Linear Equations in Two Variables

Practice Set 1.1

Q. 1. Complete the following activity to solve the simultaneous equations.
$5x + 3y = 9$ ……. (i)
$2x + 3y = 12$ ……… (ii)

Answer :

$5x + 3y = 9$ ……. (i)

$2x + 3y = 12$ ……… (ii)

Subtracting equation (ii) from (i), we get,
(5x + 3y) - (2x + 3y) = 9 - 125x - 2x + 3y - 3y = -33x = -3x = -1Putting the value of x in equation (i), 5(-1) + 3y = 9-5 + 3y = 93y = 14y = 14/3

Let's add equations (I) and (II).

Hence, x = -1 and y = 14/3 is the solution of the equation.

Q. 2 A. Solve the following simultaneous equation.

$3a + 5b = 26$; $a + 5b = 22$

Answer :

$3a + 5b = 26$ ... (I)

$a + 5b = 22$ ... (II)

Change the sign of Eq. (II)

$3a + 5b = 26$

$\underline{-a - 5b = -22}$

$2a = 4$

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

$a = 2$

Substituting a = 2 in Eq. (II)

$2 + 5b = 22$

$5b = 22 - 2$

$5b = 20$

$b = \frac{20}{5}$

$b = 4$

∴ solution is (a, b) = (2, 4)

Q. 2 B. Solve the following simultaneous equation.

x + 7y = 10; 3x – 2y = 7

Answer :

$x + 7y = 10 \;\; ...(I)$

$3x - 2y = 7 \;\; ...(II)$

Multiply Eq. I by 2 and Eq. II by 7

$2x + 14y = 20$

$\underline{21x - 14y = \; 49}$

$23\,x = 69$

$x = \frac{69}{23}$

x=3

Substituting x= 3 in Eq. I

$3 + \; 7y = 10$

$7y = 10 - 3$

7y=7

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

y=1

∴ Solution is (x , y) = (3, 1)

Q. 2 C. Solve the following simultaneous equation.

2x – 3y = 9; 2x + y = 13

Answer :

$2x - 3y = 9 \ \ldots(\mathrm{I})$

$2x + y = 13 \ \ldots(\mathrm{II})$

Change the sign of Eq. (II)

$$\begin{array}{r} 2x - 3y = 9 \\ \underline{-2x - y = -13} \\ -4y \ = 4 \end{array}$$

$$y = \frac{4}{4}$$

$y = 1$

Substituting y = 1 in Eq. (II)

$2x + \ 1 = 13$

2x = 13 - 12x = 12x = 6

∴ solution is (x, y) = (1,6)

Q. 2 D. Solve the following simultaneous equation.

5m – 3n = 19; m – 6n = –7

Answer :

$5m - 3n = 19$ ... (I)

$m - 6n = -7$ ... (II)

Multiply Eq. II by 5

$5m - 30n = -35$ ... (III)

equating (I) and (III), change the sign of Eq. (III)

$5m - 3n = 19$

$-5m + 30n = 35$

Adding both we get

$\Rightarrow 27n = 54$

$\Rightarrow n = \frac{54}{27}$

⇒ n = 2

Substituting n = 2 in Eq 1

⇒ 5m - 3(2) = 19⇒ 5m - 6 = 19⇒ 5m = 25⇒ m = 5

∴ Solution is (m , n) = (5, 2)

Q. 2 E. Solve the following simultaneous equation.

5x + 2y = –3; x + 5y = 4

Answer :

$5x + 2y = -3$ ... (I)

$x + 5y = 4$ ... (II)

Multiply Eq. I by 5 and Eq. II by 2

$$25x + 10y = -15 \ldots (III)$$

$$2x + 10y = 8 \ldots (IV)$$

Change sign of Eq.(IV)

$$\begin{array}{l} 25x + 10y = -15 \\ \underline{-2x - 10y = -8} \\ \quad 23x = -23 \end{array}$$

$$x = -\frac{23}{23}$$

$$x = -1$$

Subsituting x=–1in Eq.II

$$-1 + 5y = 4$$

$$5y = 4 + 1$$

$$5y = 5$$

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

$$y = 1$$

∴ solution is (x, y) = (–1, 1)

Q. 2 F. Solve the following simultaneous equation.

$$\frac{1}{3}x + y = \frac{10}{3};\ 2x + \frac{1}{4}y = \frac{11}{4}$$

Answer :

$\frac{1}{3}x + y = \frac{10}{3} \Rightarrow \frac{x+3y}{3} = \frac{10}{3} \Rightarrow x + 3y = 10 \; ... (I)$

$2x + \frac{1}{4}y = \frac{11}{4} \Rightarrow \frac{8x+y}{4} = \frac{11}{4} \Rightarrow 8x + y = 11 \; ... (II)$

Multiplying Eq. II by 3

$24x + 3y = 33 \; ... (III)$

Equating Eq. I and III, change the signs of Eq. III

$x + 3y = 10$

$\underline{-24x - 3y = -33}$

$-23x = -23$

$x = 1$

Substituting x = 1 in Eq. I

$1 + 3y = 10$

$3y = 10 - 1$

$3y = 9$

$y = \frac{9}{3}$

$y = 3$

∴ solution is (x,y) = (1, 3)

Q. 2 G. Solve the following simultaneous equation.

99x + 101 y = 499; 101x + 99y = 501

Answer :

$99x + 101y = 499 \; ... (I)$

$101x + 99y = 501$ ... (II)

Adding both the Equations

$$\begin{array}{r} 99x + 101y = 499 \\ \underline{101x + 99y = 501} \\ 200x + 200y = 1000 \end{array}$$

Dividing both sides by 200

$x + y = 5$ ...(III)

Subtract equation (I) and (II)

$$\begin{array}{r} 99x + 101y = 499 \\ \underline{-101x - 99y = -501} \\ -2x + 2y = -2 \end{array}$$

Divide both sides by (–2)

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

Equating Eq. (III) and (IV)

$$\begin{array}{r} x + y = 5 \\ \underline{x - y = 1} \\ 2x = 6 \end{array}$$

$$x = \frac{6}{2}$$

$$x = 3$$

Substituting x=3 in Eq. III

$$3 + y = 5$$

$$y = 5 - 3$$

$$y = 2$$

∴ solution is (x, y) = (3, 2)

Q. 2 H. Solve the following simultaneous equation.

49x – 57y = 172; 57x – 49y = 252

Answer :

$49x - 57y = 172$ ... (I)

$57x - 49y = 252$ ... (II)

Adding both the Equations

$$\begin{array}{r} 49x - 57y = 172 \\ \underline{57x - 49y = 252} \\ 106x - 106y = 424 \end{array}$$

Dividing both sides by 106

$x - y = 4$ …(III)

Subtract equation (I) and (II)

$$\begin{array}{r} 49x - 57y = 172 \\ \underline{-57x + 49y = -252} \\ -8y - 8y = -80 \end{array}$$

Divide both sides by (–8)

$x + y = 10$ …(IV)

Equating Eq. (III) and (IV)

$$\begin{array}{r} x - y = 4 \\ \underline{x + y = 10} \\ 2x = 14 \end{array}$$

$$x = \frac{14}{2}$$

$x = 7$

Substituting x=7 in Eq. IV

$7 + y = 10$

$y = 10 - 7$

$y = 3$

∴ solution is (x, y) = (7,3)

Practice Set 1.2

Q. 1. Complete the following table to draw graph of the equations -

(I) x+y = 3 (II) x – y = 4

$x + y = 3$

x	3	$\square$	$\square$
y	$\square$	5	3
(x, y)	(3, 0)	$\square$	(0, 3)

$x - y = 4$

x	$\square$	-1	0
y	0	$\square$	-4
(x, y)	$\square$	$\square$	(0, -4)

Answer :

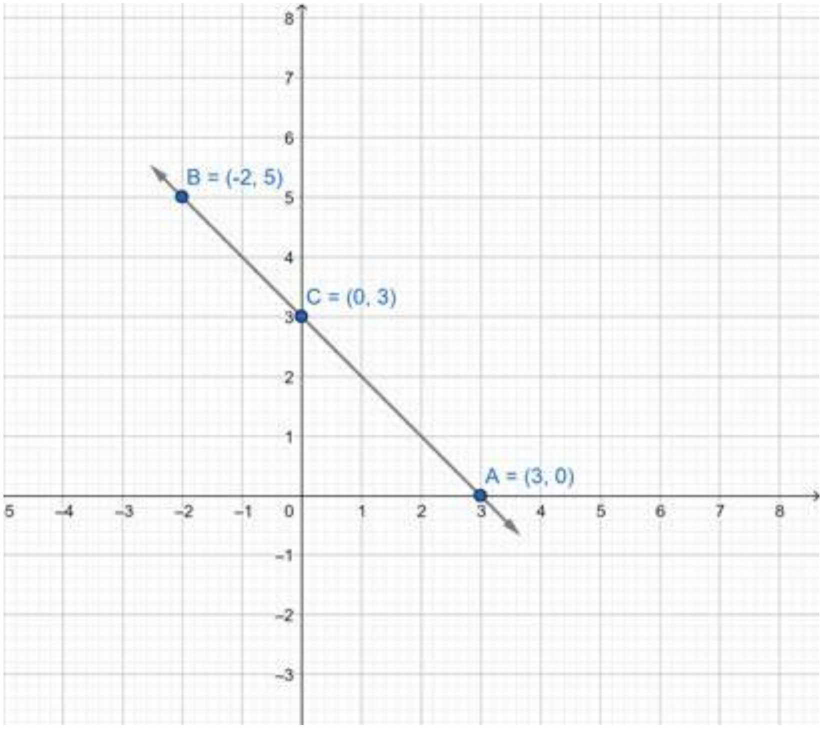
(1). In Equation $x + y = 3$ ...I

i. Put value x=3 in Eq. I we get, $y = 3 - 3 \Rightarrow y = 0$

ii. Put value y=5 in Eq. I we get, $x = 3 - 5 \Rightarrow x = -2$

iii. Put value y=3 in Eq. I we get, $x = 3 - 3 \Rightarrow x = 0$

x	3	-2	0
y	0	5	3
(x, y)	(3, 0)	(-2, 5)	(0, 3)



(2). In Equation $x - y = 4 \ldots\ldots II$

i. Put value y=0 in Eq. II we get, $x = 4 - 0 \Rightarrow x = 4$

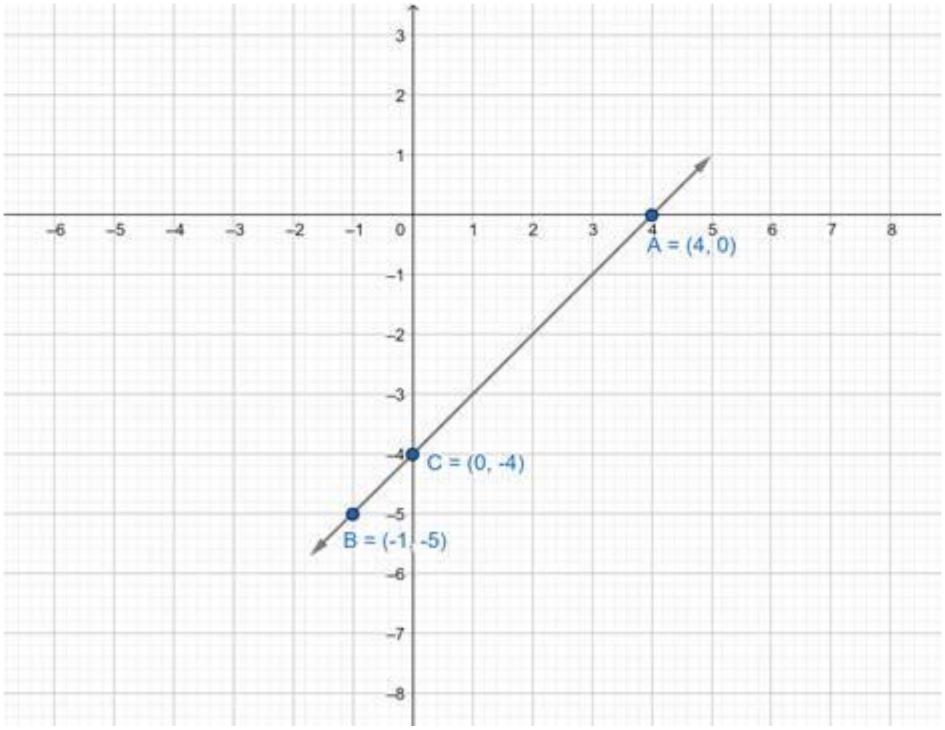
ii. Put value x=–1 in Eq. I we get,

$-y = 5$

$\therefore\ y = -5$

iii. Put value y=–4 in Eq. I we get, $x = 4 + 4 \Rightarrow x = 8$

x	4	-1	0
y	0	-5	-4
(x, y)	(4, 0)	(-1, -5)	(0, -4)



Q. 2 A. Solve the following simultaneous equation graphically.

(1) x + y = 6; x – y = 4

Answer :

Eq. I = $x + y = 6$

x	0	6	5
y	6	0	1
x, y	0,6	6,0	5,1

Eq. II = $x - y = 4$

X	0	2	5
Y	-4	-2	1
x, y	0, -4	2, -2	5,1

Calculating intersecting point

$$x + y = 6$$

$$\underline{x - y = 4}$$

$$2x = 10$$

$$x = \frac{10}{2}$$

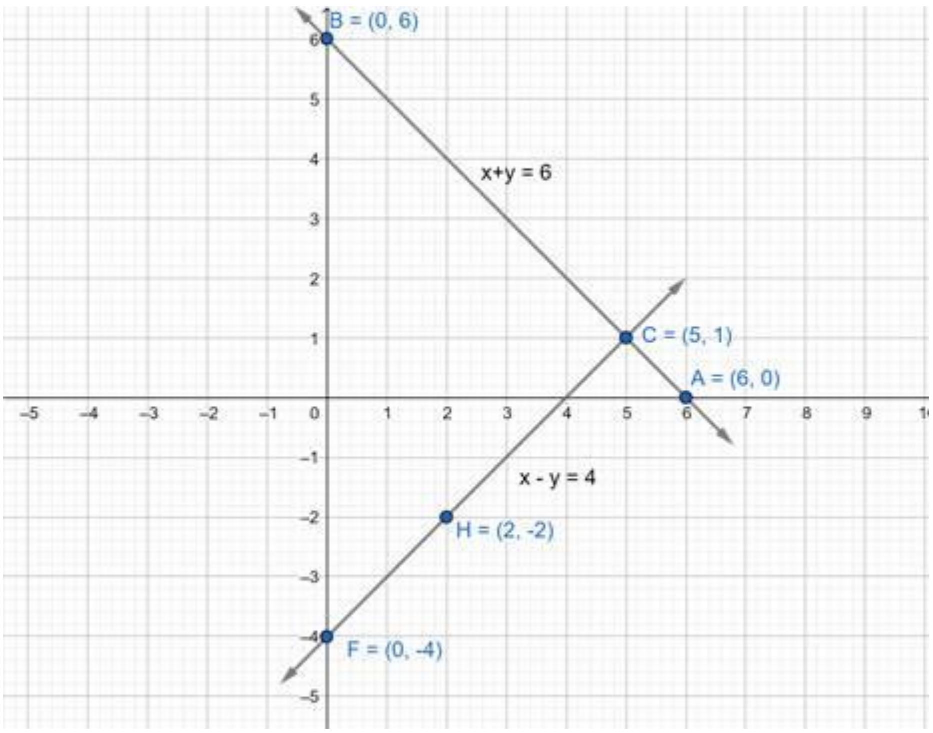
$$x = 5$$

Putting x= 5 in Eq.I

5+ y = 6

$$y = 6 - 5$$

$$y = 1$$



Q. 2 B. Solve the following simultaneous equation graphically.

x + y = 5; x – y = 3

Answer :

Eq. I = $x + y = 5$

x	0	2	4
y	5	3	1
x, y	0,6	2,3	4,1

Eq. II = $x - y = 3$

X	0	2	4
Y	-3	-1	1
x, y	0, -3	2, -1	4,1

Calculating intersecting point

$$\begin{aligned} x + y &= 5 \\ \underline{x - y} &\underline{= 3} \\ 2x &= 8 \end{aligned}$$

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

$$x = 4$$

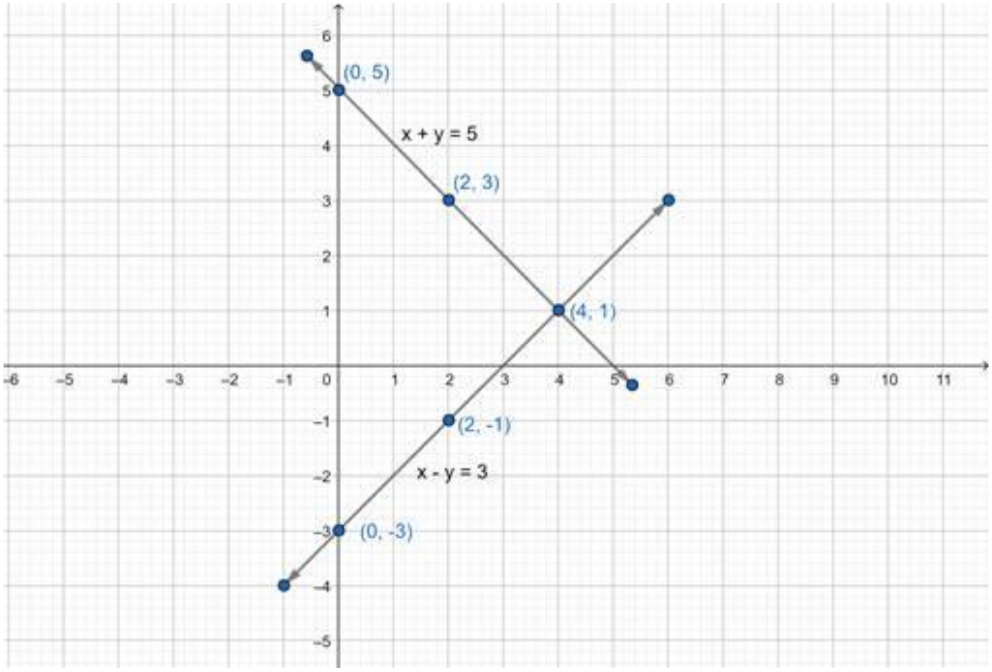
Putting x= 4 in Eq.I

4+ y = 5

$$y = 5 - 4$$

$$y = 1$$

Intersection Point (4,1)



Q. 2 C. Solve the following simultaneous equation graphically.

x + y = 0; 2x – y = 9

Answer :

Eq. I = $x + y = 0$

x	1	3	5
y	-1	-3	-5
x,y	(1,-1)	(3,-3)	(5,-5)

Eq. II = $2x - y = 9$

X	2	3	4
Y	-5	-3	-1
x, y	2,-5	3,-3	4,-1

Calculating intersecting point

$x + y = 0$

$2x - y = 9$

$3x = 9$

$x = \frac{9}{3}$

$x = 3$

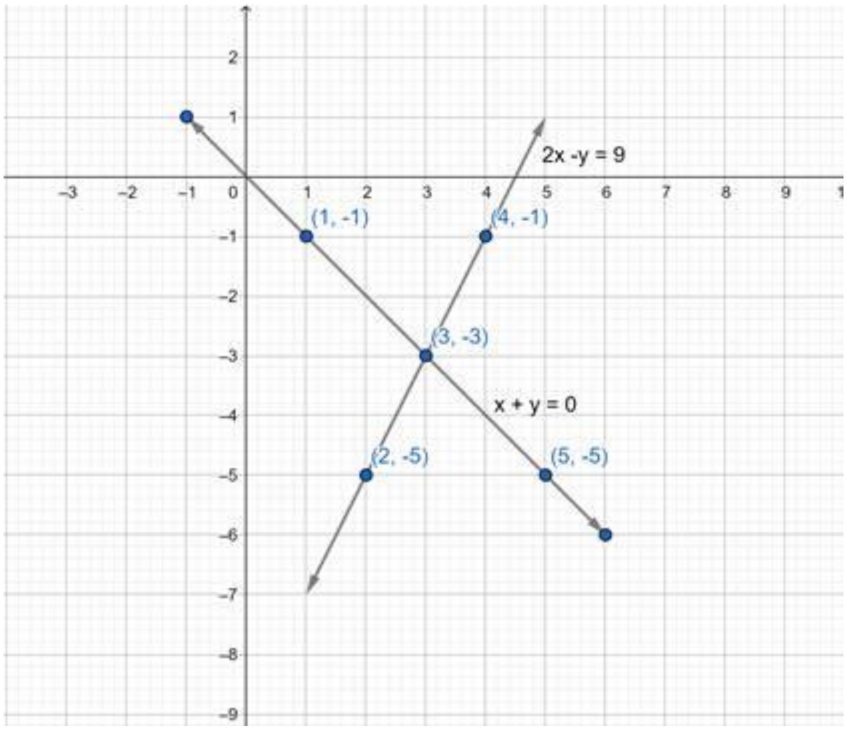
Putting x= 3 in Eq.I

3+ y = 0

$y = 0 - 3$

$y = -3$

Intersection point (3,–3)



Q. 2 D. Solve the following simultaneous equation graphically.

3x – y = 2; 2x – y = 3

Answer :

Eq. I = $3x - y = 2$

x	0	1	-1
y	-2	1	-5
x, y	0,-2	1,1	-1,-5

Eq. II = $2x - y = 3$

x	3	2	-1
y	3	1	-5
(x.y)	(3,3)	(2,1)	(-1,-5)

Calculating intersecting point

$3x - y = 2$

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

$$x = -1$$

Putting x= –1 in Eq.I

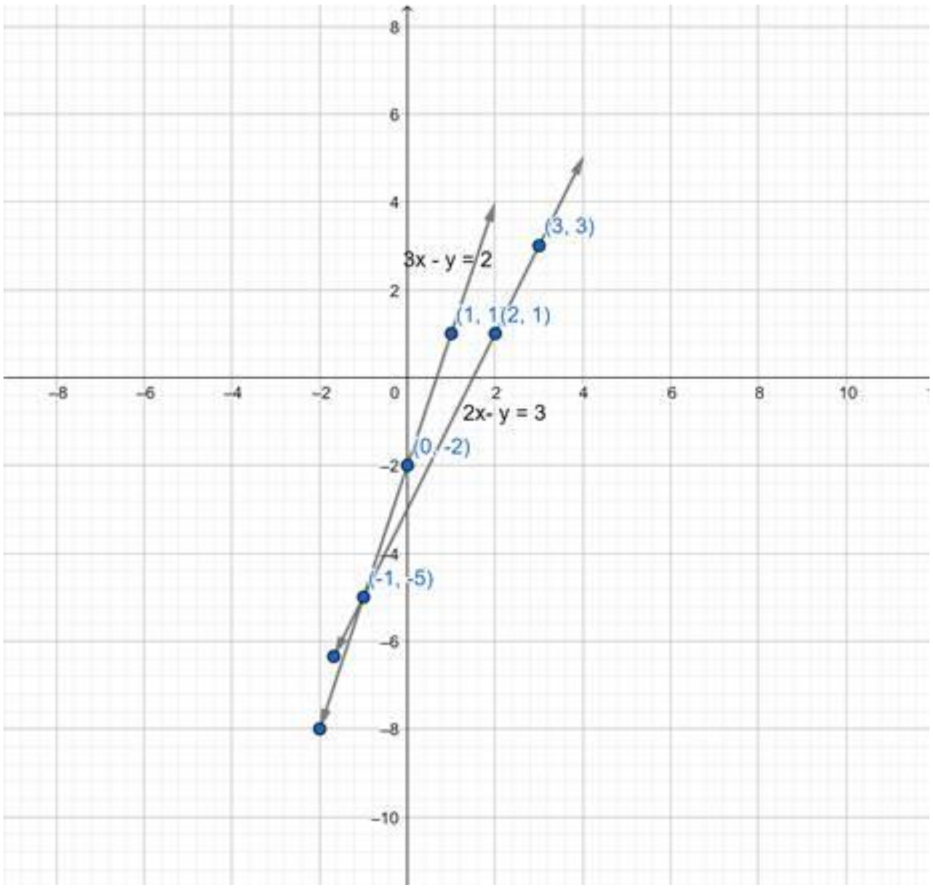
3× –1 – y = 2

$$-3 - y = 2$$

$$-y = 2 + 3$$

$$y = -5$$

Intersection point (–1,–5)



Q. 2 E. Solve the following simultaneous equation graphically.

3x – 4y = –7; 5x – 2y = 0

Answer :

Eq. I = $3x - 4y = -7$

When x = 0, 4y = 7, y = 7/4

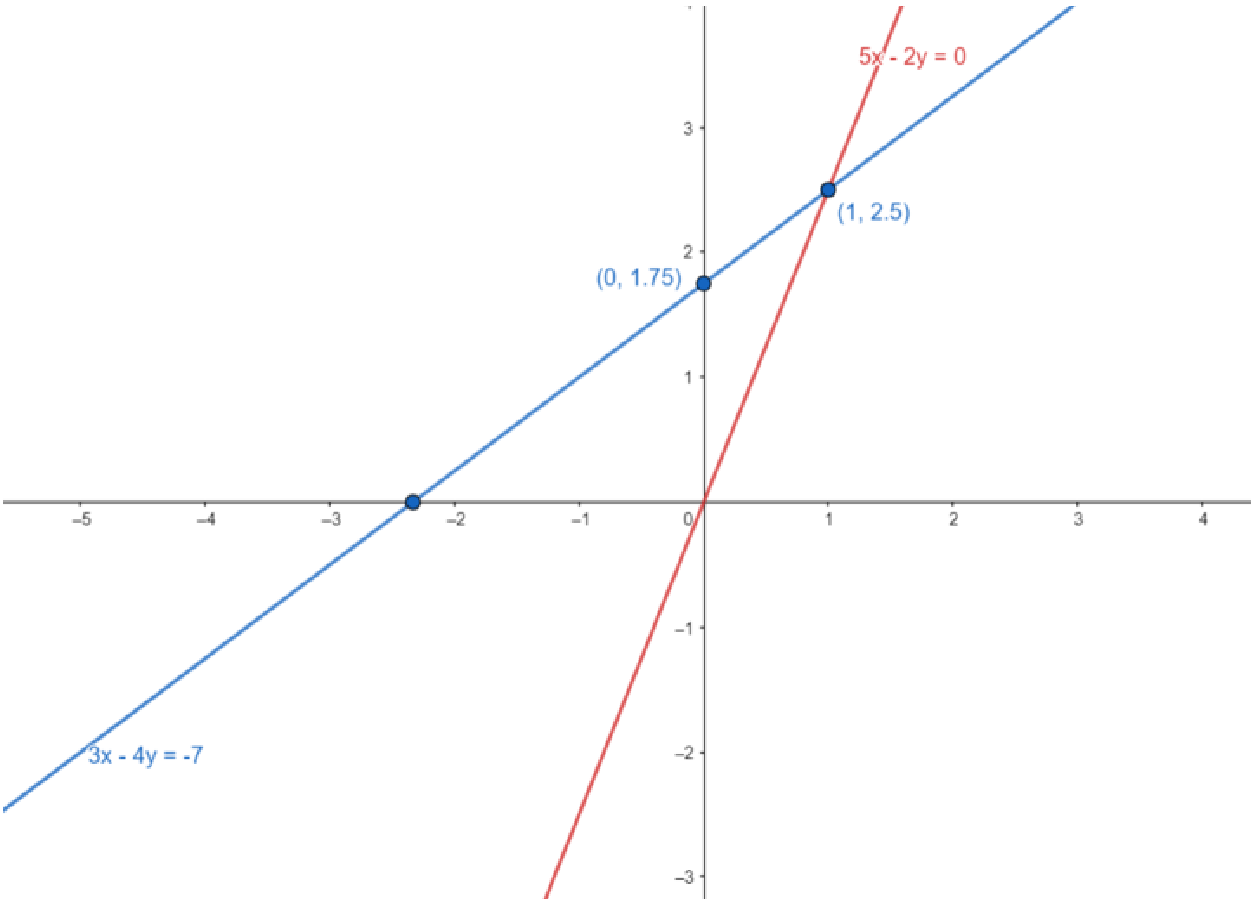
When y = 0, 3x = -7, x = -7/3

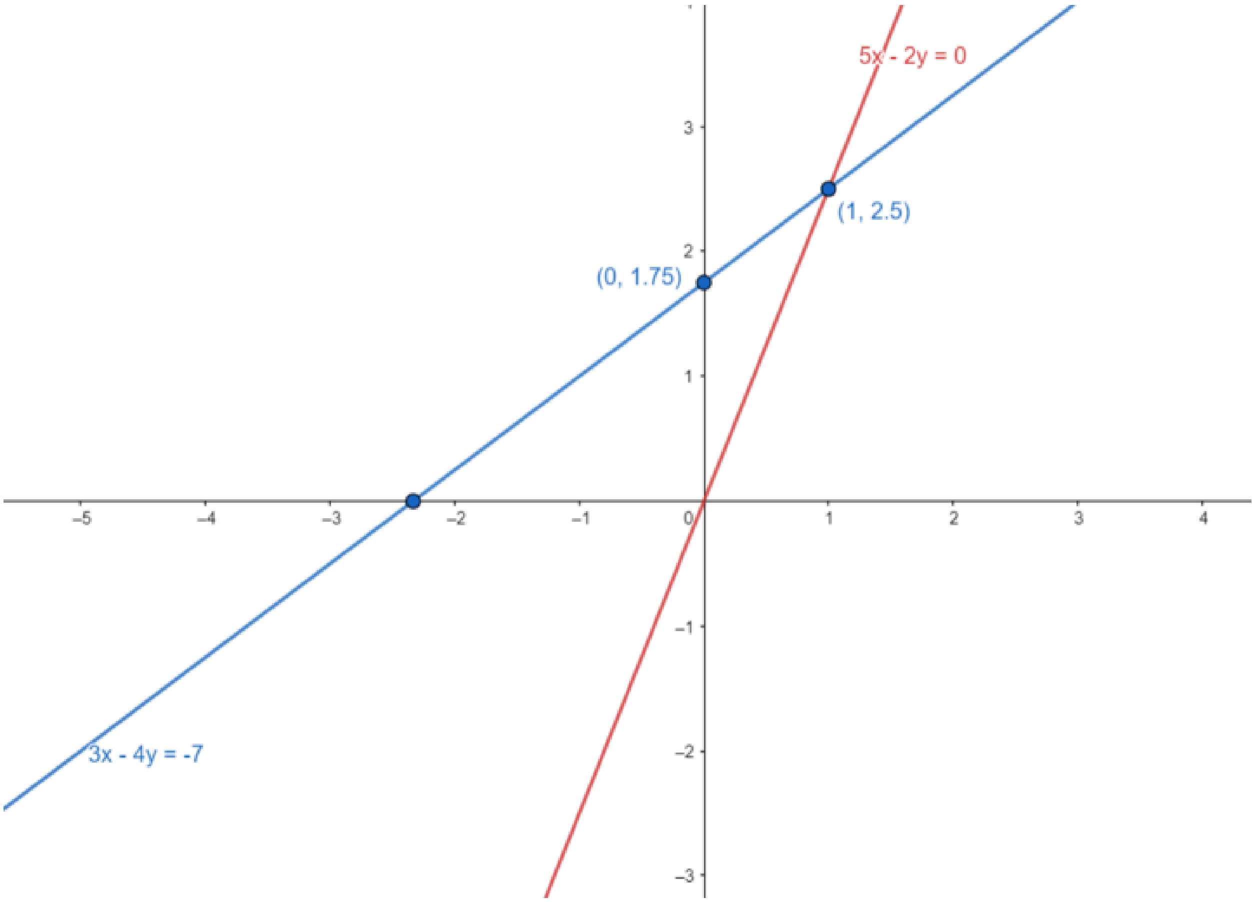
Eq. II = $5x - 2y = 0$

When x = 0, y = 0

When x = 1, y = 5/2

Plotting both the graphs we get,





Calculating intersecting point

$3x - 4y = -7$

$5x - 2y = 0$

$x = -1$

Putting x= –1 in Eq.I

3× –1 – y = 2

$-3 - y = 2$

$-y = 2 + 3$

$y = -5$

Intersection point (–1,–5)

Practice Set 1.3

Q. 1. Fill in the blanks with correct number

$$\begin{vmatrix} 3 & 2 \\ 4 & 5 \end{vmatrix} = 3 \times \boxed{} - \boxed{} \times 4 = \boxed{} - 8 = \boxed{}$$

Answer :

$$\begin{vmatrix} 3 & 2 \\ 4 & 5 \end{vmatrix} = 3 \times \boxed{5} - \boxed{2} \times 4 = \boxed{15} - 8 = \boxed{7}$$

Q. 2. Find the values of following determinants.

(1) $\begin{vmatrix} -1 & 7 \\ 2 & 4 \end{vmatrix}$

(2) $\begin{vmatrix} 5 & 3 \\ -7 & 0 \end{vmatrix}$

(3) $\begin{vmatrix} \frac{7}{3} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix}$

Answer :

we know, determinant of a 2 × 2 matrix

$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$

is (ad - bc)(1) $(-1\times 4) - (7 \times 2) = -4 - 14 = -18$

(2) $(5\times 0) - (3\times -7) = 0 - (-21) = 21$

(3) $\frac{7}{3} \times \frac{1}{2} - \frac{5}{3} \times \frac{3}{2} = \frac{7}{6} - \frac{15}{6} = \frac{15}{6} = -\frac{4}{3}$

Q. 3 A. Solve the following simultaneous equations using Cramer's rule.

3x – 4y = 10; 4x + 3y = 5

Answer :

$3x - 4y = 10$

$4x + 3y = 5$

$D = \begin{vmatrix} 3 & -4 \\ 4 & 3 \end{vmatrix} = (3 \times 3) - (-4 \times 4) = 9 + 16 = 25$

$D_x = \begin{bmatrix} 10 & -4 \\ 5 & 3 \end{bmatrix} = (10 \times 3) - (-4 \times 5) = 30 + 20 = 50$

$D_y = \begin{bmatrix} 3 & 10 \\ 4 & 5 \end{bmatrix} = (3 \times 5) - (10 \times 4) = 15 - 40 = -25$

$x = \frac{D_x}{D} = \frac{50}{25} = 2 \quad y = \frac{D_y}{D} = -\frac{25}{25} = -1$

∴ (x,y) = (2, –1) is the solution

Q. 3 B. Solve the following simultaneous equations using Cramer's rule.

4x + 3y – 4 = 0; 6x = 8 – 5y

Answer :

$4x + 3y = 4$

$6x + 5y = 8$

$D = \begin{bmatrix} 4 & 3 \\ 6 & 5 \end{bmatrix} = (4 \times 5) - (3 \times 6) = 20 – 18 = 2$

$$D_x = \begin{bmatrix} 4 & 3 \\ 8 & 5 \end{bmatrix} = (4 \times 5) - (3 \times 8) = 20 - 24 = -4$$

$$D_y = \begin{bmatrix} 4 & 4 \\ 6 & 8 \end{bmatrix} = (4 \times 8) - (4 \times 6) = 32 - 24 = 8$$

$$x = \frac{D_x}{D} = -\frac{4}{2} = -2 \; y = \frac{D_y}{D} = \frac{8}{2} = 4$$

∴(x,y)= (–2, 4) is the solution.

Q. 3 C. Solve the following simultaneous equations using Cramer's rule.

x + 2y = –1; 2x – 3y = 12

Answer :

$x + 2y = -1$

$2x - 3y = 12$

$$D = \begin{bmatrix} 1 & 2 \\ 2 & -3 \end{bmatrix} = (1 \times -3) - (2 \times 2) = -3 - 4 = -7$$

$$D_x = \begin{bmatrix} -1 & 2 \\ 12 & -3 \end{bmatrix} = (-1 \times -3) - (2 \times 12) = 3 - 24 = -21$$

$$D_y = \begin{bmatrix} 1 & -1 \\ 2 & 12 \end{bmatrix} = (1 \times 12) - (-1 \times 2) = 12 + 2 = 14$$

$$x = \frac{D_x}{D} = -\frac{21}{-7} = 3 \; y = \frac{D_y}{D} = \frac{14}{-7} = -2$$

∴ (x,y) = (3, –2) is solution.

Q. 3 D. Solve the following simultaneous equations using Cramer's rule.

6x – 4y = –12; 8x – 3y = –2

Answer :

$6x - 4y = -12$

$8x - 3y = -2$

$D = \begin{bmatrix} 6 & -4 \\ 8 & -3 \end{bmatrix} = (6 \times -3) - (-4 \times 8) = -18 + 32 = 14$

$D_x = \begin{bmatrix} -12 & -4 \\ -2 & -3 \end{bmatrix} = (-12 \times -3) - (-4 \times -2) = 36 - 8 = 28$

$D_y = \begin{bmatrix} 6 & -12 \\ 8 & -2 \end{bmatrix} = (6 \times -2) — 12 \times 8 = 12 + 96 = 108$

$x = \frac{D_x}{D} = \frac{28}{14} = 2\ y = \frac{D_y}{D} = \frac{108}{14} = 6$

∴ (x,y) = (2, 6) is solution.

Q. 3 E. Solve the following simultaneous equations using Cramer's rule.

4m + 6n = 54; 3m + 2n = 28

Answer :

$4m + 6n = 54$

$3m + 2n = 28$

$D = \begin{bmatrix} 4 & 6 \\ 3 & 2 \end{bmatrix} = (4 \times 2) - (6 \times 3) = 8 - 18 = 10$

$D_x = \begin{bmatrix} 54 & 6 \\ 28 & 2 \end{bmatrix} = (54 \times 2) - (6 \times 28) = 108 - 168 = 60$

$D_y = \begin{bmatrix} 4 & 54 \\ 3 & 28 \end{bmatrix} = (4 \times 28) — (54 \times 3) = 112 - 162 = 50$

$x = \frac{D_x}{D} = \frac{60}{10} = 6\ y = \frac{D_y}{D} = \frac{50}{10} = 5$

∴ (x,y) = (6, 5) is solution.

Q. 3 F. Solve the following simultaneous equations using Cramer's rule.

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

Answer :

$2x + 3y = 2$

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

$$D = \begin{bmatrix} 2 & 3 \\ 2 & -1 \end{bmatrix} = (2 \times -1) - (3 \times 2) = -2 - 6 = -8$$

$$D_x = \begin{bmatrix} 2 & 3 \\ 1 & -1 \end{bmatrix} = (2 \times -1) - (3 \times 1) = -2 - 3 = -5$$

$$D_y = \begin{bmatrix} 2 & 2 \\ 2 & 1 \end{bmatrix} = (2 \times 1) - (2 \times 2) = 2 - 4 = (-2)$$

$$x = \frac{D_x}{D} = \frac{-5}{-8} = \frac{5}{8}\ y = \frac{D_y}{D} = \frac{-2}{-8} = \frac{1}{4}$$

$\therefore$ (x,y) = $\left(\frac{5}{8}, \frac{1}{4}\right)$ is solution.

Practice Set 1.4

Q. 1 A. Solve the following simultaneous equation.

$$\frac{2}{x} - \frac{3}{y} = 15\ ;\ \frac{8}{x} + \frac{5}{y} = 77$$

Answer :

$\frac{2}{x} - \frac{3}{y} = 15$

$\frac{8}{x} + \frac{5}{y} = 77$

Let $\frac{1}{x}$ = m and $\frac{1}{y}$= n

$2m - 3n = 15$ ...(I)

$8m + 5n = 77$ ...(II)

Multiply Eq. I by 4

$8m - 12n = 60$ ...(III)

Equating Eq. II and III. Change the signs of Eq. III

$$\begin{array}{r} 8m + 5n = 77 \\ \underline{-8m + 12n = -60} \\ 17n = 17 \end{array}$$

$$n = \frac{17}{17}$$

$n = 1$

Substituting n=1 in Eq. II

$8m + 5 \times 1 = 77$

$8m + 5 = 77$

$8m = 77 - 5$

$8m = 72$

$$m = \frac{72}{8}$$

$m = 9$

$\therefore m = \frac{1}{x} \Rightarrow \frac{1}{x} = 9 \Rightarrow x = \frac{1}{9}$

$\therefore n = \frac{1}{y} \Rightarrow \frac{1}{y} = 1 \Rightarrow y = 1$

Hence (x,y) = $(\frac{1}{9}, 1)$

Q. 1 B. Solve the following simultaneous equation.

$$\frac{10}{x+y} + \frac{2}{x-y} = 4 \; ; \; \frac{15}{x+y} - \frac{5}{x-y} = -2$$

Answer :

$$\frac{10}{x+y} + \frac{2}{x-y} = 4$$

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

Let $\frac{1}{x+y}$ = m and $\frac{1}{x-y}$ = n

$10m + 2n = 4$ ... (I)

$15m - 5n = -2$ ... (II)

Multiply Eq. I by 5 and Eq.II by 2

$$\begin{aligned} 50m + 10n &= 20 \\ \underline{30m - 10n} &\underline{= -4} \\ 80m &= 16 \end{aligned}$$

$$m = \frac{16}{80}$$

$$m = \frac{1}{5}$$

Substituting $m = \frac{1}{5}$ in Eq. I

$$10 \times \frac{1}{5} + 2n = 4$$

$$2 + 2n = 4$$

$$2n = 4 - 2$$

$$2n = 2$$

$$n = \frac{2}{2}$$

$$n = 1$$

$$\therefore m = \frac{1}{x+y} \Rightarrow \frac{1}{x+y} = \frac{1}{5} \Rightarrow x + y = 5 \text{ ....(III)}$$

$$\therefore n = \frac{1}{x-y} \Rightarrow \frac{1}{x-y} = 1 \Rightarrow x - y = 1 \text{ ....(IV)}$$

Now, equating Eq. III and IV

$$\begin{array}{l} x + y = 5 \\ \underline{x - y = 1} \\ \quad 2x = 6 \end{array}$$

$$x = \frac{6}{2}$$

$$x = 3$$

Subsituting value of x=3 in Eq. III

$$3 + y = 5$$

$$y = 5 - 3$$

$$y = 2$$

Hence (x,y) = (3,2)

Q. 1 C. Solve the following simultaneous equation.

$$\frac{27}{x-2}+\frac{31}{y+3}=85\,;\ \frac{31}{x-2}+\frac{27}{y+3}=89$$

Answer :

$$\frac{27}{x-2}+\frac{31}{y+3}=85$$

$$\frac{31}{x-2}+\frac{27}{y+3}=89$$

Let $\frac{1}{x-2}$ = m and $\frac{1}{y+3}$= n

$$27m+\ 31n=85\ \ldots(I)$$

$$31m+27n=89\ldots(II)$$

Adding both equations

$$58m+58n=174$$

Dividing both sides by 58

$m+n=3$ …(III)

Subtracting Eq. I and II

$$27m+\ 31n=85$$

$$-31m-27n=-89$$

$$-4m+4n=-4$$

Dividing both sides by 4

$-m+n=-1$ …(IV)

Equating Eq. III and IV

$$\begin{array}{r} m + n = 3 \\ \underline{-m + n = -1} \\ 2n = 2 \end{array}$$

$$n = \frac{2}{2}$$

$$n = 1$$

Subsituting n=1 in Eq. III

$$m + 1 = 3$$

$$m = 3 - 1$$

$$m = 2$$

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

$$\Rightarrow 2x = 5 \Rightarrow x = \frac{5}{2}$$

$$\therefore n = \frac{1}{y+3} \Rightarrow \frac{1}{y+3} = 1 \Rightarrow y + 3 = 1 \Rightarrow y = 1 - 3 \Rightarrow y = -2$$

$$y = 2$$

Hence (x,y) = $(\frac{5}{2}, -2)$

Q. 1 D. Solve the following simultaneous equation.

$$\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4} \; ;$$

$$\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{1}{8}$$

Answer :

$\frac{1}{3x+y}+\frac{1}{3x-y}=\frac{3}{4}$

$$\frac{1}{[2(3x+y)]}-\frac{1}{[2(3x-y)]}=\frac{1}{8}$$

Let $\frac{1}{3x+y}$ = m and $\frac{1}{3x-y}$= n

$m+n=\frac{3}{4}\Rightarrow 4(m+n)=3 \Rightarrow 4m+4n=3 \ldots(I)$

$\frac{1}{2}m-\frac{1}{2}n=\frac{1}{8}\Rightarrow 8(m-n)=1\times 2 \Rightarrow 8m-8n=2\ldots(II)$

Multiply Eq. I by 2

$8m+8n=6$ .... (a)

$8m-8n=2$ ..... (b)

Add (a) and (b) to get,

8m + 8n + 8m - 8n = 8⇒ 16m = 8

$$m=\frac{8}{16}$$

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

Substituting $m=\frac{1}{2}$ in Eq. II

$$8\times\frac{1}{2}-8n=2$$

⇒ 4 - 8n = 2

⇒ - 8n = 2 – 4

$\Rightarrow$ - 8n = -2

$\Rightarrow$ 8n = 2

$$\Rightarrow n = \frac{2}{8}$$

$$\Rightarrow n = \frac{1}{4}$$

$$\therefore m = \frac{1}{2(3x+y)}$$
$$\Rightarrow \frac{1}{2(3x+y)} = \frac{1}{2}$$
$\Rightarrow$ 2 = 2 (3x+y)

$\Rightarrow$ 2 = 6x + 2y III

$$\therefore n = \frac{1}{2(3x-y)}$$
$$\Rightarrow \frac{1}{2(3x-y)} = \frac{1}{4}$$

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

$\Rightarrow$ 4 = 6x - 2y IV

Add Eq. III and IV

$$\begin{array}{r} 6x + 2y = 2 \\ \underline{6x - 2y = 4} \\ 12x = 6 \end{array}$$

$$x = \frac{6}{12}$$

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

Substituting

$$x = \frac{1}{2} \text{ in Eq. III}$$

$$6 \times \frac{1}{2} + 2y = 2$$

⇒ 3 + 2y = 2

⇒ 2y = 2 - 3⇒ 2y = -1

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

Hence (x,y) = $(\frac{1}{2}, -\frac{1}{2})$

Practice Set 1.5

Q. 1. Two numbers differ by 3. The sum of twice the smaller number and thrice the greater number is 19. Find the numbers.

Answer : Let the greater no. be x and smaller no. be x–3

As per given situation,

2(x–3) + 3(x) = 19

$\Rightarrow 2x - 6 + 3x = 19$

$\Rightarrow 5x - 6 = 19$

$\Rightarrow 5x = 19 + 6$

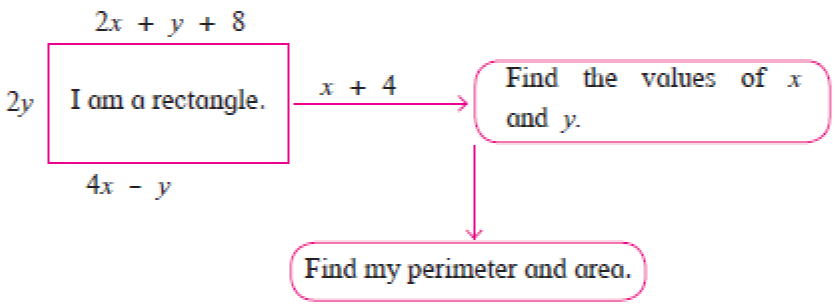
$\Rightarrow 5x = 25$

$\Rightarrow x = \frac{25}{5} = 5$

∴ smaller no is x–3 ⇒ $5 - 3 = 2$

Hence, The numbers are 5 and 2.

Q. 2. Complete the following.



Answer :

Length of rectangle $\Rightarrow 2x + y + 8 = 4x - y$

$\Rightarrow 2x - 4x + y + y = -8$

$\Rightarrow -2x + 2y = -8$

$\Rightarrow -x + y = -4$ ......(I)

Breadth of the rectangle = $2y = x + 4$

$\Rightarrow -x + 2y = 4$ ......(II)

Equating Eq. I and II and change sign of Eq. II

$$\begin{array}{r} -x + y = -4 \\ \underline{x - 2y = -4} \\ -y = -8 \end{array}$$

$y = 8$

Substituting y=8 in Eq.I

$-x + 8 = -4$

$-x = -4 - 8$

$-x = -12$

$x = 12$

Length $= 2 \times 12 + 8 + 8 = 40$

Breadth $= 2 \times 8 = 16$

Area = Length × breadth = 40× 16 = 640 sq. unit

Perimeter = 2(Length + Breadth) = 2(40+16) = 2(56) =112 unit.

Q. 3. The sum of father's age and twice the age of his son is 70. If we double the age of the father and add it to the age of his son the sum is 95. Find their present ages.

Answer : Suppose father's age(in years) be x and that son's age be y.

Then,

$x + 2y = 70$ ...(I)

$2x + y = 95$ ...(II)

Multiply Eq.I by 2 and equate

$$\begin{array}{r} 2x + 4y = 140 \\ \underline{-2x - y = -95} \\ 3y = 45 \end{array}$$

$$y = \frac{45}{3}$$

$y = 15$

Substituting y=15 in Eq.II

$2x + 15 = 95$

$2x = 95 - 15$

$2x = 80$

$x = \frac{80}{2}$

$x = 40$

∴ Son's age is 15 years, father's age is 40 years.

Q. 4. The denominator of a fraction is 4 more than twice its numerator. Denominator becomes 12 times the numerator, if both the numerator and the denominator are reduced by 6. Find the fraction.

Answer : Let the numerator and denominator of the fraction be x and y respectively.

Fraction = $\frac{x}{y}$

Given,

Denominator = 2(Numerator) + 4

$\Rightarrow y = 2x + 4$

$\Rightarrow$ 2x-y=(-4) ...I

According to the given condition, we have

$y - 6 = 12(x - 6)$

$\Rightarrow y - 6 = 12x - 72$

$\Rightarrow 12x - y = 66$ ...II

Equating Eq. I and II,

$2x - y = -4$

$-12x + y = -66$

$-10x = -70$

$x = \frac{70}{10}$

$x = 7$

Putting x = 7 in equation I, we get

$\Rightarrow 2 \times 7 - y = -4$

$\Rightarrow 14 - y = -4$

$\Rightarrow y = 14 + 4$

$\Rightarrow y = 18$

Hence, required fraction = $\frac{7}{18}$

Q. 5. Two types of boxes A, B are to be placed in a truck having capacity of 10 tons. When 150 boxes of type A and 100 boxes of type B are loaded in the truck, it weighes 10 tons. But when 260 boxes of type A are loaded in the truck, it can still accommodate 40 boxes of type B, so that it is fully loaded. Find the weight of each type of box.

Answer : A – 30kg, B – 55k

Let the weight of box ‘A’ = x kg

Let the Weight of box’B’ = y kg

According to question,

150 boxes of type A and 100 boxes of type B are loaded in the truck and it weighs 10tons.

Q. 5. Two types of boxes A, B are to be placed in a truck having capacity of 10 tons. When 150 boxes of type A and 100 boxes of type B are loaded in the truck, it weighes 10 tons. But when 260 boxes of type A are loaded in the truck, it can still accommodate 40 boxes of type B, so that it is fully loaded. Find the weight of each type of box.

Answer : A – 30kg, B – 55k

Let the weight of box ‘A’ = x kg

Let the Weight of box’B’ = y kg

According to question,

150 boxes of type A and 100 boxes of type B are loaded in the truck and it weighs 10tons.

$\therefore 150x + 100y = 10000$ [$\because$ 1ton = 1000kg]

$\Rightarrow 3x + 2y = 200 \ldots\ldots (I)$

260 boxes of type A are loaded in the truck, it can still accommodate 40 boxes of type B, still it weighs 10tons

$\therefore 260x + 40y = 10000$ [$\because$ 1ton = 1000kg]

$\Rightarrow 13x + 2y = 500 \ldots\ldots (II)$

Solving Equation I and II

$3x + 2y = 200$

$-13x - 2y = -500$

$-10x = -300$

$$x = \frac{300}{10}$$

$x = 30$

Putting x=30 in Eq. I

$3 \times 30 + 2y = 200$

$90 + 2y = 200$

$2y = 200 - 90$

$2y = 110$

$$y = \frac{110}{2} = 55$$

Hence, A – 30kg, B – 55kg

Q. 6. Out of 1900 km, Vishal travelled some distance by bus and some by aeroplane. Bus travels with average speed 60 km/hr and the average speed of aeroplane is 700 km/hr. It takes 5 hours to complete the journey. Find the distance, Vishal travelled by bus.

Answer : Let the distance travelled by bus = x

Speed of bus = 60 km/hr

As,

$$time = \frac{distance}{speed}$$

Time taken travelling by bus = $\frac{x}{60}$

Let the distance traveled by plane = y

As, total distance traveled was 1900 km

x + y = 1900

Distance traveled by plane = (1900–x)

Speed of plane = 700 km/hr

Time travelling by plane =

$$\frac{(1900-x)}{700}$$

Given,

Total time = 5 hours

$$\frac{x}{60} + \frac{1900-x}{700} = 5$$

$$\Rightarrow \frac{35x + 3(1900 - x)}{2100} = 5$$

$$\Rightarrow \frac{35x + 5700 - 3x}{2100} = 5$$

⇒ 32x + 5700 = 10500⇒ 32x = 4800⇒ x = 150 kmand y = 1900 - x = 1900 - 150 = 1750 km

Vishal travels 150km by bus and 1750 km by plane.

Problem Set 1

Q. 1 A. Choose correct alternative for each of the following question
To draw graph of 4x+5y=19, Find y when x = 1.

A. 4
B. 3
C. 2
D. –3

Answer :

Put x= 1 in Eq. $4x + 5y = 19$

$4 \times 1 + 5y = 19$

$\Rightarrow 5y = 19 - 4$

$\Rightarrow 5y = 15$

$\Rightarrow y = \frac{15}{5} = 3$

Hence, option B is correct.

Q. 1 B. Choose correct alternative for each of the following question

For simultaneous equations in variables x and y, $D_X = 49$, $D_Y = -63$, $D = 7$, then what is x?

A. 7

B. –7

C. $\frac{1}{7}$

D. $\frac{-1}{7}$

Answer :

$$x = \frac{D_x}{D} = \frac{49}{7} = 7$$

Hence option A is correct.

Q. 1 C. Choose correct alternative for each of the following question

Find the value of $\begin{vmatrix} 5 & 3 \\ -7 & -4 \end{vmatrix}$

A. –1
B. –41
C. 41
D. 1

Answer :

$$D = \begin{bmatrix} 5 & 3 \\ -7 & -4 \end{bmatrix} = (5 \times -4) - (3 \times -7) = -20 + 21 = 1$$

Hence, option D is correct.

Q. 1 D. Choose correct alternative for each of the following question

To solve x + y = 3; 3x–2y – 4 = 0 by determinant method find D.

A. 5
B. 1
C. –5
D. –1

Answer :

$x + y = 3$

$3x - 2y = 4$

$$D = \begin{bmatrix} 1 & 1 \\ 3 & -2 \end{bmatrix} = (1 \times -2) - (1 \times 3) = -2 - 3 = -5$$

Hence, Option C is correct.

Q. 1 E Choose correct alternative for each of the following question

ax + by = c and mx + ny = d and an ≠ bm then these simultaneous equations have –

A. Only one common solution.
B. No solution.
C. Infinite number of solutions.
D. Only two solutions.

Answer : Given: ax + by = c and mx + ny = d

Then, $\frac{a}{m} \neq \frac{b}{n}, \ as \ an \ \neq \ bm$

Now, we know that when the ratio of coefficients is not equal.Equations will have unique solution.
Hence, A is the correct answer.

Q. 2. Complete the following table to draw the graph of 2x – 6y = 3

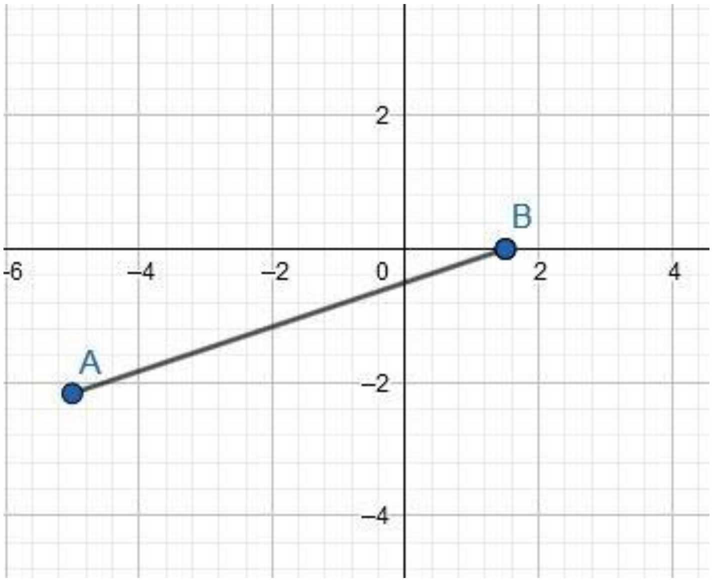
X	-5	$\square$
Y	$\square$	0
(x, y)	$\square$	$\square$

Answer :

Put x= –5, then $2 \times -5 - 6y = 3 \Rightarrow 3 + 10 = -6y \Rightarrow y = -\frac{13}{6}$

Put y = 0, then $2x - 0 = 3 \Rightarrow x = \frac{3}{2}$

X	-5	$\frac{3}{2}$
Y	$-\frac{13}{6}$	0
(x, y)	$\left(-5, -\frac{13}{6}\right)$	$\left(\frac{3}{2}, 0\right)$



Where A=(-5,-13/6) and B=(3/2,0)

Q. 3 A. Solve the following simultaneous equation graphically.

2x + 3y = 12; x – y = 1

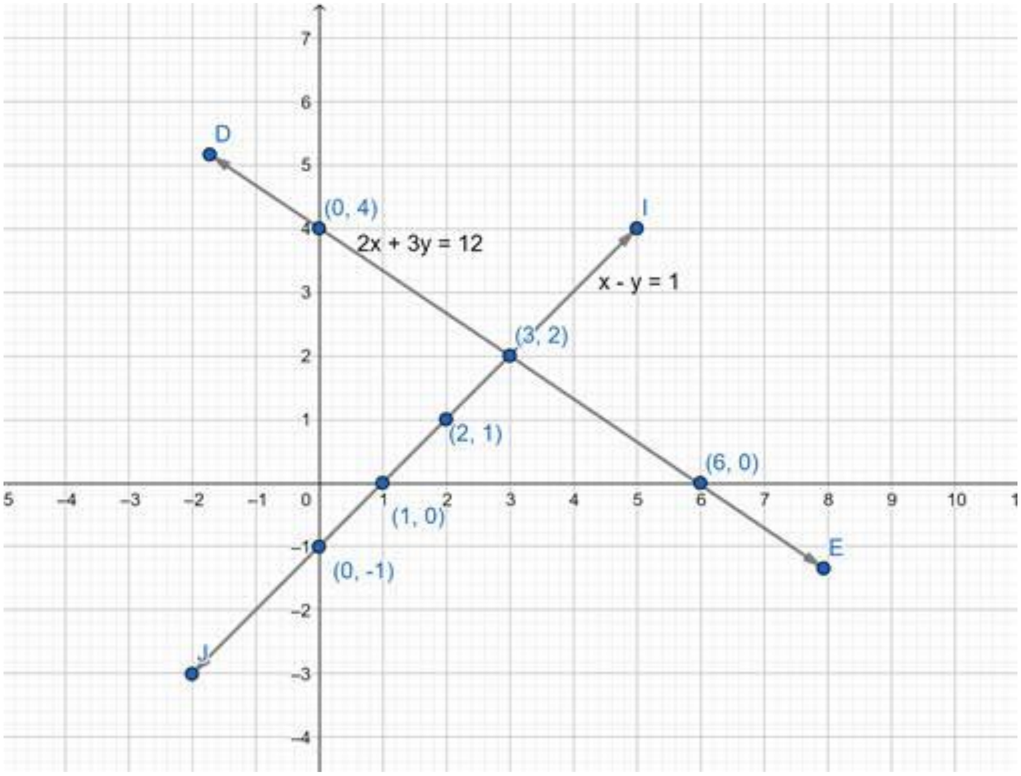
Answer :

$2x + 3y = 12$

X	0	6	3
y	4	0	2

$x - y = 1$

X	1	0	2
Y	0	-1	1



Q. 3 B. Solve the following simultaneous equation graphically.

x – 3y = 1; 3x – 2y + 4 = 0

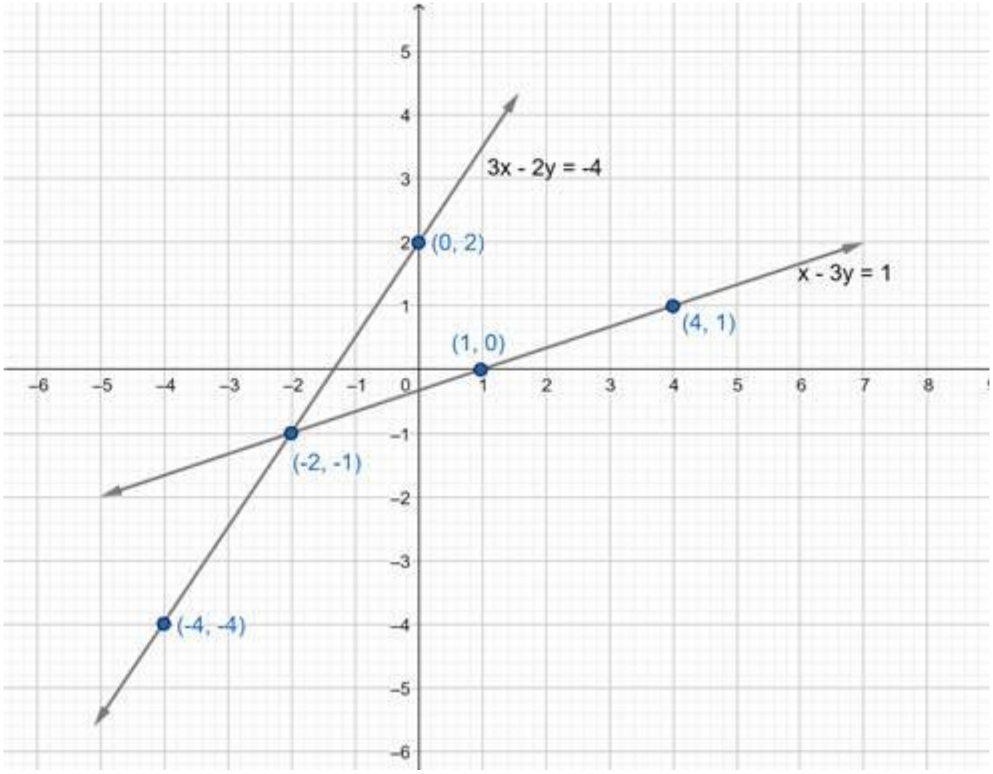
Answer :

$x - 3y = 1$

X	-2	4	1
y	-1	1	0

$3x - 2y + 4 = 0$

X	0	-2	-4
y	2	-1	-4



Q. 3 C. Solve the following simultaneous equation graphically.

5x – 6y + 30 = 0; 5x + 4y – 20 = 0

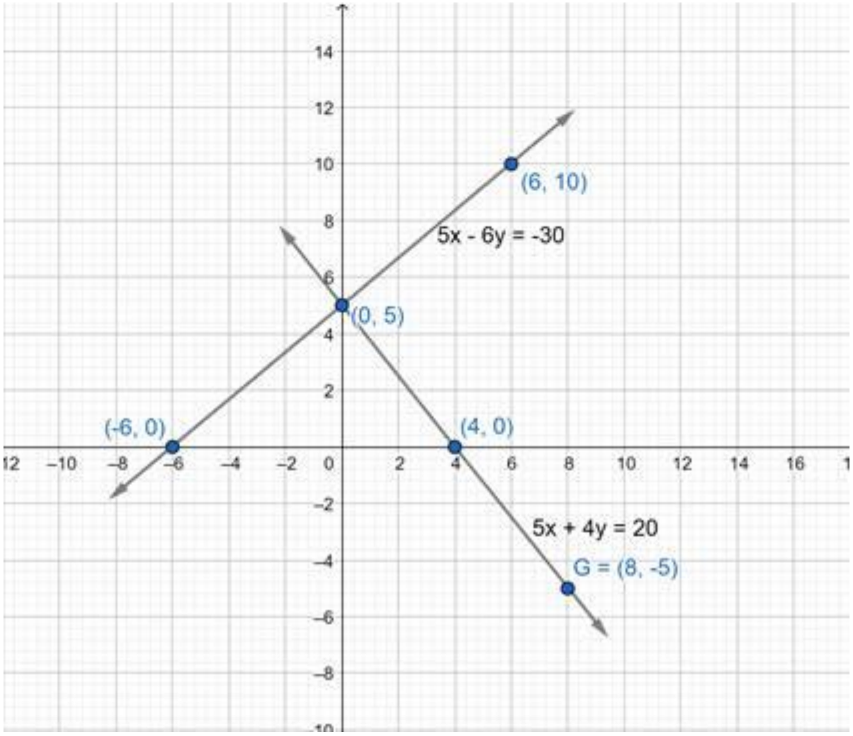
Answer :

$5x - 6y + 30 = 0$

x	0	-6	6
y	5	0	10

$5x + 4y - 20 = 0$

x	0	4	8
y	5	0	-5



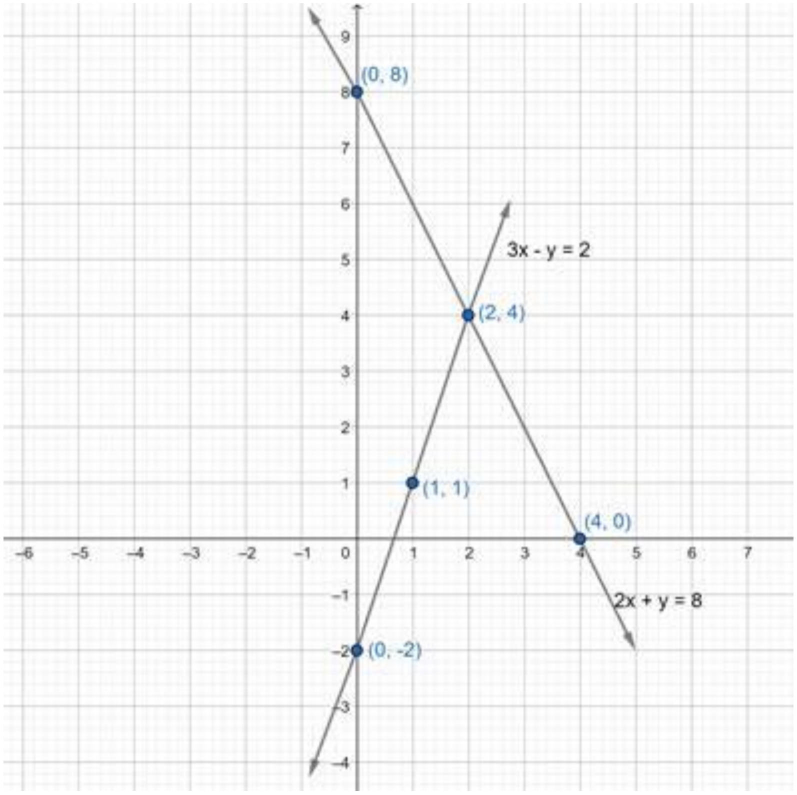
Q. 3 D. Solve the following simultaneous equation graphically.

3x – y – 2 = 0; 2x + y = 8

Answer :

For equation 1, let's find the points for graph

3x - y - 2 = 0At x = 03(0) - y - 2 = 0⇒ y = -2At x = 13(1) - y - 2 = 0⇒ y = 1At x = 23(2) - y - 2 = 0⇒ 6 - y - 2 = 0⇒ y =4Hence, points for graph are (0, -1) (1, 1) and (2, 4)For equation 22x+ y = 8at x = 0y =8at x = 12(1) + y = 8⇒ y = 6at x =42(4) + y = 8⇒ y = 0Hence, points for graph are (0, 8) (1, 6) and (4, 0)



From graph, we observe both lines intersect at (2, 4)hence, x =2 y = 4 is the solution of given pair

Q. 3 E. Solve the following simultaneous equation graphically.

3x + y = 10; x – y = 2

Answer : 3x+y=10

x	1	2	3
y	7	4	1
(x,y)	(1,7)	(2,4)	(3,1)

x-y=2

x	0	2	3
y	-2	0	1
(x,y)	(0,-2)	(2,0)	(3,1)

Solving Both equations

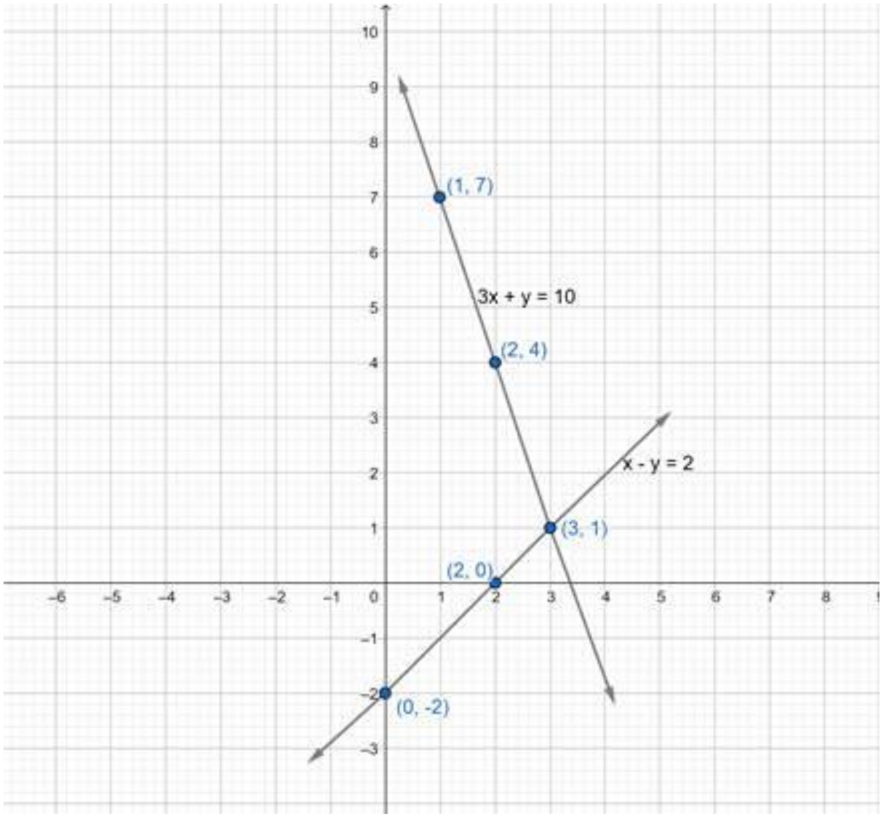
$3x + y = 10$

$x - y = 2$

$\Rightarrow 4x = 12$

$\Rightarrow x = 3$

$\therefore \ y = 1$



Q. 4. Find the values of each of the following determinants.

(1) $\begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix}$

(2) $\begin{vmatrix} 5 & -2 \\ -3 & 1 \end{vmatrix}$

(3) $\begin{vmatrix} 3 & -1 \\ 1 & 4 \end{vmatrix}$

Answer :

(1) $D = \begin{bmatrix} 4 & 3 \\ 2 & 7 \end{bmatrix} = (4 \times 7) - (3 \times 2) = 28 - 6 = 22$

(2) $D = \begin{bmatrix} 5 & -2 \\ -3 & 1 \end{bmatrix} = (5 \times 1) — 2 \times -3 = 5 - 6 = -1$

(3) $D = \begin{bmatrix} 3 & -1 \\ 1 & 4 \end{bmatrix} = (3 \times 4) - (-1 \times 1) = 12 + 1 = 13$

Q. 5 A. Solve the following equations by Cramer's method.

6x – 3y = –10; 3x + 5y – 8 = 0

Answer :

$6x - 3y = -10$

$3x + 5y = 8$

$D = \begin{bmatrix} 6 & -3 \\ 3 & 5 \end{bmatrix} = (6 \times 5) - (-3 \times 3) = 30 + 9 = 39$

$D_x = \begin{bmatrix} -10 & -3 \\ 8 & 5 \end{bmatrix} = (-10 \times 5) — 3 \times 8 = -50 + 24 = -26$

$D_y = \begin{bmatrix} 6 & -10 \\ 3 & 8 \end{bmatrix} = (6 \times 8) - (-10 \times 3) = 48 + 30 = 78$

$x = \frac{D_x}{D} = \frac{-26}{39} = \frac{-2}{3}\ y = \frac{D_y}{D} = \frac{78}{39} = 2$

$\therefore (x , y) = (-\frac{2}{3}, 2)$

Q. 5 B. Solve the following equations by Cramer's method.

4m – 2n = –4; 4m + 3n = 16

Answer :

$$D = \begin{bmatrix} 4 & -2 \\ 4 & 3 \end{bmatrix} = (4 \times 3) - (-2 \times 4) = 12 + 8 = 20$$

$$D_x = \begin{bmatrix} -4 & -2 \\ 16 & 3 \end{bmatrix} = (-4 \times 3) - (-2 \times 16) = -12 + 32 = 20$$

$$D_y = \begin{bmatrix} 4 & -4 \\ 4 & 16 \end{bmatrix} = (4 \times 16) - (-4 \times 4) = 64 + 16 = 80$$

$$x = \frac{D_x}{D} = \frac{20}{20} = 1 \; y = \frac{D_y}{D} = \frac{80}{20} = 4$$

∴ (x , y) = (1, 4)

Q. 5 C. Solve the following equations by Cramer's method.

$$3x - 2y = \frac{5}{2}; \frac{1}{3}x + 3y = -\frac{4}{3}$$

Answer :

$$3x - 2y = \frac{5}{2} \Rightarrow 6x - 4y = 5$$

$$\frac{1}{3}x + 3y = -\frac{4}{3} \Rightarrow \frac{x + 9y}{3} = -\frac{4}{3} \Rightarrow x + 9y = -4$$

$$D = \begin{bmatrix} 6 & -4 \\ 1 & 9 \end{bmatrix} = (6 \times 9) - (-4 \times 1) = 54 + 4 = 58$$

$$D_x = \begin{bmatrix} 5 & -4 \\ -4 & 9 \end{bmatrix} = (5 \times 9) - (-4 \times -4) = 45 - 16 = 29$$

$$D_y = \begin{bmatrix} 6 & 5 \\ 1 & -4 \end{bmatrix} = (6 \times -4) - (5 \times 1) = -24 - 5 = -29$$

$$x = \frac{D_x}{D} = \frac{1}{2}, \; y = \frac{D_y}{D} = \frac{(-29)}{58} = \frac{(-1)}{2}$$

∴ (x , y) = (1/2, -1/2)

Q. 5 D. Solve the following equations by Cramer's method.

7x + 3y = 15; 12y – 5x = 39

Answer :

$D = \begin{bmatrix} 7 & 3 \\ -5 & 12 \end{bmatrix} = (7 \times 12) - (3 \times -5) = 84 + 15 = 99$

$D_x = \begin{bmatrix} 15 & 3 \\ 39 & 12 \end{bmatrix} = (15 \times 12) - (3 \times 39) = 180 - 117 = 63$

$D_y = \begin{bmatrix} 7 & 15 \\ -5 & 39 \end{bmatrix} = (7 \times 39) - (15 \times -5) = 273 + 75 = 348$

$x = \frac{D_x}{D} = \frac{63}{99} = \frac{7}{11}$ $y = \frac{D_y}{D} = \frac{348}{99} = \frac{116}{33}$

$\therefore (x, y) = \left(\frac{7}{11}, \frac{116}{33}\right)$

Q. 5 E. Solve the following equations by Cramer's method.

$$\frac{x+y-8}{2} = \frac{x+2y-14}{3} = \frac{3x-y}{4}$$

Answer : Let,

$\frac{x+y-8}{2} = \frac{x+2y-14}{3}$

⇒ $3x + 3y - 24 = 2x + 4y - 28$

⇒ $x - y = -4$ …(1)

Also,

Let

$\frac{x+2y-14}{3} = \frac{3x-y}{4}$

⇒ $4x + 8y - 56 = 9x - 3y$

⇒ $5x - 11y = -56$ …(2)

Hence the two equations are:

$x - y = -4$ …(1)

5x – 11y = – 56 …(2)

Now,

$$D = \begin{vmatrix} 1 & -1 \\ 5 & -11 \end{vmatrix}$$

⇒ D = (–11 -(- 5)) = -6

Also,

$$D_x = \begin{vmatrix} -4 & -1 \\ -56 & -11 \end{vmatrix}$$

D_x = 44 - 56 = -12

And,

$$D_y = \begin{vmatrix} 1 & -4 \\ 5 & -56 \end{vmatrix}$$

⇒ D_y = –56 + 20 = – 36

Now, $x = \frac{D_x}{D} = \frac{-12}{-6} = 2$

And, $y = \frac{D_y}{D} = \frac{-36}{-6} = 6$

Hence, (2, 6) is the solution

Q. 6 A. Solve the following simultaneous equations.

$$\frac{2}{x} + \frac{2}{3y} = \frac{1}{6}\ ;\ \frac{3}{x} + \frac{2}{y} = 0$$

Answer :

Let $\frac{1}{x} = m$ and $\frac{1}{y} = n$

$$2m + \frac{2}{3}n = \frac{1}{6} \Rightarrow 12m + \frac{12}{3n} = 1 \Rightarrow 12m + 4n = 1 \;...(I)$$

$$3m + 2n = 0 \;...(II)$$

Multiply Eq. II by 2

$$6n + 4n = 0 \;...(III)$$

Subtract Eq.III from Eq. I

$$12m + 4n = 1$$

$$\underline{-6m - 4n = 0}$$

$$6m = 1$$

$$m = \frac{1}{6}$$

Substitute m=1/6 in Eq. I

$$12 \times \frac{1}{6} + 4n = 1$$

$$2 + 4n = 1$$

$$4n = 1 - 2$$

$$4n = -1$$

$$n = -\frac{1}{4}$$

$$\therefore m = \frac{1}{x} \Rightarrow \frac{1}{6} = \frac{1}{x} \Rightarrow x = 6$$

$$\therefore n = \frac{1}{y} \Rightarrow -\frac{1}{4} = \frac{1}{y} \Rightarrow y = -4$$

Hence, $(x, y) = (6, -4)$

Q. 6 B. Solve the following simultaneous equations.

$$\frac{7}{2x+1}+\frac{13}{y+2}=27;\frac{13}{2x+1}+\frac{7}{y+2}=33$$

Answer :

Let $\frac{1}{2x+1}=m$ and $\frac{1}{y+2}=n$

$7m+13n=27\ \ldots(I)$

$13m+7n=33\ \ldots(II)$

Adding Eq. I and II

$20m+20n=60\ \Rightarrow m+n=3\ldots(III)$

Subtract Eq. I and II

$-6m+6n=-6\ \Rightarrow\ -m+n=-1\ \ldots(IV)$

Equating Eq. III and IV

$m+n=3$

$\underline{-m+n=-1}$

$2n=2$

$n=1$

Substituting n=1 in Eq. III

$m+1=3$

$m=3-1$

$m=2$

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

$\Rightarrow 4x = -1 \Rightarrow x = -\frac{1}{4}$

$\therefore \frac{1}{y+2} = n \Rightarrow \frac{1}{y+2} = 1 \Rightarrow y + 2 = 1 \Rightarrow y = 1 - 2 \Rightarrow y = -1$

Hence, $(x, y) = \left(-\frac{1}{4}, -1\right)$

Q. 6 C. Solve the following simultaneous equations.

$$\frac{148}{x} + \frac{231}{y} = \frac{527}{xy} ; \frac{231}{x} + \frac{148}{y} = \frac{610}{xy}$$

Answer :

$$\frac{148}{x} + \frac{231}{y} = \frac{527}{xy} \Rightarrow \frac{148y + 231x}{xy} = \frac{527}{xy} \Rightarrow 231x + 148y = 527 \ldots (I)$$

$$\frac{231}{x} + \frac{148}{y} = \frac{610}{xy} \Rightarrow \frac{231y + 148x}{xy} = \frac{610}{xy} \Rightarrow 148x + 231y = 610 \ldots (II)$$

Adding Eq. I and II

$379x + 379y = 1137$

$x + y = 3$ …(III)

Subtracting Eq. I and II

$83x - 83y = -83$

$x - y = -1$ …(IV)

Equating I and II

$x + y = 3$

$x - y = -1$

$2x = 2$

$x = \frac{2}{2}$

$x = 1$

Substituting x=1 in Eq. I

$1 + y = 3$

$y = 3 - 1$

$y = 2$

Hence,

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

Q. 6 D. Solve the following simultaneous equations.

$$\frac{7x - 2y}{xy} = 5 \; ; \; \frac{8x + 7y}{xy} = 15$$

Answer :

$$\frac{7x - 2y}{xy} = 5 \Rightarrow \frac{7x}{xy} - \frac{2y}{xy} = 5 \Rightarrow \frac{7}{y} - \frac{2}{x} = 5 \; \dots (\mathrm{I})$$

$$\frac{8x + 7y}{xy} = 15 \Rightarrow \frac{8x}{xy} + \frac{7y}{xy} = 15 \Rightarrow \frac{8}{y} + \frac{7}{x} = 15 \; \dots (\mathrm{II})$$

Let $\frac{1}{x} = m$ and $\frac{1}{y} = n$

$7n - 2m = 5 \; \dots (\mathrm{III})$

$8n + 7m = 15 \; \dots (\mathrm{IV})$

Multiply Eq. 1 by 7 and Eq.II by 2

$49n - 14m = 35 \ldots (V)$ $16n + 14m = 30 \ldots (VI)$

$65n = 65$

$n = \frac{65}{65}$

$n = 1$

Substituting value in Eq.VI

$16 \times 1 + 14m = 30$

$14m = 30 - 16$

$14m = 14$

$m = \frac{14}{14}$

$m = 1$

$\therefore \frac{1}{x} = m \Rightarrow \frac{1}{x} = 1 \Rightarrow x = 1$

$\therefore \frac{1}{y} = n \Rightarrow \frac{1}{y} = 1 \Rightarrow y = 1$

Hence, $(x,y) = (1,1)$

Q. 6 E. Solve the following simultaneous equations.

$$\frac{1}{2(3x+4y)} + \frac{1}{5(2x-3y)} = \frac{1}{4};\ \frac{5}{(3x+4y)} - \frac{2}{(2x-3y)} = -\frac{3}{2}$$

Answer :

Let $\frac{1}{3x+4y} = m$ and $\frac{1}{2x-3y} = n$

$\frac{1}{2}m + \frac{1}{5}n = \frac{1}{4} \Rightarrow 5m + 2n = \frac{10}{4} \Rightarrow 20m + 8n = 10 \Rightarrow 10m + 4n = 5$ ...(I)

$5m - 2n = -\frac{3}{2} \Rightarrow 10m - 4n = -3$ ... (II)

Equating Eq. I and II

$10m + 4n = 5$

$10m - 4n = -3$

$20m = 2$

$$m = \frac{2}{20}$$

$$m = \frac{1}{10}$$

Substituting $m = \frac{1}{10}$ in Eq. I

$$10 \times \frac{1}{10} + 4n = 5$$

$1 + 4n = 5$

$4n = 5 - 1$

$4n = 4$

$$n = \frac{4}{4}$$

$n = 1$

$$\therefore \frac{1}{3x+4y} = m \Rightarrow \frac{1}{3x+4y} = \frac{1}{10} \Rightarrow 3x + 4y = 10 \ \ldots (III)$$

$$\therefore \frac{1}{2x-3y} = n \Rightarrow \frac{1}{2x-3y} = 1 \Rightarrow 2x - 3y = 1 \ \ldots (IV)$$

Multiply Eq. III by 3 and Eq. IV by 4 and Equate

$$9x + 12y = 30 \ \ldots (V)$$

$$8x - 12y = 4 \ \ldots (VI)$$

$$17x = 34$$

$$x = \frac{34}{17}$$

$$x = 2$$

Substituting x=2 in Eq. V

$$9 \times 2 + 12y = 30$$

$$18 + 12y = 30$$

$$12y = 30 - 18$$

$$12y = 12$$

$$y = \frac{12}{12}$$

$$y = 1$$

Hence,

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

Q. 7 A. Solve the following word problems.

A two digit number and the number with digits interchanged add up to 143. In the

given number the digit in unit's place is 3 more than the digit in the ten's place. Find the original number.

Let the digit in unit's place is x
and that in the ten's place is y

$\therefore$ the number $= \boxed{}\, y + x$

The number obtained by interchanging the digits is

$\boxed{}\, x + y$

According to first condition two digit number + the number obtained by interchanging the digits = 143

$$\therefore \boxed{10y + x} + \boxed{} = 143$$

$$\therefore \boxed{}\, x + \boxed{}\, y = 143$$

$$x + y = \boxed{} \ldots\ldots (I)$$

From the second condition,

digit in unit's place = digit in the ten's place + 3

$$\therefore x = \boxed{} + 3$$

$$\therefore x - y = 3 \ldots\ldots (II)$$

Adding equations (I) and (II)

$$2x = \boxed{}$$

$$\boxed{x = 8}$$

Putting this value of x in equation (I)

x + y = 13

$$8 + \boxed{} = 13$$

$$\therefore \ y = \boxed{}$$

The original number is 10

$$= \boxed{} + 8$$

$$= 58$$

Answer :

Let the digit in unit's place is x

and that in the ten's place is y

∴ the number = 10y+ x

The number obtained by interchanging the digits is $10x + y$

According to first condition two digit number + the number obtained by interchanging the digits = 143

$$\therefore 10y + x + 10x + y = 143$$

$$\therefore 11x + 11y = 143$$

$$\therefore x + y = 13 \ \ldots\ldots (I)$$

From the second condition,

digit in unit's place = digit in the ten's place + 3

$$\therefore x = y + 3$$

$$\therefore x - y = 3 \ \ldots.. (II)$$

Adding equations (I) and (II)

$2x = 16$

$x = 8$

Putting this value of x in equation (I)

x + y = 13

$8 + y = 13$

$\therefore y = 5$

The original number is 10

⇒ 50+8

⇒ 58

Q. 7 B. Kantabai bought $1\frac{1}{2}$ kg tea and 5 kg sugar from a shop. She paid Rs 50 as return fare for rickshaw. Total expense was Rs 700. Then she realised that by ordering online the goods can be bought with free home delivery at the same price. So next month she placed the order online for 2 kg tea and 7 kg sugar. She paid Rs 880 for that. Find the rate of sugar and tea per kg.

Answer :

Let x be the cost of tea and y be the cost of sugar

As she paid ₹50 as return fare

$₹700 - ₹50 = ₹650$

$\therefore \frac{3}{2}x + 5y = 650 \Rightarrow 3x + 10y = 1300 \; \ldots..(I)$

According to second situation,

$2x + 7y = 880 \; \ldots..(II)$

Multiplying Eq. I by 2 and Eq. II by 3

$6x + 20y = 2600$ …..(III)

$6x + 21y = 2640 \; \ldots (IV)$

Subtracting Eq. III from IV

$$6x + 21y = 2640$$

$$-6x - 20y = -2600$$

$$y = 40$$

Substituting y=40 in Eq. I

$$3x + 10 \times 40 = 1300$$

$$3x + 400 = 1300$$

$$3x = 1300 - 400$$

3x=900

$$x = \frac{900}{3}$$

$$x = 300$$

Tea; ₹ 300 per kg.

Sugar ; ₹ 40 per kg.

Q. 7 C. To find number of notes that Anushka had, complete the following activity

Suppose that Anushka had $\boxed{x}$ notes of ₹ 10 and $\boxed{y}$ notes of ₹ 50 each

Anushka got ₹ 2500/– from Anand as denominations mentioned above
∴ .... equation I

If Anand would have given her the amount by interchanging number of notes, Anushka would have received ₹ 500 less than the previous amount
∴ .... equation II

∴ The No. of notes ($\boxed{}$, $\boxed{}$)

Answer : According to 1st situation ,

$$100x + 50y = 2500 \;\ldots\ldots(\mathrm{I})$$

According to 2nd situation,

$50x + 100y = 2000\ldots..(II)$

Adding I and II,

$150x + 150y = 4500$

$x + y = 30$ …III

Subtracting I from II

$50x - 50y = -500$

$x - y = -10$ ….IV

Equating Eq. III with Eq. IV

$x + y = 30$

$x - y = -10$

$2x = 20$

$x = \frac{20}{2} = 10$

Substituting x=10 in Eq. III

$10 + y = 30$

$y = 20$

₹100 notes = 10

₹50 notes = 20

Q. 7 D. Sum of the present ages of Manish and Savita is 31. Manish's age 3 years ago was 4 times the age of Savita. Find their present ages.

Answer :

Let Manish's present age be x

Let Savita's present age be y

According to 1st situation,

$x + y = 31 \ \ldots..(I)$

According to second situation,

$x - 3 = 4(y - 3)$

$x - 3 = 4y - 12$

$x - 4y = -12 + 3$

$x - 4y = \ -9 \ldots.II$

Subtracting Eq. II from I

$x + y = 31$

$-x + 4y = 9$

$5y = 40$

$y = \dfrac{40}{5}$

$y = 8$

Substitute y=8 in eq. I

$x + 8 = 31$

$x = 31 - 8$

$x = 23$

Manisha's age 23 years

Savita's age 8 years.

Q. 7 E. In a factory the ratio of salary of skilled and unskilled workers is 5 : 3. Total salary of one day of both of them is ₹ 720. Find daily wages of skilled and unskilled workers.

Answer : Ratio of skilled and unskilled worker's salary = 5:3

Let it be 5x and 3x

Total of one day's salary = ₹720

So, $5x + 3x = 720$

$8x = 720$

$x = \frac{720}{8}$

$x = 90$

Skilled worker's wages = $5x = 5 \times 90$ = ₹450.

unskilled worker's wages $3x = 3 \times 90$ = ₹270

Q. 7 F. Places A and B are 30 km apart and they are on a straight road. Hamid travels from A to B on bike. At the same time Joseph starts from B on bike, travels towards A. They meet each other after 20 minutes. If Joseph would have started from B at the same time but in the opposite direction (instead of towards A) Hamid would have caught him after 3 hours. Find the speed of Hamid and Joseph.

Answer :

Let the speed of Joseph = x km/h

Let the speed of Hamid be = y km/h

When approaching each other, combined speed =

$(x + y)\text{km/h}$

Time taken to meet =

$\frac{30}{x+y} = \frac{1}{3}(20\text{mins})$

$\therefore x + y = 90 \;\; \ldots \mathrm{I}$

When moving away from each other, combined speed =

$(x-y) km/h$

Time taken for Hamid to catch up =

$\frac{30}{x-y} = 3$

$\therefore x-y = 10 \ldots II$

Equating I and II,

$x+y = 90$

$x-y = 10$

$2x = 100$

$x = \frac{100}{2} = 50$

Substituting x=50in eq. I

$50+y = 90$

$y = 90-50$

$y = 40$

Hamid's speed 50 km/hr.

Joseph's speed 40 km/hr.