q(x+y)+r=0$

$\Rightarrow x+y=-\frac{r}{q}$

Ans: A, B

4

12. $ax+by+c=0 \rightarrow (1)$

$bx+cy+a=0 \rightarrow (2)$

$cx+ay+b=0 \rightarrow (3)$

Sol: Since (1), (2), (3) are Concurrent

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$$

$\Rightarrow a(bc-a^2)-b(b^2-ac)+c(ab-c^2)=0$

$\Rightarrow abc-a^3-b^3+abc+abc-c^3=0$

$\Rightarrow 3abc = a^3+b^3+c^3$

Also, $a^3+b^3+c^3-3abc=0$

$\Rightarrow (a+b+c)(a^2+b^2+c^2-ab-bc-ca)=0$

$\Rightarrow a+b+c=0.$

Ans: A, B

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13. Statement I: $x+y=70$

$x(1)+y\left(\frac{-1}{2}\right)=40$

$\Rightarrow x=50, \quad y=20.$ (True)

Statement II: Conceptual (True)

Ans: A

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14. Statement I: $4x+5y+9z=36 \rightarrow (1)$

$6x+\frac{15}{2}y+11z=49$

$\Rightarrow 12x+15y+22z=98$

$\Rightarrow 3(4x+5y)+22z=98$

$\Rightarrow 3(36-9z)+22z=98$

$z=2$

Statement II: Conceptual (True)

Ans: A

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15. $2x - 3(2k-1)y - 10 = 0$

$3x + 4(k+1)y - 20 = 0$

$$\frac{2}{3} \neq \frac{-3(2k-1)}{4(k+1)}$$

$$\Rightarrow k \neq \frac{1}{26}$$

$$\Rightarrow k \in R - \left\{\frac{1}{26}\right\}$$

Ans: A

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16. $3x + 4y - 8 = 0 \rightarrow (1)$

$9x + 12y - 24 = 0 \rightarrow (2)$

$$\frac{3}{9} = \frac{4}{12} = \frac{-8}{-24}$$

$$\Rightarrow \frac{1}{3} = \frac{1}{3} = \frac{1}{3} \quad \left(\because \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}\right)$$

Hence, infinite solutions

Ans: B

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17. $4x + 5y - 20 = 0 \rightarrow (1)$

$8x + 10y - 30 = 0 \rightarrow (2)$

$$\frac{4}{8} = \frac{5}{10} \neq \frac{-20}{-30}$$

$$\Rightarrow \frac{1}{2} = \frac{1}{2} \neq \frac{2}{3} \quad \left(\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}\right)$$

The lines are parallel, hence No solution

Ans: A

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18. All the options $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ Ans. D

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19. Please correct the problem, Amar and Bhavan have a certain amount with them. If Bhavan give Rs. 20 to Amar, he will have half the amount with Amar. If Amar gives Rs. 40 to Bhavan, he will have half the amount with Bhavan. Find the amount with Bhavan.

Solution: Amar Rs. x | Bhavan Rs. y

(6)

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) $\Rightarrow y = Rs.80$.

Ans: 80

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20. Let the fraction be $\frac{x}{y}$

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

solving we get $x+y=8$.

Ans: 8

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21. a) $2x+3y-19=0$

$5x+4y-37=0$

$(x,y)=(5,3)$ satisfies both equations

b) $4x-3y-32=0$

$x+y-1=0$

$(x,y)=(5,-4)$ satisfies both equations

c) $4x+5y-71=0$

$5x+3y-66=0$

$(x,y)=(9,7)$ satisfies both equations

d) $5x+6y-30=0$

$10x+12y-40=0$

Since $\frac{5}{10} = \frac{6}{12} \neq \frac{-30}{40}$

Infinite solutions.

Ans: t, s, r, —

22 a) $x+y-40=0$

$x-y-12=0$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \rightarrow$ Unique solution

b) $x-3y-8=0$

$x-2y-8=0$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \rightarrow$ Unique solution

c) $x-y+7=0$

$2x-2y+14=0$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \rightarrow$ Infinitely many solutions

d) $x-2y+8=0$

$2x-4y+7=0$

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

Ans. r, r, s, q

STUDENTS TASK

01.	Conceptual:	Ans: A
02.	Conceptual.	Ans: D
03	Conceptual	Ans: A
04.	Conceptual	Ans: B
05	Conceptual	Ans: D
06	Conceptual	Ans: B

07. Conceptual Ans: C 8

08 Conceptual Ans: B

09 Conceptual Ans: A

10 Conceptual Ans: B

JEE MAINS LEVEL

01. let $x \to$ Correct option

$y \to$ wrong option

$z \to$ Unattempted.

Given $x+y+z = 100 \to (1)$

$2x + y(-1) + z\left(-\frac{1}{2}\right) = 135 \to (2)$

$2x + y\left(-\frac{1}{2}\right) + z(-1) = 133 \to (3)$

Solving (1), (2) and (3) we get $z = 14$ Ans: A

02. let $x+2y+3=0 \to (1)$

$4x+5y+6=0 \to (2)$

$(x,y) = (1,-2)$ satisfies above equations. Ans: A

03. $99x + 101y = 400 \to (1)$

$101x + 99y = 600 \to (2)$

$(1)+(2) \Rightarrow 200(x+y) = 1000$

$\Rightarrow x+y = 5$ Ans: D

04. $\frac{1}{x} + \frac{1}{y} = k \to (1)$

$\frac{1}{x} - \frac{1}{y} = k \to (2)$

$\underline{- \quad + \quad -}$

$\frac{2}{y} = 0$

$\Rightarrow y \to$ does not exists

Ans: D

05. $3a+2b+4c=26 \rightarrow (1)$

~~6b+4~~

$4a+6b+2c=48 \rightarrow (2)$

$(1)\times 2 \Rightarrow 6a+4b+8c=52 \rightarrow (3)$

$(2)\times 4 \Rightarrow 16a+24b+8c=192 \rightarrow (4)$

$(4)-(3) \Rightarrow 10a+20b=140$

$\Rightarrow a+2b=14$

$\Rightarrow a=14-2b$

Now $(1) \Rightarrow 3(14-2b)+2b+4c=26$

$\Rightarrow b-c=4$

$\Rightarrow c=b-4$

Now $a+b+c = 14-2b+b+b-4$

$= 10$

Ans : B

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06 $\frac{1}{x}+\frac{1}{y}=6 \rightarrow (1)$, $\frac{1}{y}+\frac{1}{z}=7 \rightarrow (2)$, $\frac{1}{z}+\frac{1}{x}=5 \rightarrow (3)$

$(1)+(2)+(3) \Rightarrow 2\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)=6+7+5$

$\Rightarrow \frac{1}{x}+\frac{1}{y}+\frac{1}{z}=9 \rightarrow (4)$

$\left(\frac{1}{2},\frac{1}{4},\frac{1}{3}\right)$ satisfies the above equ.

$(4)-(1) \Rightarrow \frac{1}{z}=9-6 \Rightarrow z=\frac{1}{3}$.

$(4)-(2) \Rightarrow \frac{1}{x}=2 \Rightarrow x=\frac{1}{2}$

$(4)-(3) \Rightarrow \frac{1}{y}=4 \Rightarrow y=\frac{1}{4}$

Ans: C

10

07 $3|x| + 5|y| = 8 \rightarrow (1)$

$7|x| - 3|y| = 48 \rightarrow (2)$

let $|x| = a, \quad |y| = b$

$\therefore \quad 3a + 5b - 8 = 0$

$7a - 3b - 48 = 0$

$$\begin{array}{cccc} a & b & 1 & \\ 5 & -8 & 3 & 5 \\ -3 & -48 & 7 & -3 \end{array}$$

$\Rightarrow \dfrac{a}{-240 - 24} = \dfrac{b}{-56 + 144} = \dfrac{1}{-9 - 35}$

$\Rightarrow \dfrac{a}{-264} = \dfrac{b}{88} = \dfrac{1}{-44}$

$\therefore \quad a = 6, \quad b = -2$

$|x| = 6, \quad |y| = -2$

$\Rightarrow x = \pm 6, \quad y =$ does not exists

hence, $x + y =$ Does not exists Ans: —

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08 a, b, c, d

given $3b = a + c + d \rightarrow (1)$

$4c = a + b + d \rightarrow (2)$

$5d = a + b + c \rightarrow (3)$

Solving we get $\underset{2.3}{} \; \dfrac{60}{23} a = 4b = 5c = 6d = K$

Largest = A

smallest = D

Given $99 = \dfrac{23K}{60} + \dfrac{K}{6}$

$\Rightarrow K = 180$

$B + C = \dfrac{180}{4} + \dfrac{180}{5}$

$= 81.$

Ans: B

09. Given $abc = 459 + (a+b+c)$

$\Rightarrow 100a + 10b + c = 459 + a + b + c$

$\Rightarrow 11a + b = 51$

We have to find $ab + a$

$\Rightarrow 10a + b + a$

$= 11a + b$

$= 51$

Ans : C

10. $mx + ny + a + b = a - b$

$\Rightarrow mx + ny + 2b = 0 \rightarrow (1)$

$nx + my + 2b = 0 \rightarrow (2)$

Solving equ (1) and equ (2)

we get $x = y = \frac{2b}{m+n}$.

i.e $\sin\theta = \cos\theta \Rightarrow \theta = 45^\circ$

Ans : B

11. $\frac{12}{2x+3y} + \frac{5}{3x-2y} = -7$, $\frac{8}{2x+3y} + \frac{6}{3x-2y} = -10$

$x = \frac{1}{2}$, $y = -1$ satisfies the above equation.

Ans: A, B

12. $\frac{x}{a} + \frac{y}{b} = a^2 + b^2$; $\frac{x}{a^2} + \frac{y}{b^2} = a + b$

$x = a^3$, $y = b^3$ Satisfies the above equations

13.

12

13 S.I. $2x+3y-1=0 \rightarrow (1)$

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

$$\frac{2}{3K-1} = \frac{3}{1-2K} \neq \frac{-1}{-2K-3}$$

$$\Rightarrow K = \frac{5}{13}$$

Statement II: Conceptual (True) Ans: A

14. Statement I:

$$\frac{3(K-1)}{15} = \frac{4}{20} = \frac{24}{8(K+13)}$$

$$\Rightarrow K=2 \quad (\text{False})$$

Statement II: Conceptual (True) Ans: D

15. $ax+by+(t-s)=0$ | $bx+ay+(s-r)=0$

$\Rightarrow ap+bp+(t-s)=0$ | $bp+ap+s-r=0$

$\Rightarrow p = s-t-a-b$ | $p = r-s-a-b$

$\therefore \quad s-t-a-b = r-s-a-b$

$\Rightarrow \quad 2s = r+t$ Ans: C

16 $(2,-1)$ satisfies the given two equations

Ans: D

17 $\dfrac{2}{-4} = \dfrac{-3}{q} \neq \dfrac{3}{\left(\frac{p}{q}\right)}$

$\Rightarrow q=6$ | $\dfrac{-3}{6} \neq \dfrac{18}{p}$

$\Rightarrow p \neq -36$

Ans: D

18. $\frac{4}{11k-3} = \frac{20}{40_2}$

$\Rightarrow 8 = 11k - 3$

$\Rightarrow k = 1$

Ans: D

19. $a : b = 7 : 3$

$\Rightarrow a = 7x, \quad b = 3x$

$\Rightarrow a + b = 20$

$\Rightarrow 7x + 3x = 20$

$\Rightarrow 10x = 20$

$\Rightarrow x = 2$

$b = 3x$

$\Rightarrow b = 3 \times 2$

$\Rightarrow b = 6$

Ans: 6

20. $\frac{5}{10} = \frac{4}{8} \neq \frac{6}{-12}$ i.e $\frac{a_1}{a_2} = \frac{b_1}{b_2}$

Given lines are parallel to each other

hence, no common solutions.

Ans: 0

21) a) $3x + 11 = 6x - 13$

$\Rightarrow 3x = 24 \quad \Rightarrow x = 8$

b) $4x + 5y = 71$

$5x + 3y = 66$

$\therefore (9, 7)$ satisfies the above equations

c) $\left.\begin{array}{l} 3x + 4y = 8 \\ 9x + 12y = 24 \end{array}\right\}$ $\frac{3}{9} = \frac{4}{12} = \frac{8}{12}$

$\therefore$ Infinite solutions

d) $5x + 6y = 10$

$10x + 12y = 40$

$\therefore d \quad \frac{5}{10} = \frac{6}{12} \neq \frac{10}{40}$

No solution

Ans: c, p, r, —

22 (i) $5u + 3v = 13uv$

$u - v = uv$

$(u, v) = (1, \frac{1}{2})$ satisfies the above equs

(ii) $4(2x-1) + 9(3y-1) = 17$

$3(2x) - 2(3y) = 6$

$(2, 1)$ satisfies the above equations

(iii) $3x + 2y = 20$

$4x - 5y = 42$

$\Rightarrow (x, y) = (8, -2)$

$\therefore \cancel{a} + b = 8$

$\cancel{a} - b = -2$

$- \quad + \qquad +$

$2b = 10 \Rightarrow b = 5$

(iv) $\frac{3}{2}x + 2y = 1 \Rightarrow 3x + 4y - 2 = 0$

$\frac{x}{4} - \frac{y}{2} = 1 \Rightarrow x - 2y - 4 = 0$

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

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

Ans: r, p, q, t

$\Rightarrow$ THE END $\in$