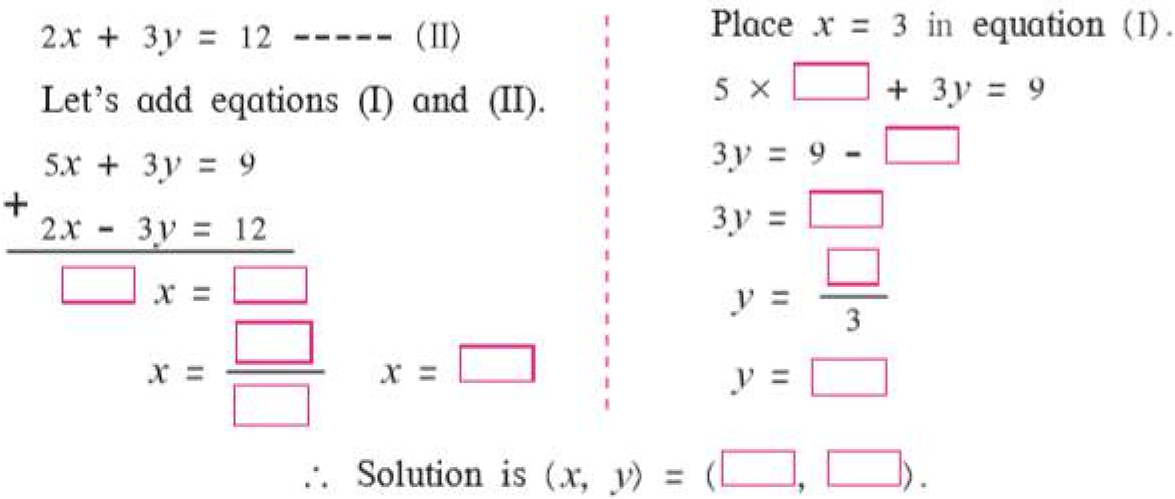
PRACTICE SET 1.1 PAGE NO: 4

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



Solution:
Given
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 = -1
Putting 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.

2. Solve the following simultaneous equation.
(1) 3a + 5b = 26; a + 5b = 22

Solution:
3a + 5b = 26 …… (i)
a + 5b = 22 ……... (ii)
Now by changing the sign of equation (ii) we get
- a – 5b = - 22

Subtracting equation (ii) from (i) we get
2a = 4
a = 4/2
a = 2
Substituting a = 2 in equation (ii) we get
2 + 5b = 22
5b = 22 – 2
5b = 20
b = 20/5
b = 4
∴ solution is (a, b) = (2, 4)

(2) x + 7y = 10; 3x – 2y = 7

Solution:
Given
x + 7y = 10 ……. (i)
x – 2y = 7 ……… (ii)
Multiply equation (i) by 2 and equation (ii) by 7
2x + 14 y = 20
21x – 14 y = 49
Which implies
23 x = 69
x = 69/23
x = 3
Substituting x = 3 in equation (i)
3 + 7y = 10
7y = 10 – 3
7y = 7
y = 7/7
y = 1
∴ Solution is (x, y) = (3, 1)

(3) 2x – 3y = 9; 2x + y = 13

Solution:
Given

2x – 3y = 9 …… (i)
2x + y = 13 …… (ii)
To subtract equation (ii) from (i)
Change the sign of equation (ii)
2x – 3y = 9
-2x – y = - 13
Which implies
- 4y = - 4
y = 4/4
y = 1
Substituting y = 1 in equation (ii)
2x + 1 = 13
2x = 13 - 12x = 12x = 6
∴ solution is (x, y) = (1, 6)

(4) 5m – 3n = 19; m – 6n = –7

Solution:
Given
5m – 3n = 19 …… (i)
m – 6n = –7 …. (ii)
Multiply equation (ii) by 5
5m – 30n = -35 …. (iii)
Equating (i) and (iii), change the sign of equation (iii)
5m – 3n = 19
- 5m + 30 n = 35
Adding both we get
27n = 54
n = 54/27
⇒ n = 2
Substituting n = 2 in equation (i)
⇒ 5m - 3(2) = 19
⇒ 5m - 6 = 19
⇒ 5m = 25
⇒ m = 5
∴ Solution is (m, n) = (5, 2)

(5) 5x + 2y = –3; x + 5y = 4

Solution:
5x + 2y = - 3 …. (i)
x + 5y = 4 …… (ii)
Multiply equation (i) by 5 and equation (ii) by 2
25 x + 10 y = -15 …. (iii)
2x + 10 y = 8 …. (iv)
Change sign of equation (iv)
25 x + 10 y = -15
- 2x - 10 y = - 8
23 x = -23
x = -1
Substituting x = –1 in equation (ii)
- 1 + 5y = 4
5y = 4 + 1
5y = 5
Y = 1
∴ solution is (x, y) = (–1, 1)

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

Solution:
Given equations can be written as
$\frac{1}{3}x + y = \frac{10}{3}$
$\Rightarrow \frac{x+3y}{3} = \frac{10}{3}$
$\Rightarrow x + 3y = 10 \ \ldots(I)$
Again consider
$2x + \frac{1}{4}y = \frac{11}{4}$
$\Rightarrow \frac{8x+y}{4} = \frac{11}{4}$
$\Rightarrow 8x + y = 11 \ldots(II)$
Multiplying Eq. II by 3
$24x + 3y = 33 \ldots(III)$

Equating equation I and III, change the signs of equation III

$x + 3y = 10$

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

$-23x = -23$

$x = 1$

Substituting x = 1 in equation I

$1 + 3y = 10$

$3y = 10 - 1$

$3y = 9$

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

$y = 3$

∴ solution is (x, y) = (1, 3)

(7) 99x + 101 y = 499; 101x + 99y = 501

Solution:

Given

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

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

Adding both the Equations

$99x + 101y = 499$

$\underline{101x + 99y = 501}$

$200x + 200y = 1000$

Dividing both sides by 200

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

Subtract equation (I) and (II)

$99x + 101y = 499$

$\underline{-101x - 99y = -501}$

$-2x + 2y = -2$

Divide both sides by (–2)

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

Equating Eq. (III) and (IV)

$x + y = 5$

$$\underline{x - y = 1}$$
$$2x = 6$$
$$x = \frac{6}{2}$$
$$x = 3$$

Substituting x=3 in Eq. III

$$3 + y = 5$$
$$y = 5 - 3$$
$$y = 2$$

∴ solution is (x, y) = (3, 2)

(8) 49x – 57y = 172; 57x – 49y = 252

Solution:

Given

$$49x - 57y = 172 \text{ ... (I)}$$
$$57x - 49y = 252 \text{ ... (II)}$$

Adding both the Equations

$$49x - 57y = 172$$
$$\underline{57x - 49y = 252}$$
$$106x - 106y = 424$$

Dividing both sides by 106

$$x - y = 4 \text{...(III)}$$

Subtract equation (I) and (II)

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

Divide both sides by (–8)

$$x + y = 10 \text{...(IV)}$$

Equating Eq. (III) and (IV)

$$x - y = 4$$
$$\underline{x + y = 10}$$
$$2x = 14$$
$$x = \frac{14}{2}$$

$x = 7$

Substituting x=7 in Eq. IV

$7 + y = 10$

$y = 10 - 7$

$y = 3$

∴ solution is (x, y) = (7,3)

PRACTICE SET 1.2

1. Complete the following table to draw graph of the equations
(I) x + y = 3
(II) x – y = 4

$x + y = 3$

x	3	☐	☐
y	☐	5	3
(x, y)	(3, 0)	☐	(0, 3)

$x - y = 4$

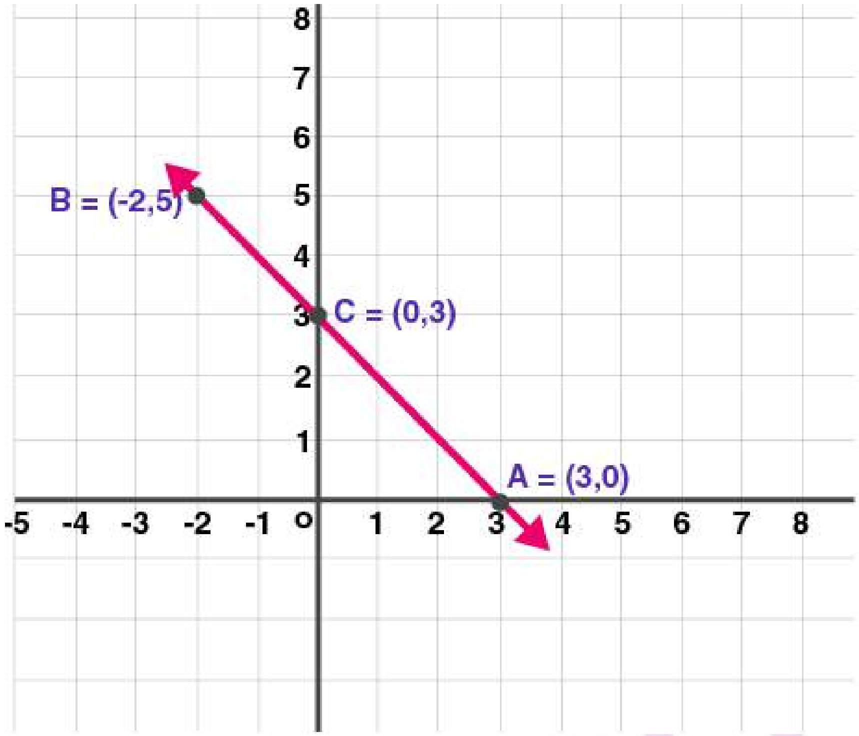
x	☐	-1	0
y	0	☐	-4
(x, y)	☐	☐	(0, -4)

Solution:
(I) Given
x + y = 3 …. (i)
(i) Put value x=3 in equation (i)
We get, y = 3 - 3
⇒ y = 0

ii. Put value y = 5 in equation (i)
We get, x = 3 – 5
⇒ x = -2

iii. Put value y = 3 in equation (i)
We get, x = 3 – 3
⇒ x = 0
Now the table becomes,

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

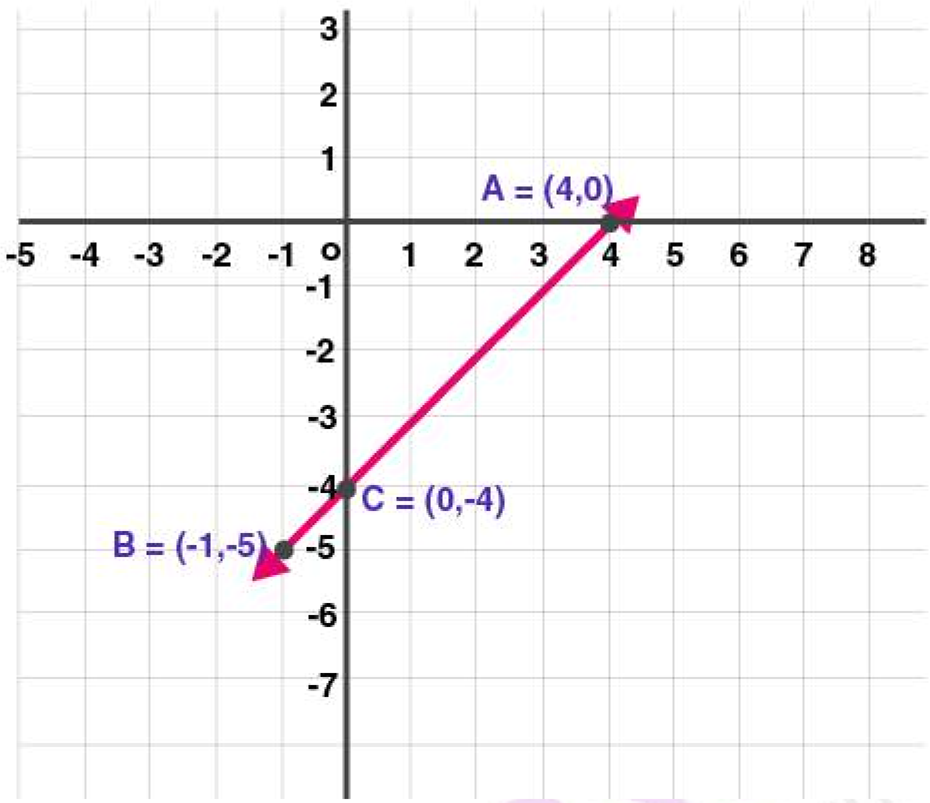


(2) Given
x – y = 4 ……. (ii)
i. Put value y = 0 in equation (ii)
we get, x = 4 – 0
⇒ x = 4

ii. Put value x = –1 in equation (ii)
we get, - y = 5

iii. Put value y = –4 in equation (ii)
we get, x = 4 + 4
⇒ x = 8

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



2. Solve the following simultaneous equations graphically.
(1) x + y = 6; x – y = 4

Solution:
Given x + y = 6 …. (i)

x	0	6	5
y	6	0	1
(x, y)	(0, 6)	(6, 0)	(5, 1)

x – y = 4 …… (ii)

x	0	2	5
y	-4	-2	1
(x, y)	(0, -4)	(2, -2)	(5, 1)

Calculating intersecting point
x + y = 6
x – y = 4
2x = 10

x = 10/2

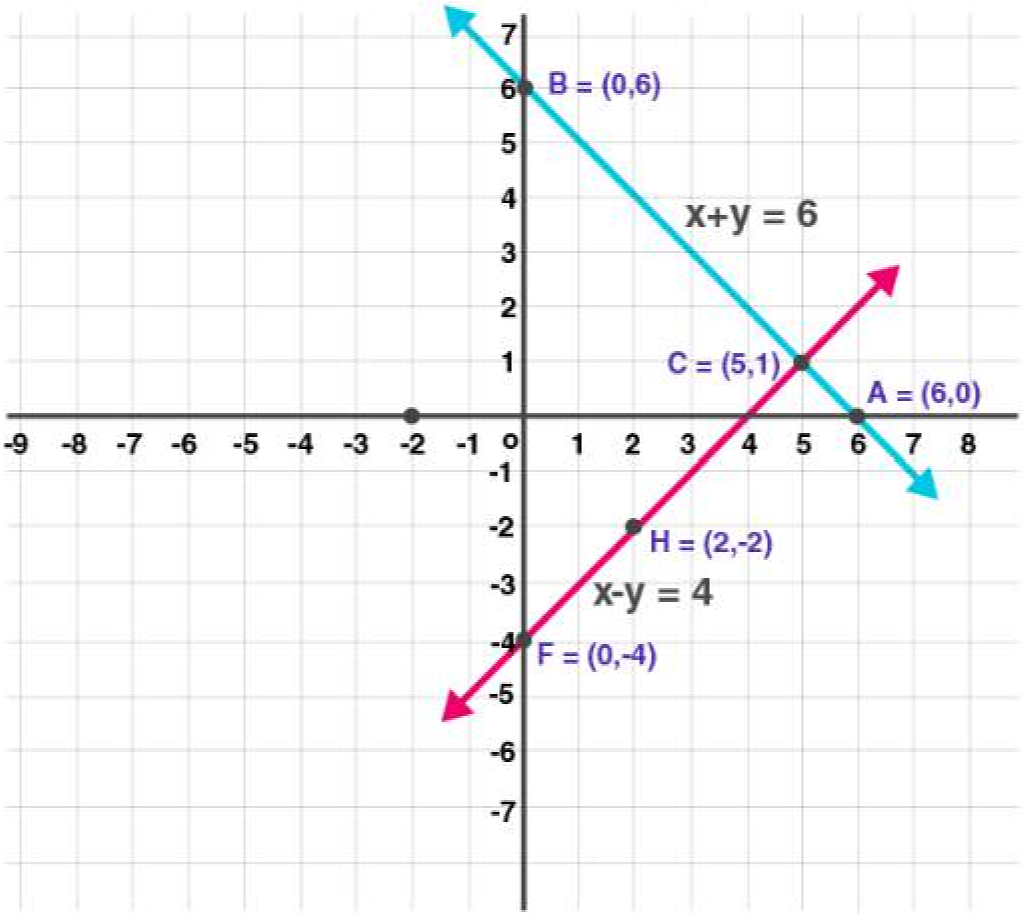
x = 5

Putting x= 5 in equation (i)

5 + y = 6

y = 6 – 5

y = 1



(2) x + y = 5; x – y = 3

Solution:

x + y = 5 …. (i)

x	0	2	4
y	5	3	1
(x, y)	(0, 5)	(2, 3)	(4, 1)

x – y = 3 …… (ii)

x	0	2	4

y	-3	-1	1
(x, y)	(0, -3)	(2, -1)	(4, 1)

Calculating intersecting point

x + y = 5

x – y = 3

which implies

2x = 8

x = 8/2

x = 4

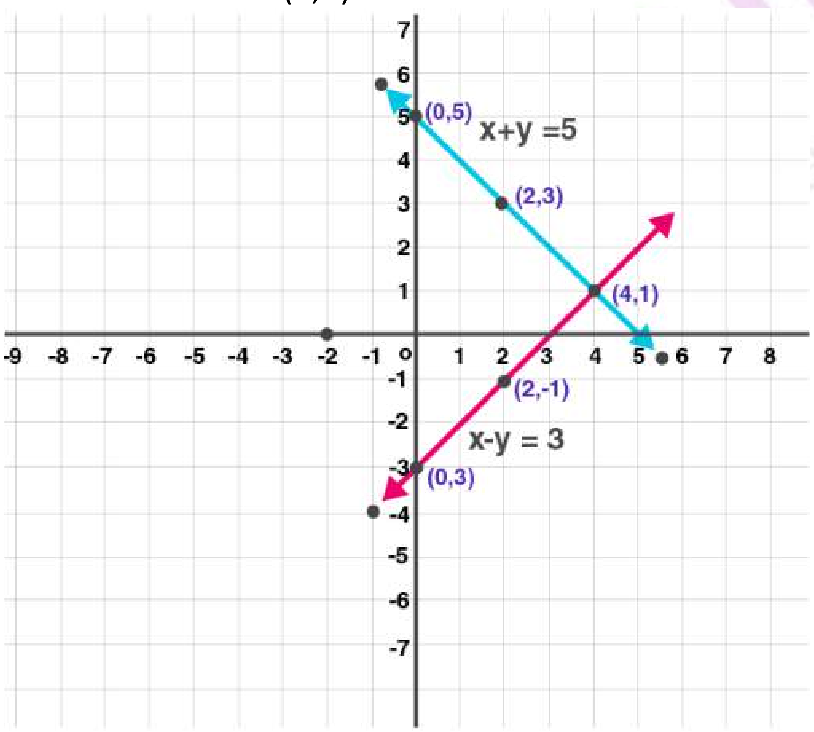
Putting x= 4 in equation (i)

4 + y = 5

y = 5 – 4

y = 1

Intersection Point (4,1)



(3) x + y = 0; 2x – y = 9

Solution:

x + y = 0 …. (i)

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

2x – y = 9 …. (ii)

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 = 9/3

x = 3

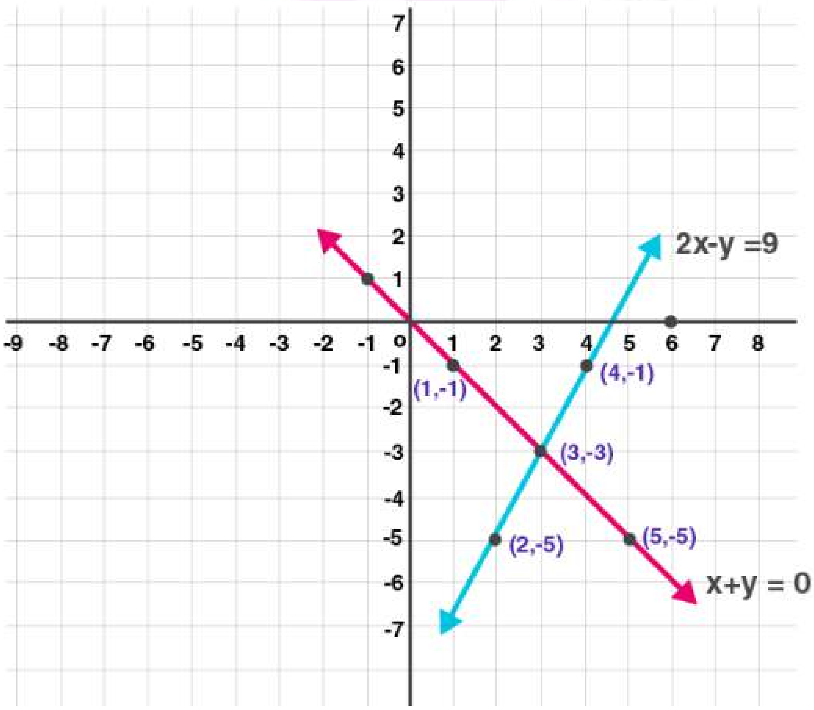
Putting x= 3 in equation (i)

3 + y = 0

y = 0 – 3

y = -3

Intersection point (3, –3)



(4) 3x – y = 2; 2x – y = 3

Solution:

3x – y = 2 …… (i)

x	0	1	-1
Y	-2	1	-5
(x, y)	(0, -2)	(1, 1)	(-1, -5)

2x – y = 3 …… (ii)

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 equation (i)

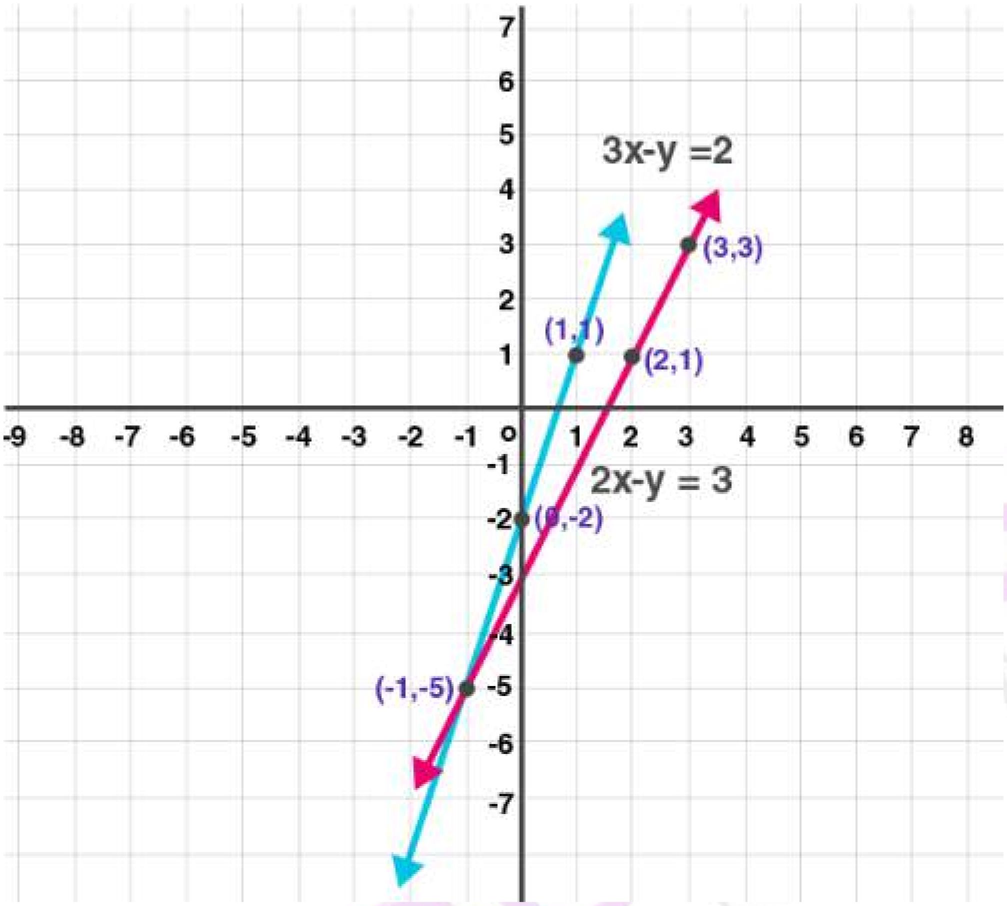
3× –1 – y = 2

- 3 – y = 2

- y = 2 + 3

y = -5

Intersection point (–1, –5)



(5) 3x – 4y = –7; 5x – 2y = 0

Solution:

3x – 4y = 7 …. (i)

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

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

5x – 2y = 0 …... (ii)

When x = 0, y = 0

When x = 1, y = 5/2

Plotting both the graphs we get,

Calculating intersecting point

3x – 4y = -7

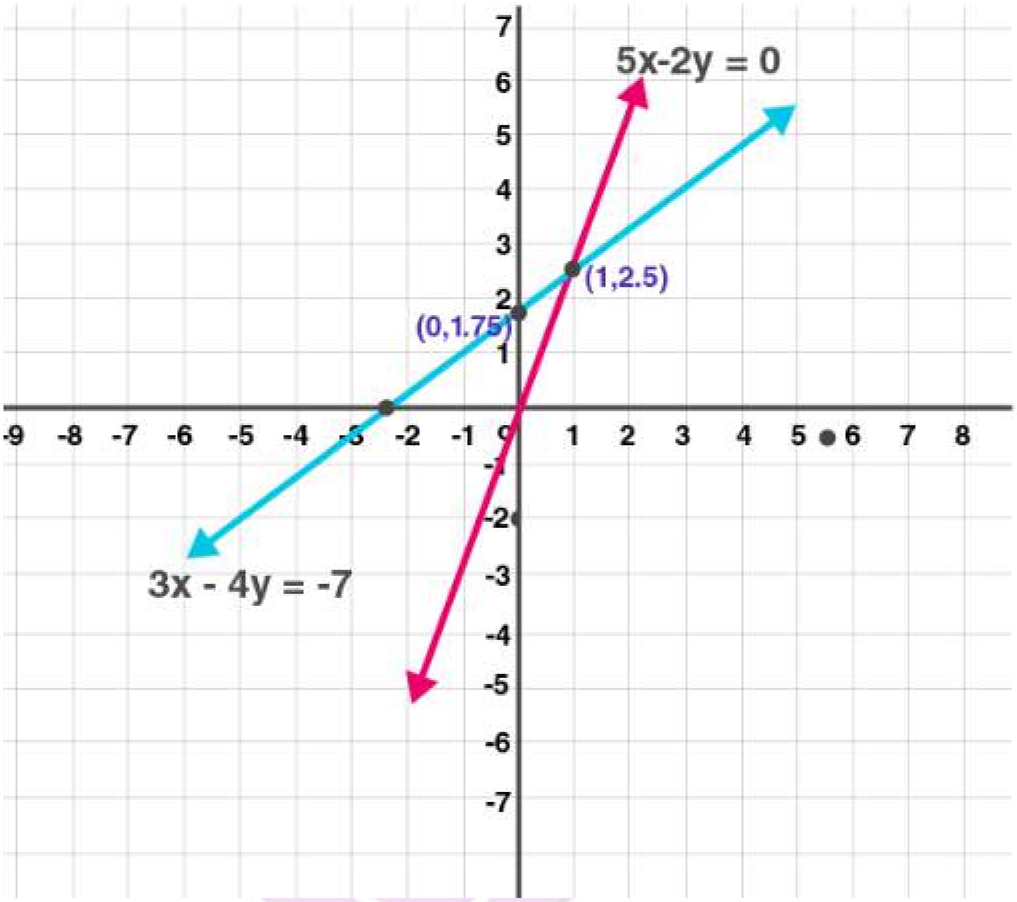
5x – 2y = 0

x = -1

Putting x= –1 in equation (i)

3 × –1 – y = 2

- 3 – y = 2
- y = 2 + 3
y = - 5
Intersection point (–1, –5)



PRACTICE SET 1.3 PAGE NO: 16

1. Fill in the blanks with correct number

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

Solution:

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

2. Find the values of following determinants.

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

Solution:

We know, determinant of a 2 × 2 matrix

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

is (ad - bc) = (1) (−1× 4) – (7 × 2)

= −4 – 14 = −18

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

Solution:

We know, determinant of a 2 × 2 matrix

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

is (ad - bc)

= (5 × 0)– (3 × −7) = 0 – (−21) = 21

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

Solution:

We know, determinant of a 2 × 2 matrix

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

is (ad - bc) =

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

$= -\frac{8}{6}$

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

3. Solve the following simultaneous equations using Cramer's rule.
(1) 3x – 4y = 10; 4x + 3y = 5

Solution:

Given

$3x - 4y = 10$

$4x + 3y = 5$

These equations can be written in determinant

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

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

= 50/25

= 2

$y = \frac{D_y}{D} = -\frac{25}{25} = -1$

∴ (x, y) = (2, –1) is the solution

(2) 4x + 3y – 4 = 0; 6x = 8 – 5y

Solution:

Given

$4x + 3y = 4$

$6x + 5y = 8$

The given equations can be written in determinants

D = $\begin{bmatrix} 4 & 3 \\ 6 & 5 \end{bmatrix}$

$= (4 \times 5) - (3 \times 6)$

= 20 – 18 = 2

consider

$D_x = \begin{bmatrix} 4 & 3 \\ 8 & 5 \end{bmatrix}$

$= (4 \times 5) - (3 \times 8)$

= 20–24 = –4

Again consider

$D_y = \begin{bmatrix} 4 & 4 \\ 6 & 8 \end{bmatrix}$

$= (4 \times 8) - (4 \times 6)$

= 32 – 24 = 8

Now,

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

∴ (x, y) = (–2, 4) is the solution.

(3) x + 2y = –1; 2x – 3y = 12

Solution:

Given

$x + 2y = -1$

$2x - 3y = 12$

The given equations can be written in determinants as

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

= –3 – 4 = –7

Now consider by replacing the solution we get

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

= 3– 24 = –21

Again consider,

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

= 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.

(4) 6x – 4y = –12; 8x – 3y = –2

Solution:

Given

$6x - 4y = -12$

$8x - 3y = -2$

The given equations can be written in determinants as

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

= –18 + 32 = 14

Now consider by replacing the solution according to Cramer's rule we get

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

Again consider

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

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

∴ (x, y) = (2, 6) is solution.

(5) 4m + 6n = 54; 3m + 2n = 28

Solution:

Given

$4m + 6n = 54$

$3m + 2n = 28$

The given equations can be written in determinants as

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

= 8 – 18 = 10

Now consider by replacing the solution according to Cramer's rule we get

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

Now consider by replacing the solution according to Cramer's rule we get

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

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

∴ (x, y) = (6, 5) is solution.

(6) 2x + 3y = 2; x – y/2 = ½

Solution:

Given

$2x + 3y = 2$

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

$\Rightarrow 2x - y = 1$

The given equations can be written in determinants as

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

$= -2 - 6 = -8$

Now consider by replacing the solution according to Cramer's rule we get

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

Now consider by replacing the solution according to Cramer's rule we get

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

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

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

PRACTICE SET 1.4 PAGE NO: 19

1. Solve the following simultaneous equations.

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

Solution:

Given

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

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

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

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

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

Now multiply equation (I) by 4

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

Equating equation (II) and (III)

Now change the signs of equation 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 equation II

$8m+5\times 1=77$

$8m+5=77$

On rearranging

$8m=77-5$

$8m=72$

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

$m = 9$

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

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

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

We have

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

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

$\Rightarrow y = 1$

Hence (x, y) = (1/9, 1)

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

Solution:

Given

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

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

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

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

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

Multiply equation I by 5 and equation II by 2

$50m + 10n = 20$

$\underline{30m - 10n = -4}$

$80m = 16$

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

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

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

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

$2 + 2n = 4$

On rearranging we get

$2n = 4 - 2$

$2n = 2$

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

$n = 1$

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

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

Now, equating equation III and IV

$x + y = 5$

$\underline{x - y = 1}$

$2x = 6$

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

$x = 3$

Substituting value of x=3 in equation III

$3 + y = 5$

$y = 5 - 3$

$y = 2$

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

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

Solution:

Given

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

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

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

$27m + 31n = 85$ ...(I)

$31m + 27n = 89$ ...(II)

Adding both equations

$58m + 58n = 174$

Dividing both sides by 58

$m + n = 3$ ...(III)

Subtracting equation, I and II

$27m + 31n = 85$

$-31m - 27n = -89$

$-4m + 4n = -4$

Dividing both sides by 4

$-m + n = -1$ ...(IV)

Equating equation III and IV

$m + n = 3$

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

$2n = 2$

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

$n = 1$

Substituting n = 1 in equation 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) = (5/2, -2)

(4) $\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4}$; $\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{1}{8}$

Solution:

Given

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

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

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 equation 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 equation II

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

⇒ 4 - 8n = 2

⇒ - 8n = 2 - 4

⇒ - 8n = -2

⇒ 8n = 2

⇒ $n = \frac{2}{8}$

⇒ $n = \frac{1}{4}$

∴ $m = \frac{1}{2(3x+y)}$

⇒ $\frac{1}{2(3x+y)} = \frac{1}{2}$

⇒ 2 = 2 (3x+y)

⇒ 2 = 6x + 2y III

∴ $n = \frac{1}{2(3x-y)}$

⇒ $\frac{1}{2(3x-y)} = \frac{1}{4}$

⇒ 4 = 2(3x - y)

⇒ 4 = 6x - 2y IV

Add equation III and IV

$6x + 2y = 2$

$\underline{6x - 2y = 4}$

$12x = 6$

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

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

Substituting x = ½ in equation III

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

⇒ 3 + 2y = 2

⇒ 2y = 2 – 3

⇒ 2y = -1

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

Hence (x, y) = (½, ½)

PRACTICE SET 1.5

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

Solution:

Let the greater number be x and smaller number be x–3

As per given situation,

$2(x-3) + 3(x) = 19$

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

$\Rightarrow 5x - 6 = 19$

$\Rightarrow 5x = 19 + 6$

$\Rightarrow 5x = 25$

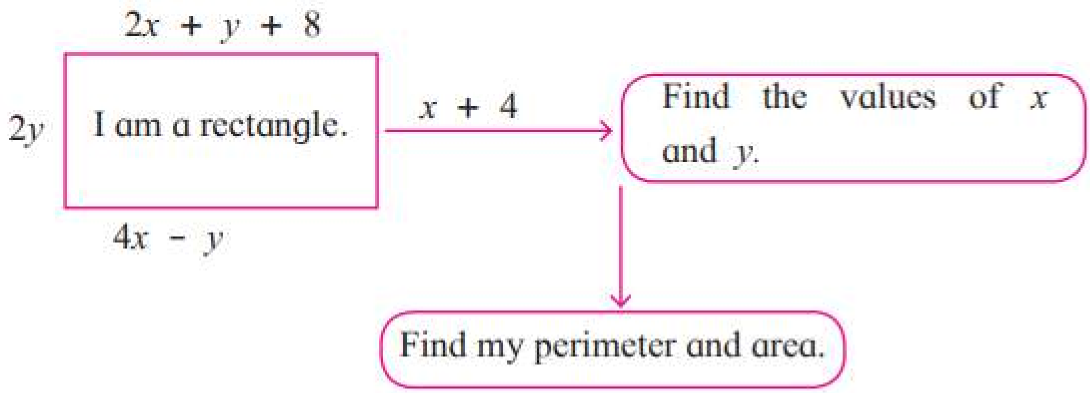
$\Rightarrow x = \frac{25}{5} = 5$

∴ smaller no is $x - 3$

$\Rightarrow 5 - 3 = 2$

Hence, the numbers are 5 and 2.

2. Complete the following.



Solution:

Given 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 equation I and II and change sign of equation II

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

$y = 8$

Substituting y = 8 in equation 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.

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.

Solution:

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 equation 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 equation 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.

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.

Solution:

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 equation 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 = $\frac{7}{18}$

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 weighs 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.

Solution:

Given 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.

$\therefore 150x + 100y = 10000$ [∵ 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

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

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

Solving Equation, I and II

$3x + 2y = 200$

$-13x - 2y = -500$

$-10x = -300$

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

$x = 30$

Putting x=30 in equation I

$3 \times 30 + 2y = 200$

$90 + 2y = 200$

$2y = 200 - 90$

$2y = 110$

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

Hence, A – 30kg, B – 55kg

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.

Solution:

Let the distance travelled by bus = x

Speed of bus = 60 km/hr

As, time = distance/speed

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

Let the distance travelled by plane = y

As, total distance travelled was 1900 km

x + y = 1900

Distance travelled by plane = (1900–x)

Speed of plane = 700 km/hr

Time travelling by plane = $\frac{(1900-x)}{700}$

Given,

Total time = 5 hours

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

[35 x + 3 (1900 – x)]/ 2100 = 5

(35 x + 5700 – 3x)/ 2100 = 5

⇒ 32x + 5700 = 10500⇒ 32x = 4800⇒ x = 150 km

and y = 1900 - x

= 1900 - 150 = 1750 km

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

PRACTICE SET 1.6 PAGE NO: 27

1. 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

Solution:
B. 3

Explanation:
Put x= 1 in given equation
Then we get
$4 \times 1 + 5y = 19$
$\Rightarrow 5y = 19 - 4$
$\Rightarrow 5y = 15$
$\Rightarrow y = \frac{15}{5} = 3$
Hence, option B is correct.

2. 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. 1/7
D. -1/7

Solution:
A. 7

Explanation:
$x = \frac{D_x}{D} = \frac{49}{7} = 7$
Hence option A is correct.

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

A. –1

B. –41

C. 41

D. 1

Solution:

D. 1

Explanation:

$D = \begin{bmatrix} 5 & 3 \\ -7 & -4 \end{bmatrix}$

$= (5 \times -4) - (3 \times -7)$

$= -20 + 21 = 1$

Hence, option D is correct.

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

A. 5

B. 1

C. –5

D. –1

Solution:

C. -5

Explanation:

Given

$x + y = 3$

$3x - 2y = 4$

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

$= -2 - 3 = -5$

Hence, Option C is correct.

5. 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.

Solution:
A. Only one common solution.

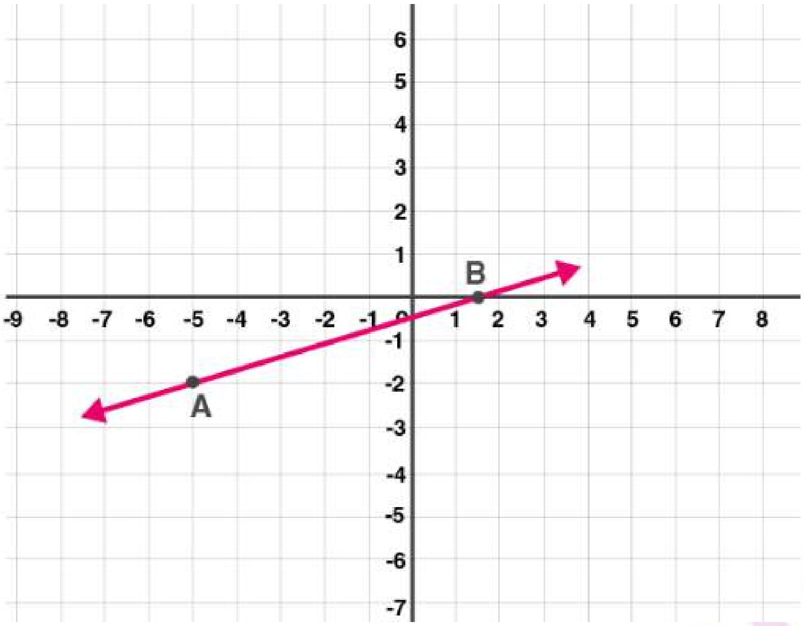
Explanation:
Given ax + by = c and mx + ny = d
Then, $\frac{a}{m} \neq \frac{b}{n}$, $as\ an\ \neq\ bm$
Now, we know that when the ratio of coefficients is not equal.
Equations will have unique solution.
Hence, A is the correct answer.

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

x	−5	☐
y	☐	0
(x, y)	☐	☐

Solution:
Put x = –5, then
2 × -5 – 6y = 3
⇒ 3 + 10 = -6y
y = -13/6
Put y = 0, then
2x – 0 = 3
x = 3/2

x	-5	3/2
y	-13/6	0
(x, y)	(-5, -13/6)	(3/2, 0)



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

3. Solve the following simultaneous equation graphically.
(1) 2x + 3y = 12; x – y = 1

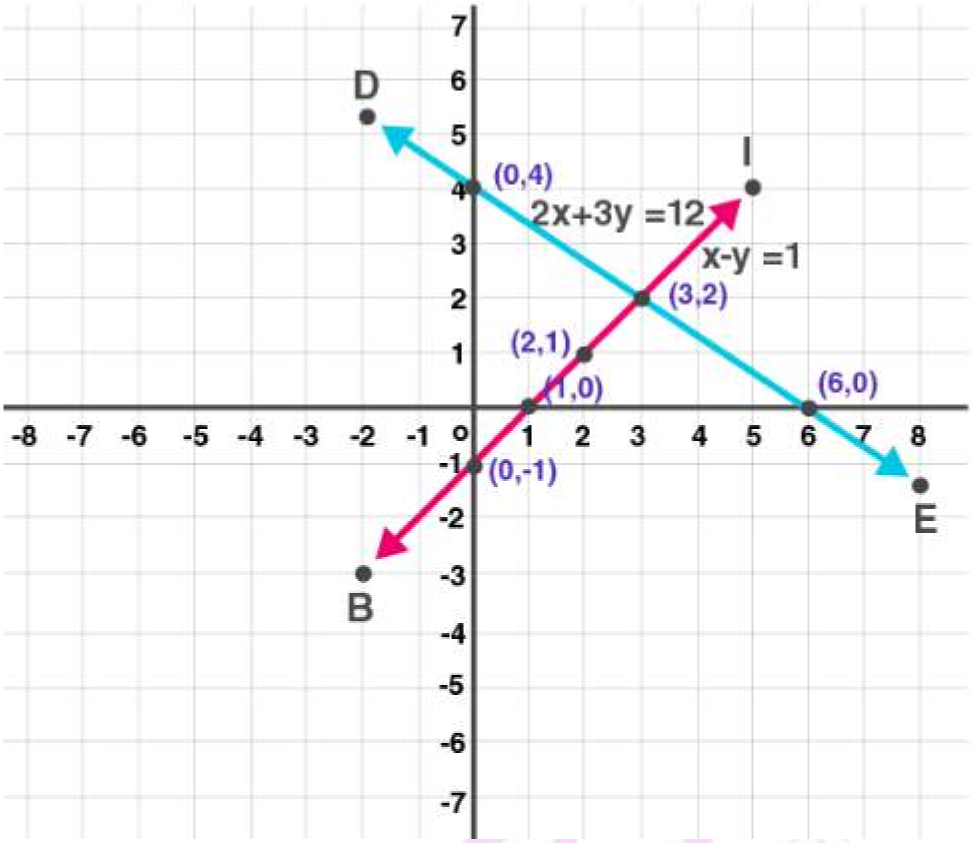
Solution:
Given
2x + 3y = 12
Substitute the values for x as shown in the table

x	0	6	3
y	4	0	2

Consider x – y = 1

x	1	0	2
y	0	-1	1

Now plot the graph as shown below:



(2) x – 3y = 1; 3x – 2y + 4 = 0

Solution:

Given

x – 3y = 1

Substitute the values for x as shown in the table

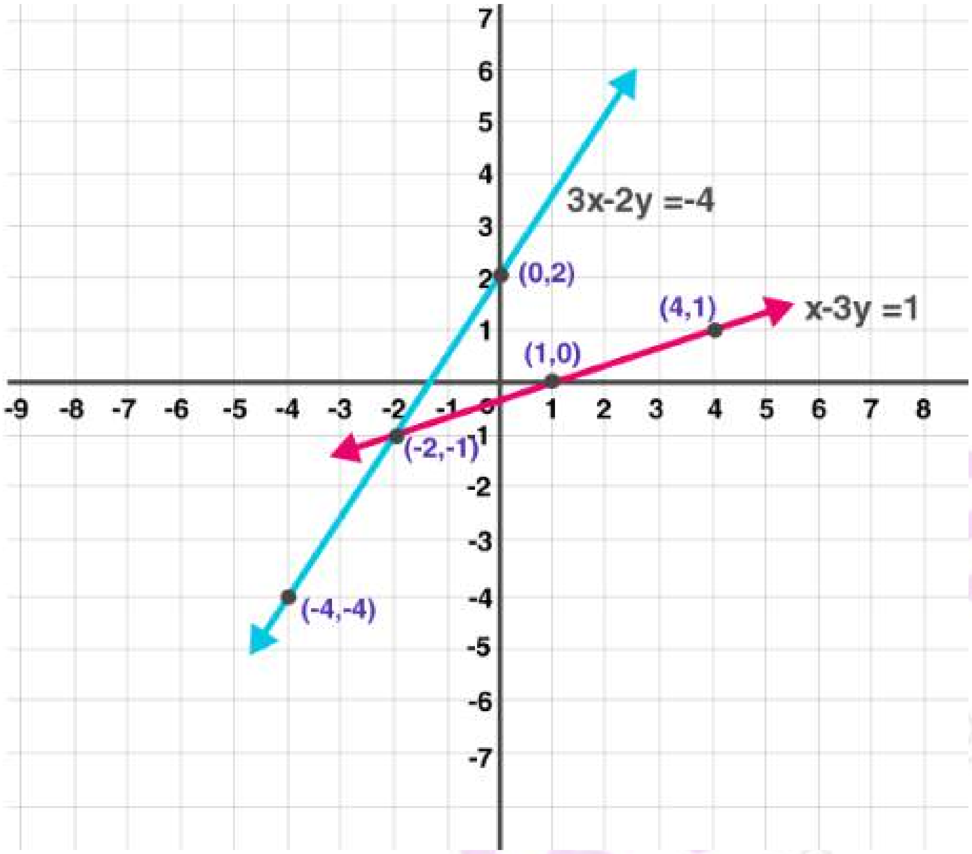
x	-2	4	1
y	-1	1	0

Also given

3x – 2y + 4 = 0

x	0	-2	-4
y	2	-1	-1

Now plot the graph as shown below:



(3) 5x – 6y + 30 = 0; 5x + 4y – 20 = 0

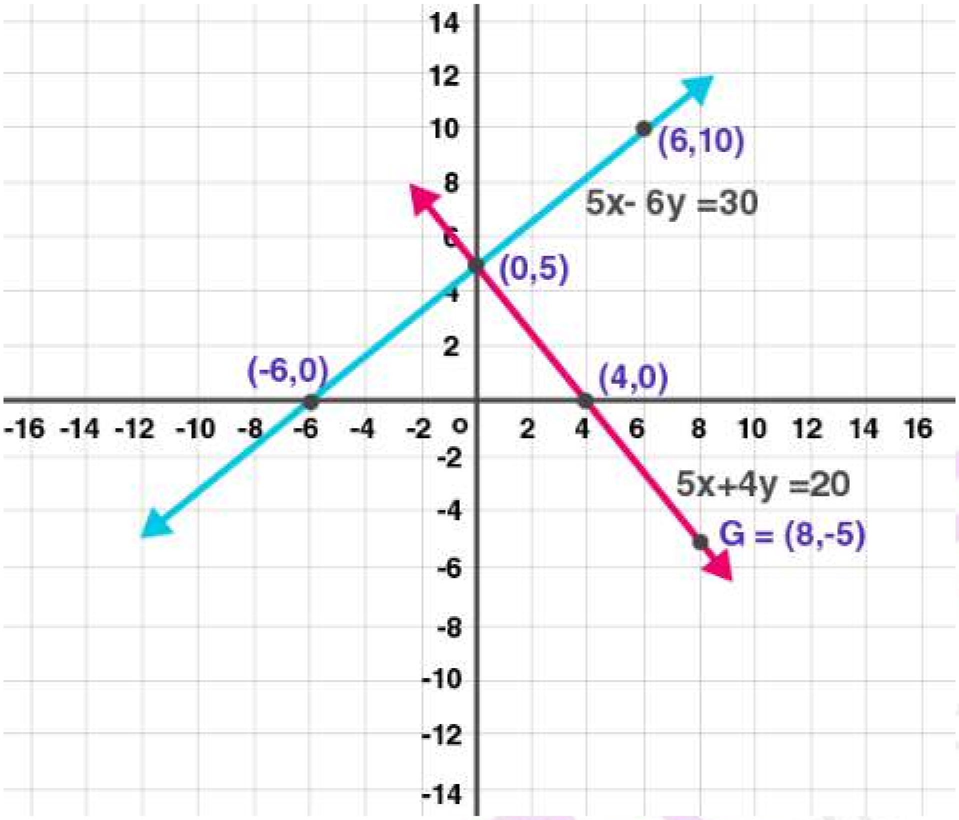
Solution:
Given
5x – 6y + 30 = 0
Substitute the values for x as shown in the table

x	0	-6	6
y	5	0	10

Also given
5x + 4y - 20 = 0

x	0	4	8
y	5	0	-5

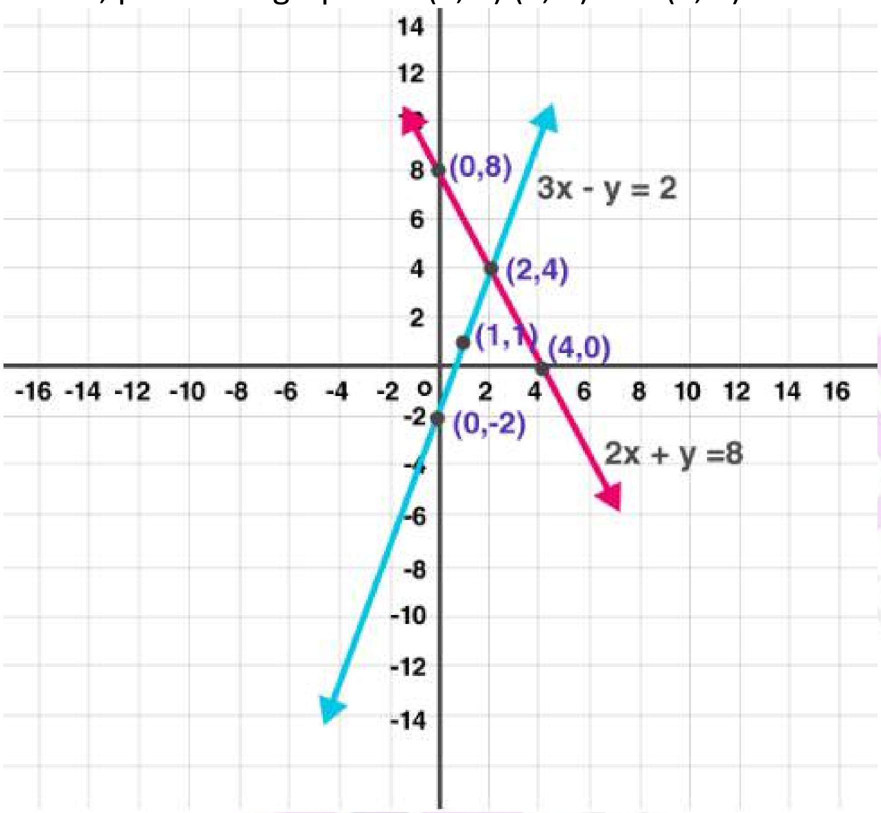
Now plot the graph as shown below:



(4) 3x – y – 2 = 0; 2x + y = 8

Solution:
For equation 1, let's find the points for graph
3x - y - 2 = 0
At x = 0
3(0) - y - 2 = 0
⇒ y = -2
At x = 13
(1) - y - 2 = 0
⇒ y = 1At x = 2
3(2) - y - 2 = 0
⇒ 6 - y - 2 = 0⇒ y =4
Hence, points for graph are (0, -1) (1, 1) and (2, 4)
For equation 22x + y = 8
At x = 0y = 8
at x = 12
(1) + y = 8

⇒ y = 6
at x =42(4) + y = 8
⇒ y = 0
Hence, 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

(5) 3x + y = 10; x – y = 2

Solution:
Given 3x + y = 10

x	1	2	3
y	7	4	1

Also, we have
x – y = 2

x	0	2	3
y	-2	0	1

Solving Both equations

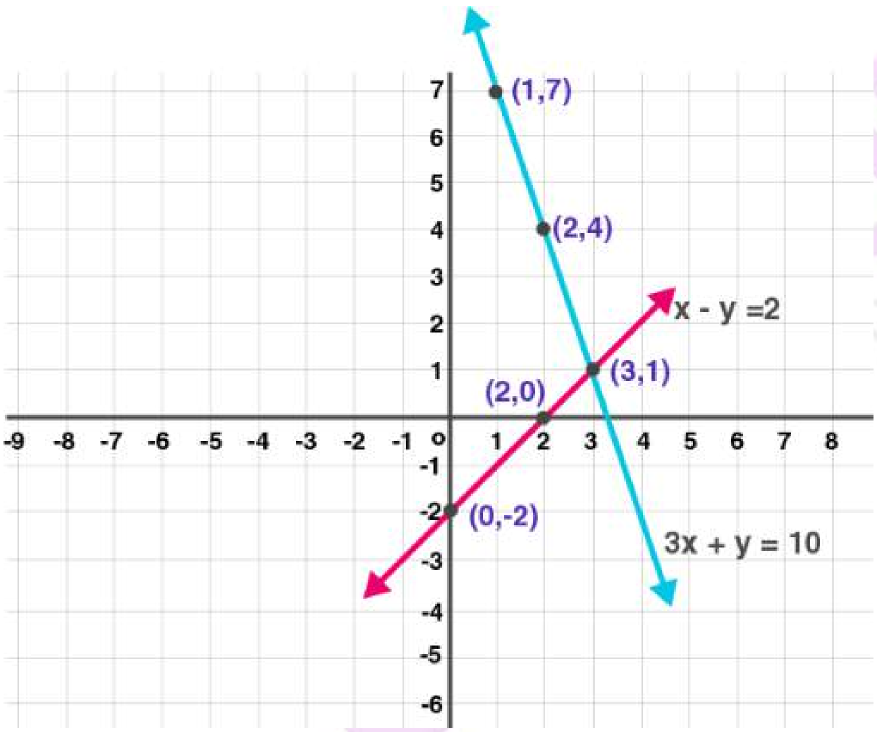
$3x + y = 10$

$x - y = 2$

$\Rightarrow 4x = 12$

$\Rightarrow x = 3$

$\therefore \; y = 1$



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

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

Solution:

Given

$D = \begin{bmatrix} 4 & 3 \\ 2 & 7 \end{bmatrix}$

= (4 × 7) – (3 × 2) = 28 – 6 = 22

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

Solution:

Given

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

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

Solution:

Given

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

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

(1) 6x – 3y = –10; 3x + 5y – 8 = 0

Solution:

Given

$6x - 3y = -10$

$3x + 5y = 8$

The given equations can be written in determinants

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

Now apply Cramer's rule by replacing the solution values

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

Again, apply Cramer's rule by replacing the solution values

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

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

∴ (x, y) = (-2/3, 2)

(2) 4m – 2n = –4; 4m + 3n = 16

Solution:

Given

4m – 2n = –4;

4m + 3n = 16

The given equations can be written in determinants

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

Now apply Cramer's rule by replacing the solution values

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

Again, apply Cramer's rule by replacing the solution values

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

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

∴ (x, y) = $(1, 4)$

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

Solution:

Given

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

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

The given equations can be written in determinants

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

Now apply Cramer's rule by replacing the solution values

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

Again, apply Cramer's rule by replacing the solution values

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

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

∴ (x, y) = (1/2, -1/2)

(4) 7x + 3y = 15; 12y – 5x = 39

Solution:

Given

7x + 3y = 15; 12y – 5x = 39

The given equations can be written in determinants

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

Now apply Cramer's rule by replacing the solution values

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

Again, apply Cramer's rule by replacing the solution values

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

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

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

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

Solution:

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 = -12/-6 = 2

y = -36/-6 = 6

Hence, (2, 6) is the solution

6. Solve the following simultaneous equations.

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

Solution:

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

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

$3\text{m} + 2\text{n} = 0$ ... (II)

Multiply equation II by 2

$6\text{n} + 4\text{n} = 0$ ... (III)

Subtract equation III from equation I

$12\text{m} + 4\text{n} = 1$

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

$6\text{m} = 1$

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

Substitute m=1/6 in equation I

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

$2 + 4n = 1$

$4n = 1 - 2$

$4n = -1$

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

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

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

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

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

Solution:

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

$7m + 13n = 27$ ...(I)

$13m + 7n = 33$ ...(II)

Adding equation, I and II

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

Subtract Eq. I and II

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

Equating equation III and IV

$m + n = 3$

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

$2n = 2$

$n = 1$

Substituting n=1 in equation 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, $(x,y) = \left(-\frac{1}{4}, -1\right)$

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

Solution:

Given

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

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

Adding equation, I and II

$379x + 379y = 1137$

$x + y = 3$ ...(III)

Subtracting equation, 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 equation I

$1 + y = 3$

$y = 3 - 1$

$y = 2$

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

(4) $\frac{7x \quad 2y}{xy} = 5$; $\frac{8x+7y}{xy} = 15$

Solution:

Given

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

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

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

$7n - 2m = 5$ ... (III)

$8n + 7m = 15$ ... (IV)

Multiply equation 1 by 7 and equation II by 2

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

$65n = 65$

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

$n = 1$

Substituting value in equation 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, $(x,y) = (1,1)$

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

Solution:

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 equation 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 equation I

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

$1 + 4n = 5$

$4n = 5 - 1$

$4n = 4$

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

$n = 1$

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

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

Multiply equation III by 3 and equation IV by 4 and Equate

$9x + 12y = 30$ ... (V)

$8x - 12y = 4$ ... (VI)

$17x = 34$

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

$x = 2$

Substituting x=2 in equation V

$9 \times 2 + 12y = 30$

$18 + 12y = 30$

$12y = 30 - 18$

$12y = 12$

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

$y = 1$

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

7. Solve the following word problems.

(1) 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

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

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

$x + y = \boxed{} \; . \; . \; . \; . \; . \; \text{(I)}$

From the second condition,

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

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

$\therefore \; x - y = 3 \; . \; . \; . \; . \; . \; \text{(II)}$

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 $10y + x$

$= \square + 8$

$= 58$

Solution:

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 10 x + y

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

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

$\therefore 11x + 11y = 143$

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

From the second condition,

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

$\therefore x = y + 3$

$\therefore x - y = 3$ ..... (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

2. 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.

Solution:

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

As she paid ₹50 as return fare

₹700 − ₹50 = ₹650

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

According to second situation,

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

Multiplying equation, I by 2 and equation II by 3

$6x + 20y = 2600$ .... (III)

$6x + 21y = 2640$ ... (IV)

Subtracting Eq. III from IV

$6x + 21y = 2640$

$-6x - 20y = -2600$

$y = 40$

Substituting y = 40 in equation I

$3x + 10 \times 40 = 1300$

$3x + 400 = 1300$

$3x = 1300 - 400$

3x=900

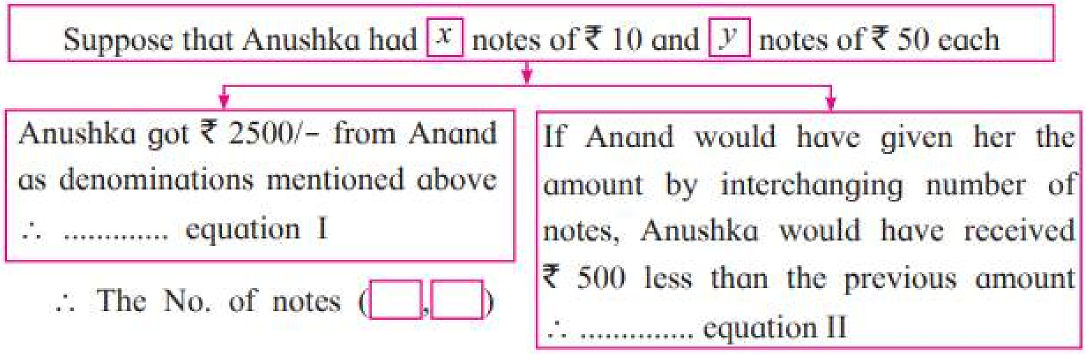
$x = \frac{900}{3}$

$x = 300$

Tea; ₹ 300 per kg.

Sugar; ₹ 40 per kg.

3. To find number of notes that Anushka had, complete the following activity



Solution:

According to 1st situation,

$100x + 50y = 2500 \ \ldots\ldots(I)$

According to 2nd situation,

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

Adding I and II,

$150x + 150y = 4500$

$x + y = 30$ ...III

Subtracting I from II

$50x - 50y = -500$

$x - y = -10$ IV

Equating equation III with equation IV

$x + y = 30$

$x - y = -10$

$2x = 20$

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

Substituting x=10 in equation III

$10 + y = 30$

$y = 20$

₹100 notes = 10

₹50 notes = 20

4. 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.

Solution:

Let Manish's present age be x

Let Savita's present age be y

According to 1^{st} situation,

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

According to second situation,

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

$x - 3 = 4y - 12$

$x - 4y = -12 + 3$

$x - 4y = -9$ II

Subtracting equation II from I

$x + y = 31$

$-x + 4y = 9$

$5y = 40$

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

$y = 8$

Substitute y = 8 in equation I

$x + 8 = 31$

$x = 31 - 8$

$x = 23$

Manisha's age 23 years

Savita's age 8 years.

5. 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.

Solution:

Given 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

6. 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.

Solution:

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

$\therefore x + y = 90 \ \ ...\text{I}$

When moving away from each other, combined speed = $(x - y)\text{km/h}$

Time taken for Hamid to catch up = $\frac{30}{x-y} = 3$

$\therefore x - y = 10 \ ...\text{II}$

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.