CHAPTER 1

LINEAR EQUATIONS IN TWO VARIABLES

LONG QUESTIONS & ANSWERS

Q. 1 (Target26)

Two numbers differ by 10. The sum of twice the smaller number and thrice the greater number is 15, find the numbers.

SOLUTION:

Let the greater number be x and the smaller number be y

According to the first condition, two numbers differ by 10

$x - y = 10$ … (i)

According to the second condition, the sum of twice the smaller number and thrice the greater number is 15.

$3x + 2y = 15$ … (ii)

Multiplying equation (i) by '2', we get

$2x - 2y = 20$ … (iii)

Adding equations (ii) & (iii), we get

$$
\begin{array}{r}
3x + 2y = 15 \\
+2x - 2y = 20 \\
\hline
5x \qquad = 35
\end{array}
$$

$$\therefore \; x = \frac{35}{5}$$

$$\therefore \; x = 7$$

Substituting x = 7n equation (i)

$7 – y = 10$

$7 – 10 = y$

$\therefore y = -3$

Ans: The required Numbers are 7 & -3.

Q. 2 (Target27)

The sum of Ashok's age and twice the age of Prakash is 70. If we double the age of the Ashok and add to the age of Prakash the sum is 80. Find their present ages.

SOLUTION:

Let the present ages of Ashok and Prakash be x and y respectively

According to the first condition, the age sum of Ashok's age and twice the age of Prakash is 70

$x + 2y = 70$ … (i)

According to the second condition, the sum of twice the age of Ashok's and age of Prakash is 95.

$2x + y = 80$ … (ii)

Multiplying equation (i) by '2', we get

$2x + 4y = 140$ … (iii)

Subtracting equation (ii) from (iii), we get

$$
\begin{array}{rl}
2x + 4y = & 140 \\
-2x - y \ = & -80 \\
\hline
3y = & 60
\end{array}
$$

$$\therefore y = \frac{60}{3}$$

$\therefore y = 20$

Substituting $y = 15$ in equation (i) we get,

$x + 2(20) = 70$

$\therefore x = 70 - 40$

$\therefore x = 30$

Ans: Present ages of Ashok and Prakash are 30 years and 20 years respectively.

Q. 3 (VIDYAMITRA 57)

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

SOLUTION:

Let the wages of Skilled workers be x and Unskilled workers be y respectively

According to the first condition,

Ratio of salary of skilled and unskilled workers is 5 : 3

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

$3x - 5y = 0$ … (i)

Now, according to the second condition,

The total salary for one day of both of them is₹ 720

$x + y = 720$ … (ii)

Multiplying equation (ii) by 3, we get

$3x + 3y = 2160$ … (iii)

Subtracting equations (i) from (iii), we get

$$\begin{array}{r} 3x + 3y = 2160 \\ -3x + 5y = -0 \\ \hline 8y = 2160 \end{array}$$

$\therefore y = \frac{2160}{8}$

$\therefore y = 270$

Place $y = 270$ in equation (ii) we get

$x + y = 720$

$x + 270 = 720$

$\therefore x = 450$

Ans: Wages of Skilled Workers is ₹ 450 and Wages of Unskilled Skilled Workers is ₹ 270 respectively.

Q. 4 (navneet31)

A two-digit number and the number with digits interchanged add up to 121. In the given number the digit in units place is 3 more than the digit in the tenth's place, find the number.

SOLUTION:

Let the digit in units place be x and that in tenth's place be y

$\therefore$ The original Number is $x + 10y$

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

According to the first condition,

Two digit number + number obtained by interchanging digits = 121

$\therefore$ $(x + 10y) + (10x + y) = 121$

$\therefore$ $11x + 11y = 121$

$\therefore$ $x + y = 11$ … (i)

According to the second condition,

The digit in units place is = the digit in the tenth's place = 3

$\therefore\ x = y + 3$

$\therefore\ x - y = 3$ … (ii)

Adding equations (i) & (ii)

$$\begin{array}{l} x - y = 3 \\ \underline{x + y = 11} \end{array}$$

$\therefore\ 2x = 14$

$\therefore\ x = 7$

Putting value in equation (i)

$x + y = 11$

$8 + y = 11$

$\therefore\ y = 3$

The original number (10y + x) = (30 + 7) = 37

Ans: The number is 37

Q. 5 (Navneet23/vidyamitra)

The denominator of a fraction is 2 more than twice its numerator. If 3 is subtracted from both, the numerator ad the denominator, the denominator becomes 6 times the numerator. Find the fraction.

SOLUTION:

Let the numerator of the fraction be x and its denominator be y

Twice the numerator $2x$

From the first condition that, denominator is 4 more than twice its numerator

$y = 2x + 2$

$2x - y = -2$ … (i)

If 3 is subtracted from the numerator and the denominator, then the numerator becomes $(x - 3)$ denominator becomes $(y - 3)$

From the second condition,

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

$\therefore\ y - 3 = 6x - 18$

$\therefore\ 6x - 18 = y - 3$

$\therefore\ 6x - y = -6 + 18$

$\therefore\ 6x - y = 24 \qquad \ldots \text{(ii)}$

Subtracting equation (i) from (ii)

$$\begin{array}{l} 6x - y = \ \ 24 \\ \underline{-2x + y = +2} \\ 4x \qquad = 26 \end{array}$$

$\therefore\ x = 6$

Substituting $x = 6$ in equation (i)

$2(6) - y = -2$

$\therefore\ (12) - y = -2$

$\therefore\ -y = (-2 - 12)$

$\therefore\ -y = -14$

$\therefore\ y = 14$

The numerator is $x = 6$ & the denominator is $y = 14$.

Thus, the fraction is $\frac{14}{6} = \frac{7}{3}$

Ans: Thus, the fraction is $\frac{7}{3}$

Q. 6 (NAVANEET23/vidyamitra)

Two type of boxes P, Q to be placed in a truck having capacity of 20 tons. When 300 boxes of type P and 200 boxes of type Q are loaded in the truck, it weighs 20 tons. But when 520 boxes of type P are loaded in the truck, it can still accommodate 80 boxes of type Q, so that it is fully loaded. Find the weight of each type of box.

SOLUTION:

Let the weight of box P type be x ton &

the weight of box Q type be y ton.

The weight of 300 boxes of type P = $300x$ ton

The weight of 200 boxes of type Q = $200y$ ton

From the first condition,

$300x + 200y = 20$ (by dividing both sides by 20)

$\therefore\ 15x + 10y = 1$ … (i)

Similarly, from second condition,

$520x + 80y = 20$ ... (Dividing both sides by 20)

$\therefore 26x + 4y = 1$ (ii)

Multiplying the equation (i) by 2 &

equation (ii) by 5

$30x + 20y = 2$ … (iii)

$130x + 20y = 5$ … (iv)

Subtracting equation (iii) from (iv)

$$\begin{array}{rcr} 130x + 20y & = & 5 \\ -\,30x - 20y & = & -\,2 \\ \hline 100\,x & = & 3 \end{array}$$

$$\therefore\ x = \frac{3}{100}$$

Substituting $x = \frac{3}{100}$ in equation (i)

$$15\left(\frac{3}{100}\right) + 10y = 1$$

$$\therefore\ \left(\frac{45}{100}\right) + 10y = 1$$

$$\therefore\ 10y = 1 - \frac{45}{100}$$

$$\therefore\ 10y = \frac{100-45}{100}$$

$$\therefore\ 10y = \frac{55}{100}$$

$$\therefore\ y = \frac{55}{1000}$$ ... (Dividing both sides by 10)

Ans.: The weight of box of type P is $\frac{3}{10}$ ton (or 0.03 ton) and the weight of box of Q is $\frac{55}{1000}$ ton (or 0.055 ton)

[Note: 0.03 ton = 0.03 x 1000 kg = 30 kg; and 0.055 ton = 0.055 x 1000 kg = 55 kg]

Q. 7 (NAVANEET 8)

Solve the simultaneous equations.

$$4a + 5b = 34$$ and

$$-a - 5b = -22$$

SOLUTION:

$$4a + 5b = 34 \quad \dots (1)$$

$$-a - 5b = -22 \qquad \ldots (2)$$

Subtracting equation (2) from (1) we get,

$$\begin{array}{rcr} 4a + 5b &=& 34 \\ -a - 5b &=& -22 \\ \hline 3a &=& 12 \end{array}$$

$$\therefore a = 4$$

Substituting *a* = 4 in equation (1)

4(4) + 5b = 56

∴ 16 + 5b = 56

∴ 5b = 56 – 16

∴ 5b = 40

∴ b = 8

Ans.: a = 2, b = 8

Q. 8 (NAVNEET 8 / vidyamitra)

Solve the simultaneous equations.

$2m - 3n = 3$

$3m - 2n = 2$

SOLUTION:

Given

$2m - 3n = 3 \quad \ldots \quad (1)$

$3m - 2n = 2 \quad \ldots \quad (2)$

Multiply (1) by 3

$6m - 9n = 9 \quad \ldots \quad (3)$

Multiply (2) by 2

$6m - 4n = 4 \quad \ldots \quad (4)$

Subtract (4) from (3)

$6m - 9n = 9$

$-6m + 4n = -4$

$-5n = 5$

Substituting n = - 1 in equation (1)

$2m - 3n = 3$

$2m - 3(-1) = 3$

$2m + 3 = 3$

$\therefore\ 2m = 0$

$\therefore\ m = 0$

Ans.: n = -1, m = 0

Q. 9 (TARGET)

Solve the simultaneous equations:

$x - y = 2$ and $5x - 3y = 2$

SOLUTION:

$x - y = 2 \qquad \dots (1)$

$5x - 3y = 2 \qquad \dots (2)$

Multiplying equation (1) by 3

$3x - 3y = 6 \qquad \dots (3)$

Subtracting equation (3) from (2)

$$\begin{array}{r} 5x - 3y = 2 \\ \underline{-\ 3x + 3y = -6} \\ 2x \qquad = -4 \end{array}$$

$\therefore\ x = -2$

Substituting x = - 2 in equation (1)

- 2 – y = 2

$\therefore$ – y = 4

$\therefore$ y = -4

Ans.: x = - 2, y = - 4

Q. 10 (target 4)

Solve the simultaneous equation.

49x + 51y = 199 and

51x + 49y = 301

SOLUTION:

49x + 51y = 199 and

51x + 49y = 301………… (2)

Adding equations (1) and (2) we get,

$$\begin{array}{r} 49x + 51y = \quad 199 \\ \underline{+51x + 49y = +301} \\ 100x + 100y = 500 \end{array}$$

$\therefore\ x + y = 5 \qquad \ldots (3)$

Subtracting equation (1) from (2) we get,

$$\begin{array}{rrr} 49x + & 51y = & 199 \\ -51x - & 49y = & -301 \\ \hline -2x + & 2y = & -2 \end{array}$$

$\therefore\ x - y = 1 \qquad \ldots (4)$

Adding equations (3) and (4)

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

$\therefore\ x = 3$

Substituting $x = 3$ in equation (3)

$x + y = 5$

$3 + y = 5$

$\therefore\ y = 5 - 3$

$\therefore\ y = 2$

Ans.: $x = 3, y = 2$

Q. 11 (target4)

Solve the following simultaneous equations:

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

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

SOLUTION:

Given $\frac{2}{3}x + 2y = \frac{10}{3}$

Multiplying both sides by 3 we get,

$\therefore 2x + 6y = 10$ **… (i)**

Given $4x + \frac{1}{2}y = \frac{11}{4}$

Similarly, multiplying both sides by 4 we get,

$\therefore 16x + 2y = 11$

$48x + 6y = 33$ **…(ii)**

Subtracting equation (i) from (ii)

$48x + 6y = \quad 33$

$\underline{-2x - 6y = -10}$

$$46x \quad = \quad 23$$

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

Putting this in equation (i) we get,

$x + 3y = 5$

$\frac{1}{2} + 3y = 5$

$\therefore\ 3y = 5 - \frac{1}{2}$

$\therefore\quad y = \frac{10-1}{2} \quad = \quad \frac{9}{6}$

Ans.: $x = 1, y = \frac{3}{2}$

Q. 12 (VIDYAMITRA24/navneet)

Solve the following simultaneous equations:

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

$$\frac{15}{x+y} - \frac{5}{x-y} = -1$$

SOLUTION:

$$\frac{10}{x+y} + \frac{2}{x-y} = 2 \qquad \ldots \text{(i)}$$

$$\frac{15}{x+y} - \frac{5}{x-y} = -1 \qquad \ldots \text{(ii)}$$

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

in equations (i) and (ii) respectively we get,

10*m* + 2*n* = 2 **… (iii)**

15*m* – 5*n* = -1 **… (iv)**

On multiplying equation (iii) by 5 and equation (iv) by 2 we get,

50*m* + 10*n* = 10 **… (v)**

30*m* – 10*n* = - 2 **… (vi)**

On adding equations (v) and (vi)

$$\begin{array}{r} 50m + 10n = \ \ 10 \\ \underline{+\ 30m - 10n = \ -2} \\ 80m \qquad\quad = 8 \end{array}$$

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

Substituting $m = \frac{1}{10}$ **in equation (iii) we get,**

10*m* + 2*n* = 2

$$10\left(\frac{1}{10}\right) + \ 2n = 2$$

$\therefore$ **1 + 2n = 2**

$\therefore$ **n =** $\frac{1}{2}$

$\therefore$ **n =** $\frac{1}{2}$

But, according to our assumption above,

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

$\therefore$ **By substituting values of** m **and** n **in our assumption we get,**

$$\frac{1}{10} = \frac{1}{x+y}$$

$\therefore$ $x + y = 10$ **… (vii) AND**

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

$\therefore$ $x - y = 2$ **… (viii)**

Multiply equation (vii) by 3

Adding equations (vii) and (viii) we get,

$$x + y = 10$$

$$+x - y = 2$$

$$2x \qquad = 12$$

$\therefore\ x = 6$

Substituting $x = 6$ in equation (vii) we get,

$x + y = 10$

$6 + y = 10$

$\therefore\ y = 10 - 6$

$\therefore\ y = 4$

$\therefore\ y = 4$

Ans.: $x = 6$ and $y = -4$

Q. 13 (NAVNEET21)

Solve the simultaneous equations:

$$\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{8} \quad ;$$

$$\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = -\frac{1}{16}$$

SOLUTION:

$$\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{8} \quad \ldots \text{(i)}$$

$$\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = -\frac{1}{16} \quad \ldots \text{(ii)}$$

Substituting $\frac{1}{3x+y} = p$ and $\frac{1}{3x-y} = q$ in equations (i) and (ii) respectively we get,

$$p + q = \frac{3}{8} \quad \ldots \text{(iii)}$$

$$\frac{1}{2}p - \frac{1}{2}q = -\frac{1}{16} \quad \ldots \text{(iv)}$$

Multiplying equation (iv) by 2 we get,

$$p - q = -\frac{1}{8} \quad \ldots \text{(v)}$$

By adding equations (iii) & (v)

$$\begin{array}{rcl} p + q &=& \frac{3}{8} \\ +p - q &=& -\frac{1}{8} \\ \hline 2p &=& \frac{2}{8} \end{array}$$

$$\therefore p = \frac{1}{8}$$

Substituting $p = \frac{1}{8}$ in equation (iii) we get,

$$p + q = \frac{3}{8}$$

$$\frac{1}{8} + q = \frac{3}{8}$$

$$\therefore q = \frac{3}{8} - \frac{1}{8}$$

$$\therefore q = \frac{2}{8}$$

$$\therefore q = \frac{1}{4}$$

Thus we get $p = \frac{1}{8}$ and $q = \frac{1}{4}$

Reconstituting values of p and q in our assumption we get,

$$\frac{1}{8} = \frac{1}{3x + y}$$

$$\therefore 3x + y = 8 \qquad \ldots \text{(vi) \&}$$

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

$$\therefore 3x - y = 4 \qquad \ldots \text{(vii)}$$

Adding equations (vi) and (vii) we get,

$$\begin{array}{r} 3x + y = \;\; 8 \\ \underline{+3x - y = \;+4} \end{array}$$

$$6x \quad = \quad 12$$

$\therefore x = 2$

Substituting $x = 2$ in equation (vi) we get,

$3x + y = 4$

$3(2) + y = 4$

$\therefore y = 4 - 6$

$\therefore y = -2$

Ans.: $x = 2, y = -2$

Q. 14 (NAVNEET20)

Solve the simultaneous equations:

$$\frac{27}{p-2} + \frac{31}{q+3} = 85\ ;$$

$$\frac{31}{p-2} + \frac{27}{q+3} = 89$$

SOLUTION:

The simultaneous equations are

$$\frac{27}{p-2} + \frac{31}{q+3} = 85\ ; \qquad \ldots \text{(i)}$$

$$\frac{31}{p-2} + \frac{27}{q+3} = 89 \qquad \ldots \text{(ii)}$$

Substituting $\frac{1}{p-2} = x$ and $\frac{1}{q+3} = y$ in equations (i) and (ii) respectively we get,

$$27x + 31y = 85 \qquad \ldots \text{(iii)}$$

$$31x + 27y = 89 \qquad \ldots \text{(iv)}$$

Adding equations (iii) and (iv) we get,

$$\begin{array}{r} 27x + 31y = \ \ 85 \\ +31x + 27y = +89 \\ \hline 58x + 58y = 174 \end{array}$$

$$\therefore x + y = \frac{174}{58}$$

$$\therefore x + y = 3 \qquad \ldots \text{(v)}$$

Subtracting equation (iv) from (iii)

$$\begin{array}{r} 27x + 31y = \ \ 85 \\ -31x - 27y = -89 \\ \hline -4x + 4y \ \ = -4 \end{array}$$

$$\therefore x - y = 1 \qquad \ldots \text{(vi)}$$

Adding equations (v) & (vi) we get,

$$\begin{array}{r} x + y = 3 \\ \underline{+x - y = +1} \\ 2x \quad = 4 \end{array}$$

$\therefore x = 2$

Substituting $x = 2$ **in equation (v)**

$x + y = 3$

$2 + y = 3$

$\therefore y = 1$

Reconstituting the values of p **and** q **in our assumption we get,**

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

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

$\therefore 2(p - 2) = 1$

$\therefore 2p - 4 = 1$

$\therefore 2p = 1 + 4$

$\therefore 2p = 5$

$\therefore p = \frac{5}{2}$ &

$y = \frac{1}{q+3}$

$1 = \frac{1}{q+3}$

$\therefore q + 3 = 1$

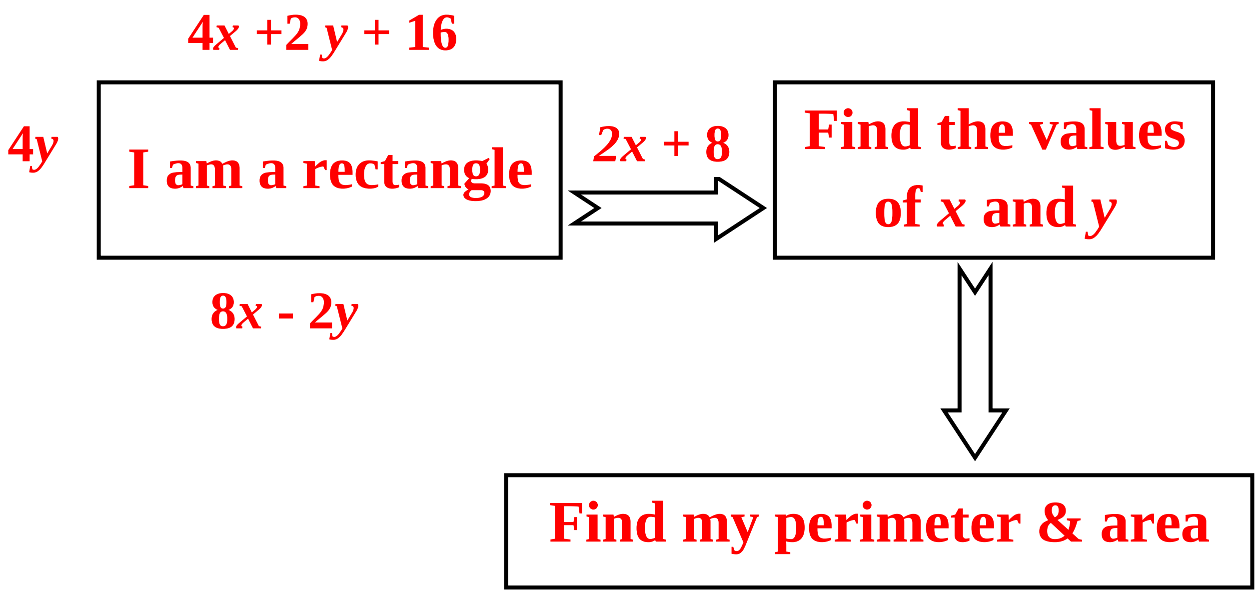
$\therefore q = 1 - 3$

$\therefore q = -2$

Ans.: $p = \frac{2}{5},\ q = -2$

Q. 15 (TARGET26/navneet)

Complete the following:



SOLUTION:

Opposite sides of rectangle are equal

$\therefore\ 4x + 2y + 16 = 8x - 2y$

$\therefore\ 16 = 8x - 4x - 2y - 2y$

$\therefore\ 4x - 4y = 16$ **by dividing both sides by 2**

$\therefore\ x - y = 4 \qquad \ldots \text{(i)}$

Also, $2x + 8 = 4y$

$\therefore\ 2x - 4y = -8 \qquad \ldots \text{(ii)}$

$\therefore\ x - 2y = -4$

Subtracting equation (ii) from (i) we get,

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

$$\therefore \qquad y = 8$$

Substituting $y = 8$ **in equation (i) we get,**

$x - y = 4$

$x - 8 = 4$

$\therefore\ x = 4 + 8$

$\therefore\ x = 12$

Now, length of rectangle = $4x - y$

$= 4(12) - 8$

$= 48 - 8$

$= 40$

$\therefore$ Length of rectangle = 40

Breadth of rectangle = $2y = 2(8) = 16$

Perimeter of rectangle = 2 (length + breadth)

= 2 (40 + 16)

= 2 (56)

Perimeter of rectangle = 112 units

Area of rectangle = length x breadth

= 40 x 16

$\therefore$ Area of rectangle = 640 sq. units

Ans.: $x = 12$ and $y = 8$, Perimeter of rectangle is 112 units and area of rectangle is 640 sq. units

Q. 16 (TARGET38)

To find the number of notes that NAMRATA had, complete the following activity:

Suppose that Namrata had x notes of ₹ 200 and y notes ₹ 100 each

Namrata got ₹ 5000/- from Ashok as denominations mentioned above

$\therefore$ ______ equation (i)

If Anand would have given her the amount by interchanging number of notes, Namrata would have received ₹ 1000 less than the previous amount

$\therefore$ ______ equation (ii)

SOLUTION:

Namrata had x notes of ₹ 100 and y notes of ₹ 50

According to first condition,

$200x + 100y = 5000$ … (i)

According to second condition,

$100x + 200y = 4000$ … (ii)

On adding these two equations we get,

$$\begin{array}{r} 200x + 100y = 5000 \\ +100x + 200y = +4000 \\ \hline 300x + 300y = 9000 \end{array}$$

$\therefore\ x + y = 30 \qquad \ldots \text{(iii)}$

Subtracting equation (ii) from (i) we get,

$$\begin{array}{r} 200x + 100y = 5000 \\ -100x - 200y = -4000 \\ \hline 100x - 100y = 1000 \end{array}$$

$\therefore\ x - y = 10 \qquad \ldots \text{(iv)}$

Adding equations (iii) & (iv) we get,

$$\begin{array}{r} x + y = 30 \\ +x - y = +10 \\ \hline 2x = 40 \end{array}$$

$\therefore\ x = 20$

Substituting $x = 20$ in equation (iii) we get,

$x + y = 30$

$20 + y = 30$

$\therefore\ y = 10$

Ans.: Namrata had 20 notes of ₹ 100 and 10 notes of ₹ 50

Q. 17 (navneet19)

Solve given equations below

$$\frac{5}{p-1} + \frac{1}{q-2} = 2\ ;$$

$$\frac{6}{p-1} - \frac{3}{q-2} = 1$$

SOLUTION:

$$\frac{5}{p-1}+\frac{1}{y-q}=2\ ;\ \frac{6}{p-1}-\ \frac{3}{q-2}=1$$

Replacing $\left(\frac{1}{p-1}\right)$ **by** x, $\left(\frac{1}{q-2}\right)$ **by** y

New Equations

$$5\,x+y=2 \qquad\qquad 6\,x-3\,y=1$$

On Solving

$$x=\frac{1}{3},\ y=\frac{1}{3}$$

Replacing x, y **by their original values**

$$\left(\frac{1}{p-1}\right)=\frac{1}{3} \qquad\qquad \left(\frac{1}{q-2}\right)=\frac{1}{3}$$

On Solving

$$p=4,\ q=5$$

Q. 18 (vidyamitra34/Navneet)

Vimal travelled some distance by bus and some by aero plane , out of 1900 km,. Bus travels with average speed of 60 km/hr and the average speed of aero plane is 700 km/hr. It takes 5 hrs to complete the journey. Find the distance, Vimal travelled by bus.

SOLUTION:

Let x be the distance by bus and y by aero plane.

From first condition $x + y = 1900$ … (i)

Speed of bus 60 km/hr

Speed of aero plane 700 km/hr

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

From second condition,

$$\frac{x}{60} + \frac{y}{700} = 5$$

$\therefore$ $700x + 60y = 5 \times 42000$

$\therefore$ $700x + 60y = 210000$

$\therefore\ 70x + 6y = 2100$ … (ii)

On multiplying equation (i) by 6 we get,

$6x + 6y = 11400$ … (iii)

On subtracting equation (iii) from (ii) we get,

$$\begin{array}{rcr} 70x + 6y & = & 21000 \\ -6x - 6y & = & -11400 \\ \hline 64x & = & 9600 \end{array}$$

$$\therefore\ x = \frac{9600}{64}$$

$\therefore\ x = 150$

Ans.: Vishal travelled 150 km by bus.

Q. 19 (vidyamitra20)

Solve the following simultaneous equations by using Cramer's rule

$3x - 4y = 10$;

$4x + 3y = 5$

SOLUTION:

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

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

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

By Cramer's rule, we get

$$x = \frac{D_x}{D} = \frac{50}{25} = 2 \qquad \&$$

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

Ans.: (x, y) = (2, -1) is the solution of simultaneous equation

Q. 20 (vidyamitra21/NAVNEET)

Solve the following equation by Cramer's rule

$4p + 3q - 4 = 0$;

$6p = 8 - 5q$

SOLUTION:

$4p + 3q - 4 = 0;$

$6p = 8 - 5q$

$\therefore\ 6p + 5q = 8$

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

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

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

By Cramer's rule, we get

$p = \frac{D_p}{D} = \frac{-4}{2} = -2$ &

$q = \frac{D_q}{D} = \frac{8}{2} = 4$

Ans.: (p, q) = (-2, 4) is the solution of simultaneous equation

Q. 21 (TARGET16)

Solve the following equation by Cramer's rule

$2x - 3y = 7;$

$5x + 2y = 8$

SOLUTION:

$$D = \begin{vmatrix} 2 & -3 \\ 5 & 2 \end{vmatrix} = (2 \times 2) - (-3 \times 5) = 4 - (-15) = 19$$

$$D_x = \begin{vmatrix} 7 & -3 \\ 8 & 2 \end{vmatrix} = (7 \times 2) - (-3 \times 8) = 14 - (-24) = 38$$

$$D_y = \begin{vmatrix} 2 & 7 \\ 5 & 8 \end{vmatrix} = (2 \times 8) - (7 \times 5) = 16 - 35 = -19$$

By Cramer's rule, we get

$$x = \frac{D_x}{D} = \frac{38}{19} = 2 \quad \&$$

$$y = \frac{D_y}{D} = \frac{-19}{19} = -1$$

Ans.: (x, y) = (2, -1) is the solution of simultaneous equation

Q. 22 (TARGET17)

Solve the following equation by Cramer's rule

$q + 2p - 19 = 0$;

$2p - 3q + 3 = 0$

SOLUTION:

Write the given equation in the form ap + bq = c

$2p + q = 19$

$2p - 3q = -3$

$D = \begin{vmatrix} 2 & 1 \\ 2 & -3 \end{vmatrix}$ = (2 x -3) – (2 x 1) = -6 – 2 = -8

$D_p = \begin{vmatrix} 19 & 1 \\ -3 & -3 \end{vmatrix}$ = (19 x -3) - (-3 x 1) = -57 – (-3) = -54

$D_q = \begin{vmatrix} 2 & 19 \\ 2 & -3 \end{vmatrix}$ = (2 x -3) – (2 x 19) = - 6 – 38 = -44

By Cramer's rule, we get

$x = \frac{D_p}{D} = \frac{-54}{-8} = \frac{27}{4}$ and

$y = \frac{D_q}{D} = \frac{-44}{-8} = \frac{11}{4}$

Ans.: $(p, q) = \left(\frac{27}{4}, \frac{11}{4}\right)$ is the solution of the given simultaneous equation

Q. 23 (NAVNEET 9)

Solve the following equations:

$x - 3y = 8 \ldots$ (i)

$3x - y = 4 \ldots$ (ii)

SOLUTION:

$x - 3y = 8 \dots \text{(i)}$

$3x - y = 4 \quad \dots \text{(ii)}$

Adding equations (1) & (2) we get,

$$\begin{array}{r} x - 3y = 8 \\ +3x - y = 4 \\ \hline 4x - 4y = 12 \end{array}$$

Dividing both sides by 4 we get,

$\therefore x - y = 3 \qquad \dots \text{(iii)}$

Subtracting equation (i) from (ii) we get,

$$\begin{array}{r} 3x - y = 4 \\ x - 3y = 8 \\ \hline 2x + 2y = -4 \end{array}$$

$\therefore x + y = -2 \qquad \dots \text{(iv)}$

Adding equations (iii) and (iv) we get,

$$\begin{array}{r} x - y = 3 \\ +x + y = -2 \\ \hline 2x = 1 \end{array}$$

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

Substituting $x = \frac{1}{2}$ in equation (iii) we get

$\therefore\ x - y = 3$

$\frac{1}{2} - y = 3$

$y = 3 - \frac{1}{2}$

$\therefore\ y = \frac{5}{2}$

Ans.: $(x, y) = \left(\frac{-1}{2}, \frac{5}{2}\right)$

Q. 24 NAVNET 32

The sum of the present ages of Suresh and Vanita is 38 years. 6 years ago Suresh was eight times Vinita's age at that time. Find the present ages.

SOLUTION:

Let Manish's present age be *x* years & Savita's age by *y* years

From the first condition,

$x + y = 38$ … (i)

6 years ago Suresh's age would be $(x - 6)$ years & Savita's age would be $(y - 6)$ years

Therefore, according to the second condition,

$$x - 6 = 8(y - 6)$$

$\therefore\ x - 6 = 8y - 48$

$\therefore x - 8y = -48 + 6$

$\therefore\ x - 4y = -42$ … (ii)

Subtracting equation (ii) from (i) we get,

$$\begin{array}{r} x + y = 38 \\ \underline{-x + 4y = 42} \\ 5y = 80 \end{array}$$

$\therefore\ y = 16$

Substituting $y = 8$ in equation (i) we get,

$$x + y = 38$$

$$x + 16 = 38$$

$\therefore\ x = 38 - 16$

$\therefore x = 22$

Ans.: The present ages of Suresh and Vanita are 22 years and 16 years respectively.

Q. 25 (VIDYAMITRA) PAGE NO 58

Places P and Q are 30 km apart and they are on straight road. Arjun travels from P to Q on bicycle. At the same time, Karan starts from Q on bicycle, travels towards A. They met each other after 20 minutes. If Arjun would have started from Q at the same time but in opposite directions (instead towards P), Karan would have caught him after 3 hours. Find the speed of Karan and Joseph.

SOLUTION:

Let the speed of Karan be x km/hr and that of Arjun be y km/hr

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Speed of Karan & Arjun = $x + y$, distance = 30 km

From first condition,

Karan and Arjun meet after 20 minutes = $\frac{1}{3}$ hr

$\therefore x + y = \frac{30}{\frac{1}{3}}$

$\therefore x + y = 90$ … (i)

From second condition,

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

$\therefore x - y = 10$ … (ii)

Adding equations (i) and equation (ii) we get,

$$\begin{array}{r} x + y = 90 \\ \underline{+x - y = +10} \\ 2x \quad = 100 \end{array}$$

$\therefore x = 50$

Place $x = 50$ in equation (i) we get,

$x + y = 90$

$50 + y = 90$

$\therefore y = 90 - 50$

$\therefore y = 40$

Ans.: Speed of Karan = 50 km/hr

Speed of Arjun = 40 km/hr

Q. 26 (TARGET) PAGE NO 36

Solve the following simultaneous equations to find x and y

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

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

SOLUTION:

$$\frac{148}{x} + \frac{231}{y} = \frac{527}{xy} \quad \ldots \text{(i)}$$

$$\frac{231}{x} + \frac{148}{y} = \frac{610}{xy} \quad \ldots \text{(ii)}$$

Multiplying equations (i) and (ii) by xy we get,

$148y + 231x = 527 \quad \ldots$ (iii)

$231y + 148x = 610 \quad \ldots$ (iv)

Adding equations (iii) and (iv) we get,

$$\begin{array}{r} 231x + 148y = 527 \\ +148x + 231y = 610 \\ \hline 379x + 379y = 1137 \end{array}$$

Dividing both sides by 379 we get,

$$x + y = \frac{1137}{379}$$

$\therefore\ x + y = 3$ **… (v)**

Subtracting equation (iii) from (iv) we get,

$$\begin{array}{r} 231x + 148y = \quad 527 \\ -148x - 231y = -610 \\ \hline 83x - \quad 83y = -83 \end{array}$$

$$\therefore\ x - y = \ -\frac{83}{83}$$

$\therefore\ x - y = -1$ **… (vi)**

Adding equations (v) and (vi) we get,

$$\begin{array}{r} x + y = \quad 3 \\ +x - y = -1 \\ \hline 2x \qquad = \quad 2 \end{array}$$

$\therefore x = 1$

Substituting $x = 1$ in equation (v) we get,

$x + y = 3$

$1 + y = 3$

$\therefore y = 3 - 1$

$\therefore y = 2$

Ans.: $x = 1$ and $y = 2$ is the solution of given simultaneous equations

Q. 27 (navneet 18)

Solve the following equation by Cramer's rule

$8x + 6y - 4 = 0$;

$12x = 8 - 10y$

SOLUTION:

Given equations are $8x + 6y - 4 = 0 = 0.$

$12x = 8 - 10y$

Writing them in the form ax + by = c

8x + 6y = 4 … (1)

12x + 10y = 8 … (2)

$$D = \begin{vmatrix} 8 & 6 \\ 12 & 10 \end{vmatrix} = (8 \times 10) - (6 \times 12) = 80 - 72 = 8$$

$$D_x = \begin{vmatrix} 4 & 6 \\ 8 & 10 \end{vmatrix} = (4 \times 10) - (6 \times 8) = 40 - 48 = -8$$

$$D_y = \begin{vmatrix} 8 & 4 \\ 12 & 8 \end{vmatrix} = (8 \times 8) - (12 \times 4) = 64 - 48 = 16$$

By Cramer's rule, we get

$$x = \frac{D_x}{D} = \frac{-8}{8} = -1 \ \&$$

$$y = \frac{D_y}{D} = \frac{16}{8} = 2$$

Ans.: $x = -1$ and $y = 2$ is the solution of given simultaneous equations.

Q. 28

If px + qy = 7 & qx + py = 5 intersect at the point (3, 1) then find values of p & q

SOLUTION:

Point of intersection of the lines is (3, 1)

Putting values $x = 3$ & $y = 1$ in both the equations

$px + qy = 7$

$p(3) + q(1) = 7$

$3p + q = 7 \qquad \ldots (1) \quad \&$

$qx + py = 5$

$q(3) + p(1) = 5$

$3q + p = 5 \qquad \ldots (2)$

Adding equation (1) & (2) we get,

$$\begin{array}{r} 3p + q = 7 \\ \underline{+p + 3q = 5} \\ 4p + 4q = 12 \end{array}$$

$\therefore p + q = 3 \qquad \ldots (3)$

Subtracting equation (1) from (2) we get,

$$\begin{array}{r} 3p + q = 7 \\ \underline{-p - 3q = -5} \end{array}$$

$2p - 2q = \ 2$

$\therefore$ a – b = 1 … (4)

Adding equation (3) & (4)

$$\begin{array}{l} p + q = \ \ 3 \\ \underline{+p - q = +1} \\ 2p \quad\quad = \ 4 \end{array}$$

$\therefore$ p= 2

Putting p = 2 in equation (3) we get,

p + q = 3

2 + q = 3

$\therefore$ q = 1

Ans.: p = 2q = 1

Q. 29 (target 19)

Solve the following equation by Cramer’s rule

4m + 6n = 108.

3m + 2n = 56

SOLUTION:

Given equations are

4m + 6n = 108

Dividing the equation by 2

2m + 3n = 54 … (1)

3m + 2n = 56 … (2)

$$D = \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} = (2 \times 2) - (3 \times 3) = 4 - 9 = -5$$

$$D_m = \begin{vmatrix} 54 & 3 \\ 56 & 2 \end{vmatrix} = (54 \times 2) - (3 \times 56) = 108 - 168 = -60$$

$$D_n = \begin{vmatrix} 2 & 54 \\ 3 & 56 \end{vmatrix} = (2 \times 56) - (54 \times 3) = 112 - 162 = -50$$

By Cramer's rule, we get

$$m = \frac{D_m}{D} = \frac{-60}{-5} = 12 \qquad \text{and}$$

$$n = \frac{D_n}{D} = \frac{-50}{-5} = 10$$

Ans.: m = 12 and n = 10 is the solution of given simultaneous equations

Q. 30 (navneet 30)

Solve the following equation by Cramer's rule

5m + 4n = 20

4m + 3n = 10

SOLUTION:

Given equations are

5m + 4n = 20

4m + 3n = 10

$D = \begin{vmatrix} 5 & 4 \\ 4 & 3 \end{vmatrix} = (5 \times 3) - (4 \times 4) = 15 - 16 = -1$

$D_m = \begin{vmatrix} 20 & 4 \\ 10 & 3 \end{vmatrix} = (20 \times 3) - (4 \times 10) = 60 - 40 = -20$

$D_n = \begin{vmatrix} 5 & 20 \\ 4 & 10 \end{vmatrix} = (5 \times 10) - (20 \times 4) = 50 - 80 = -30$

By Cramer's rule, we get

$m = \frac{D_m}{D} = \frac{20}{-1} = -20$ **and**

$n = \frac{D_n}{D} = \frac{-30}{-1} = 30$

Ans.: m = -20 and n = 30 is the solution of given simultaneous equations

Q. 31 (Navneet 31)

Mohanlal bought 3 kg of tea and 10 kg sugar from a shop. He paid ₹ 100 as return fare for rickshaw. Total expense was ₹ 1400. Then she realized 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 4 kg tea and 14 kgs sugar. She paid ₹ 1760 for that. Find the rate of sugar and tea per kg

SOLUTION:

Let the rate of 1 kg tea be ₹ x and that of 1 kg sugar be ₹ y

The cost of 3 kg tea = ₹ $3x$

The cost of 10 kg of sugar is ₹ $10y$

Rickshaw fare = ₹ 100

From the first condition,

$3x + 10y + 100 = 1400$

$\therefore\ 3x + 10y = 1400 - 100$

$\therefore$ $3x + 10y = 1300$

Multiplying this equation by 2, we get

$6x + 20y = 2600$ … (1)

The cost of 4 kg tea = $4x$ and that of 14 kg sugar = $14y$

From second condition,

$4x + 14y = 1760$ … (2)

Multiplying equation (1) by 2 and equation (2) by 3

$12x + 40y = 5200$ … (3)

$12x + 42y = 5280$ … (4)

Subtracting equation (3) from (4) we get,

$$\begin{array}{r} 12x + 42y = 5280 \\ \underline{-12x - 40y = -5200} \\ 2y = 80 \end{array}$$

Substituting $y = 40$ in equation (2),

$4x + 14(40) = 1760$

$4x + 560 = 1760$

$\therefore$ $4x = 1760 - 560$

$\therefore$ $4x = 1200$

$\therefore$ $x = 300$

Ans.: The rate of 1 kg tea is ₹ 900 & the rate of 1 kg of sugar is ₹ 400

Q. 32 Navneet 28

Solve $14x + 6y = 15$ and $24y – 10x = 39$ by Cramer's rule

SOLUTION:

Given equations are

$14x + 6y = 15$ and $24y – 10x = 39$

Writing them in the form $ax + by = c$

$14x + 6y = 15$ … (1)

$– 10x + 24y = 39$ … (2)

$D = \begin{vmatrix} 14 & 6 \\ -10 & 24 \end{vmatrix} = (14 \times 24) – (6 \times - 10) = 336+60 = 396$

$D_x = \begin{vmatrix} 15 & 6 \\ 39 & 24 \end{vmatrix} = (15 \times 24) - (6 \times 39) = 360 – 234 = 126$

$D_y = \begin{vmatrix} 14 & 15 \\ -10 & 39 \end{vmatrix}$ = (14 x 39) – (15 x -10) = 546 + 150

= 696

By Cramer's rule, we get

$x = \frac{D_x}{D} = \frac{126}{396} = \frac{63}{198}$ **and**

$y = \frac{D_y}{D} = \frac{696}{396} = \frac{323}{198}$

Ans.: $x = \frac{63}{198}$ **and** $y = \frac{323}{198}$ **is the solution of the given simultaneous equation.**

Q. 33

Denominator and numerator of a number when added, the sum of them is four more than the three times the numerator. If numerator is subtracted by one, the number becomes 1/4, then find the number.

SOLUTION:

Let the numerator be *x* and denominator be *y*

Then the number is $\frac{x}{y}$

According to first condition,

$x + y = 3x + 4$

$\therefore\ 3x - x - y = -4$

$\therefore\ 2x - y = -4 \qquad \dots (1)$

If numerator is subtracted by 1 then the number is

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

According to second condition,

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

$\therefore\ 4(x - 1) = y$

$\therefore\ 4x - 4 = y$

$\therefore\ 4x - y = 4$

Multiplying this equation by - 1 we get,

$-\ 4x + y = -4 \qquad \dots (2)$

Adding equations (1) & (2)

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

$\therefore$ $x = 4$

Putting $x = 4$ in equation (1)

$2x - y = -4$

$2(4) - y = -4$

$\therefore$ $8 - y = -4$

$\therefore$ $-y = -4 - 8$

$\therefore$ $-y = -12$

$\therefore$ $y = 12$

Number is $\frac{4}{12} = \frac{1}{3}$

Ans.: The number is $= \frac{1}{3}$

Q. 34 target29

Draw graphs of $2x + 3y = 12$ and $x - y = 1$ on the same coordinate plane. Observe it. Think of the relation between coefficients of x, coefficient of y and the constant terms and the interface.

SOLUTION:

1) $2x + 3y = 12$

$\therefore\ 3y = 12 - 2x$

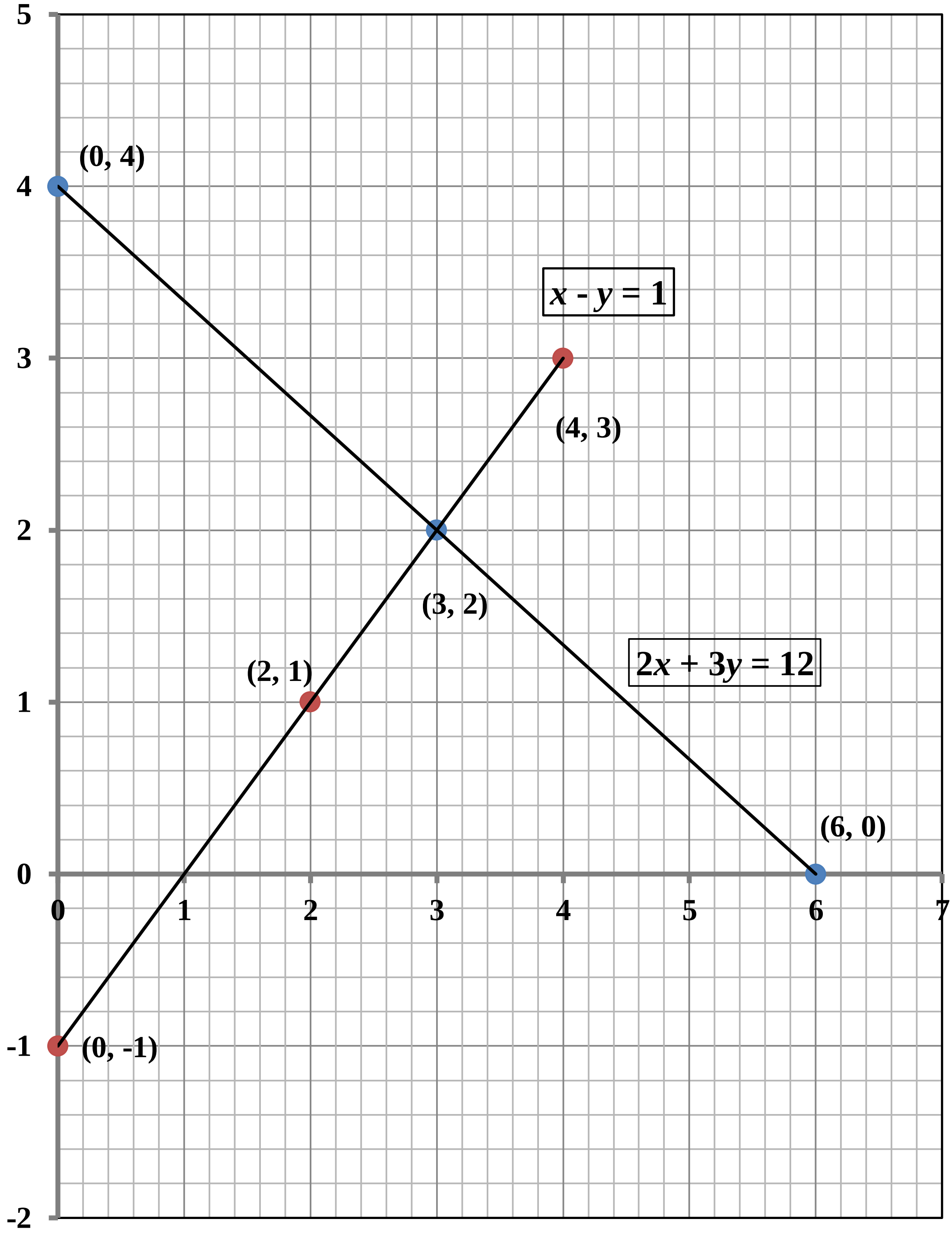
$\therefore\ y = \dfrac{12 - 2x}{3}$

x	0	3	6
y	4	2	0
(x, y)	(0, 4)	(3, 2)	(6, 0)

2) $x - y = 1$

$\therefore\ y = x - 1$

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



5
4
3
2
1
0
-1
-2
0
1
2
3
4
5
6
7
(0, 4)
x - y = 1
(4, 3)
(3, 2)
2x + 3y = 12
(2, 1)
(6, 0)
(0, -1)

Q. 35 navneet 11

Solve the following equations graphically:

$x + y = 6;$

$x - y = 4$

SOLUTION:

$x + y = 6$

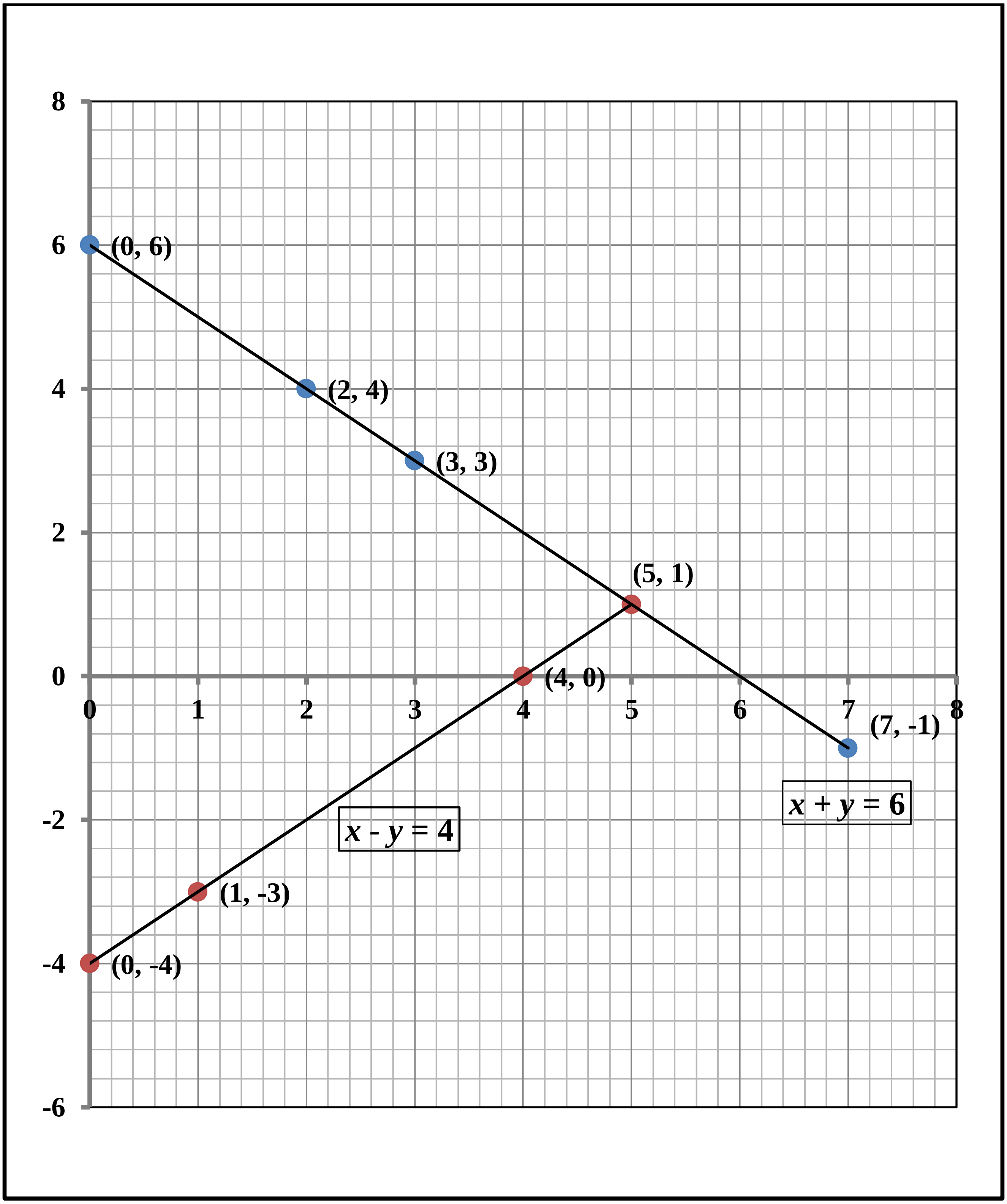
Co-ordinates of points are as follows:

x	0	2	3	7
y	6	4	3	- 1
(x, y)	(0 , 6)	(2 ,4)	(3 ,3)	(4 , 2)

$x - y = 4$

Co-ordinates of points are as follows:

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



Ans: The solution of the given simultaneous equation is $x = 5$ and $y = 1$

Q. 36

Find the length of each side of an isosceles triangle.If the Perimeter is 24 cm.& length of equal sides is 13 cm less than twice the length of base.

SOLUTION:

Let the base be x cm long and equal side be y cm long.

By condition the length of equal sides is 13 cm less than twice the length of base.

$y = 2x - 13$ … (1)

Perimeter of the triangle = 24 cm

Hence, $x + y + y = 24$

$\therefore\ x + 2y = 24$ … (2)

Putting value of y in equation (2) we get,

$x + 2y = 24$

$x + 2(2x - 13) = 24$

$\therefore\ x + 4x - 26 = 24$

$\therefore\ 5x = 24 + 26$

$\therefore\ 5x = 50$

$\therefore\ x = 10$

Putting this value in equation (1)

$y = 2x - 13$

$= 2 \times (10) - 13$

$= 20 - 13$

$= 7$

Ans.: Length of sides of triangle is 7 cm, 7cm and 10cm

Q. 37 target 24

Solve the simultaneous equations:

$$\frac{27}{x-2} + \frac{31}{y+3} = 64\ ;$$

$$\frac{31}{x-2} + \frac{27}{y+3} = 52$$

SOLUTION:

The given simultaneous equations are:

$$\frac{27}{x-2} + \frac{31}{y+3} = 64 \qquad \ldots (1)$$

$$\frac{31}{x-2}+\frac{27}{y+3}=52 \qquad \ldots (2)$$

Let $\frac{1}{x-2}=p$ and $\frac{1}{y+3}=q$, therefore the equations will be as follows:

27p + 31q = 64 … (3) And

31p + 27q = 52 … (4)

Adding equations (3) & (4) we get,

$$\begin{array}{r}
27p+31q = \quad 64 \\
\underline{+31p+27q = \ +52} \\
58p+58q = \ 116
\end{array}$$

$$\therefore p+q=\frac{116}{58}$$

$$\therefore p+q=2 \qquad \ldots (5)$$

Subtracting equation (4) from (3) we get,

$$\begin{array}{r}
27p+31q = \quad 64 \\
\underline{-31p-27q = \ -52} \\
p-q = \ 12
\end{array} \qquad \ldots (6)$$

Adding equations (5) & (6) we get,

$$\begin{array}{r} p + q = \ \ 2 \\ +p - q = 12 \\ \hline 2p \ = \ 14 \end{array}$$

$\therefore$ $p = 7$

Substituting $p = 7$ in equation (5) we get

$p + q = 3$

$7 + q = 3$

$\therefore$ $q = -4$

$\therefore$ $(p, q) = (8, -4)$

Reconstituting values of p & q we get,

$8 = \dfrac{1}{x-2}$ **AND** $-4 = \dfrac{1}{y+3}$

$\therefore$ $8(x - 2) = 1$ **AND** $\therefore$ $-4(y + 3) = 1$

$\therefore$ $8x - 16 = 1$ **AND** $\therefore$ $-4y - 12 = 1$

$\therefore$ $8x = 16 + 1$ **AND** $\therefore$ $-4y = 1 + 13$

$\therefore$ $8x = 17$ **AND** $\therefore$ $-4y = 14$

$\therefore$ $x = \dfrac{17}{8}$ $y = \dfrac{14}{-4} = -\dfrac{7}{2}$

Ans.: $x = \frac{17}{8}, y = -\frac{7}{2}$

Q. 38 (VIDYAMITRA 46)

Solve the simultaneous equations:

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

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

SOLUTION:

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

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

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

Therefore, the equations would be as follows:

7m + 13n = 27 … (3)

13m + 7n = 33 … (4)

Adding equations (3) & (4) we get,

$$7m + 13n = \ \ 27$$

$$\underline{+13m + 7n = +33}$$

$$20m + 20n = 60$$

$\therefore$ $m + n = 3$ ... (5)

Subtracting equation (3) from (4) we get,

$$13m + 7n = \quad 33$$

$$\underline{-7m - 13n = \ -27}$$

$$6m - \ \ 6n \ = 6$$

$\therefore$ $m - n = 1$ ... (6)

Adding equations (5) and (6) we get,

$$m + n = \quad 3$$

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

$$2m \qquad = \quad 4$$

$\therefore$ $m = 2$

Putting m = 2 in equation (5) we get,

$m + n = 3$

2 + n = 3

$\therefore$ **n = 1**

Reconstituting values of *p* & *q* we get,

$2 = \frac{1}{2x+1}$ **AND** $1 = \frac{1}{y+2}$

$\therefore 2(2x + 1) = 1$ **AND** $\therefore 1(y + 2) = 1$

$\therefore 4x + 2 = 1$ **AND** $\therefore y + 2 = 1$

$\therefore 4x = 1 - 2$ **AND** $\therefore y = 1 - 2$

$\therefore 4x = -1$ **AND** $\therefore y = -1$

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

Ans.: $x = -\frac{1}{4}$ **and** $y = -1$ **is the solution**

Q. 39 (NAVNEET20)

Solve the simultaneous equations:

$\frac{4}{x} - \frac{6}{y} = 15;$

$\frac{16}{x} + \frac{10}{y} = 77$

SOLUTION:

$\frac{4}{x} - \frac{6}{y} = 15$ ... (1)

$\frac{16}{x} + \frac{10}{y} = 77$ … (2)

Substituting $\frac{1}{x} = a\ and\ \frac{1}{y} = b$ the equations become,

$4a - 6b = 15$ … (3)

$16a + 10b = 77$ … (4)

Multiplying equation (3) by 4 we get,

$16a - 24b = 60$ … (5)

Subtracting equation (5) from equation (4) we get,

$$\begin{array}{r} 16a + 10b = 77 \\ -16a - 24b = 60 \\ \hline 17b = 17 \end{array}$$

$\therefore\ b = 1$

Substituting b = 1 in equation (3) we get,

$4a - 6b = 15$

$4a - 6(1) = 15$

$\therefore\ 4a - 6 = 15$

$\therefore\ 4a = 15 + 6$

$\therefore\ 2a = 21$

$\therefore$ a = $\frac{21}{2}$

Reconstituting these values of a and b

$a = \frac{1}{x}$ **And** $b = \frac{1}{y}$

$\frac{21}{2} = \frac{1}{x}$ **And** $1 = \frac{1}{y}$

$\therefore x = \frac{2}{21}$ **And** $\therefore y = 1$

Ans $(x, y) = \left(\frac{2}{21}, 1\right)$

Q. 40 (VIDYAMITRa28)

Solve the simultaneous equation

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

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

SOLUTION:

$$\frac{1}{3x+y} + \frac{3}{3x-y} = \frac{3}{4} \qquad \dots (1)$$

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

Let $\frac{1}{3x+y} = m$ **and** $\frac{1}{3x-y} = n$ **therefore we get,**

$$m + n = \frac{3}{4}$$

$$\therefore\ 4m + 4n = 3 \qquad \dots (3)$$

Similarly,

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

On multiplying above equation by 8 we get,

$$4m - 4n = -1 \qquad \dots (4)$$

Adding equations (3) & (4) we get,

$$\begin{array}{rcr} 4m + 4n &=& 3 \\ \underline{+\ 4m - 4n} &\underline{=}& \underline{-1} \\ 8m &=& 2 \end{array}$$

$$\therefore\ m = \frac{1}{4}$$

Substituting this value in equation (3) we get

$$4m + 4n = 3$$

$$4\left(\frac{1}{4}\right) + 4n = 3$$

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

Reconstituting the values of m & n we get,

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

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

$\therefore 3x + y = 4$ **… (5)**

Similarly,

$$n = \frac{1}{3x - y}$$

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

$\therefore 3x - y = 2$ **… (6)**

Adding equation (5) and (6) we get,

$$\begin{array}{rcr} 3x + y & = & 4 \\ +3x - y & = & +2 \\ \hline 6x & = & 6 \end{array}$$

$\therefore x = 1$

On substituting $x = 1$ in equation (5) we get

$3x + y = 4$

(3 x 1) + y = 4

∴ 3 + y = 4

∴ y = 4 – 3

∴ y = 1

Ans.: (x, y) = (1, 1)

Q. 41 (vidyamitra 45)

Solve the simultaneous equation

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

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

SOLUTION:

$\frac{1}{x} + \frac{1}{3y} = \frac{1}{3}$ … (1)

$\frac{3}{x} + \frac{2}{y} = 0$ … (2)

Let $\frac{1}{x} = a$ and $\frac{1}{y} = b$, therefore the equations would be as follows:

$a + \frac{b}{3} = \frac{1}{3}$

$3a + b = 1$ ... (3)

$3a + 2b = 0$ ... (4)

On subtracting equation (3) from (4) we get,

$$\begin{array}{l} 3a + 2b = 0 \\ \underline{-3a - b = -1} \\ b = -1 \end{array}$$

$\therefore b = -1$

Putting $b = -1$ in equation (3) we get,

$3a + b = 1$

$3a + (-1) = 1$

$\therefore 3a = 2$

$\therefore a = \frac{2}{3} \therefore b = -1$

But $a = \frac{1}{x}$ *and* $b = \frac{1}{y}$

But $\frac{2}{3} = \frac{1}{x}$ *and* $-1 = \frac{1}{y}$

$$\therefore \left(x = \frac{3}{2}\right) \ \ and \ \ (y = -1)$$

$$\therefore x = \frac{3}{2} \qquad and \qquad y = -1$$

Ans : $(x, y) = \left(\frac{3}{2}, -1\right)$

Q. 42 (vidyamitra 8)

Solve the simultaneous equations

$x + 7y = 20$ and $3x - 2y = 14$

SOLUTION:

Let $x + 7y = 20$ … (1)

$3x - 2y = 14$ … (2)

On multiplying equation (1) by 3 we get,

$3x + 21y = 60$ … (3)

Let us subtract equation (2) from (3)

$$\begin{array}{r} 3x + 21y = \ \ 60 \\ \underline{-\ 3x + 2y = \ -14} \\ 23y = 46 \end{array}$$

$\therefore y = 2$

Putting $y = 2$ in equation (1) we get,

$x + 7y = 20$

$x + 7(2) = 20$

$x = 20 - 14$

$x = 6$

Ans $(x, y) = (6, 2)$

Q. 43 (vidyamitra 8)

By Crammers rule Solve the simultaneous equation

2m + 3n = 27

3m + 2n = 28

SOLUTION:

$$D = \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} = (2 \times 2) - (3 \times 3) = 4 - 9 = -5$$

$$D_m = \begin{vmatrix} 27 & 3 \\ 28 & 2 \end{vmatrix} = (27 \times 2) - (3 \times 28) = 54 - 84 = -30$$

$$D_n = \begin{vmatrix} 2 & 27 \\ 3 & 28 \end{vmatrix} = (2 \times 28) - (27 \times 3) = 56 - 81 = -25$$

By Cramer's rule, we get

$$m = \frac{D_m}{D} = \frac{-30}{-5} = 6 \text{ and}$$

$$n = \frac{D_n}{D} = \frac{-25}{-5} = 5$$

Ans.: (m, n) = (6, 5)

Q. 44 navneet pag12

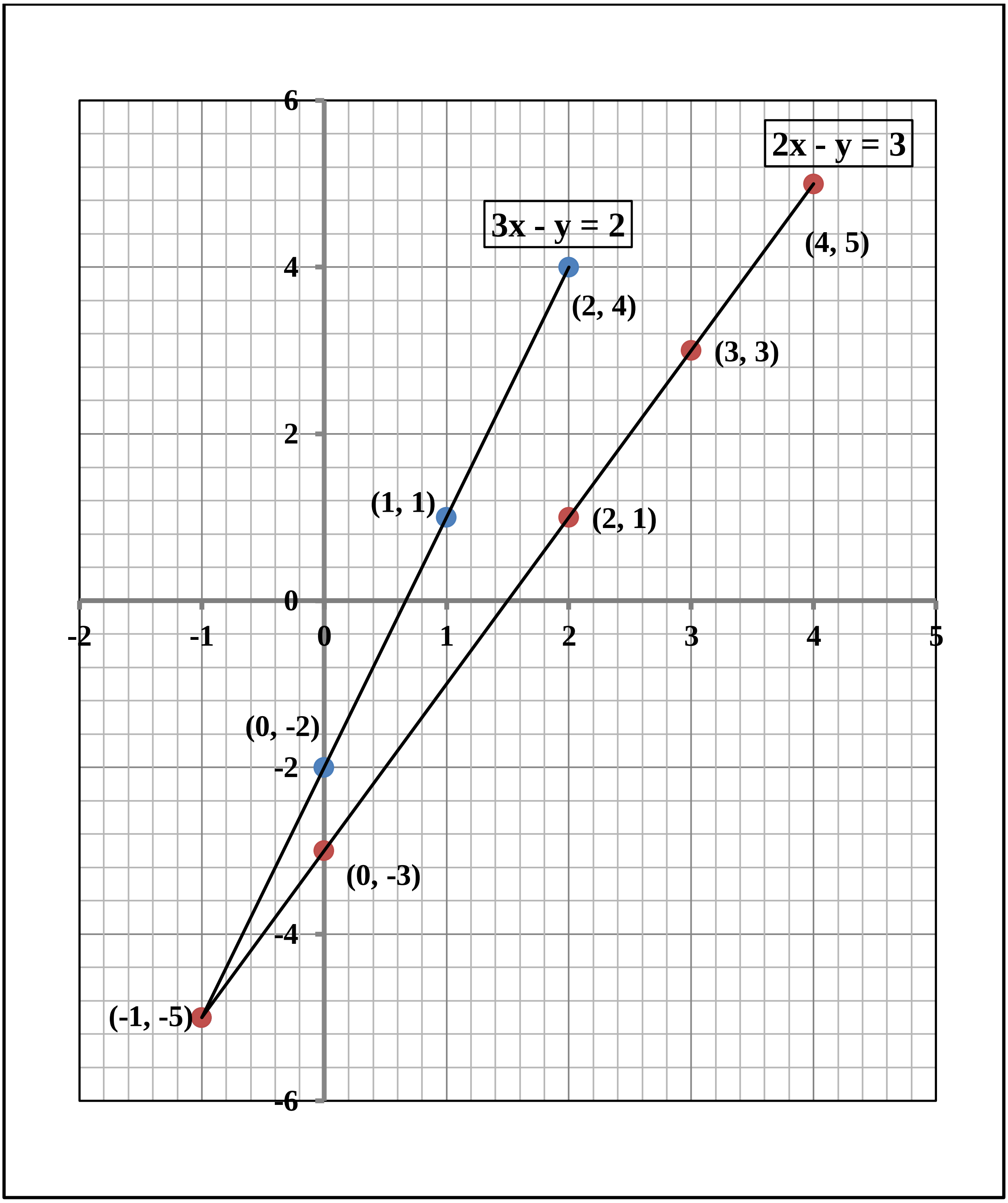
Solve the simultaneous equations graphically

$3x - y = 2$ and $2x - y = 3$

SOLUTION:

Following is the x , y co-ordinates chart of points for graphical representation of the equations:

$3x - y = 2$			$2x - y = 3$	
x	y		x	y
-1	-5		0	-3
0	-2		2	1
1	1		3	3
2	4		4	5



intersection point is (-1, -5)

Ans.: Hence ,the solution of simultaneous equation is

$x = -1, y = -5$

Q. 45 navneet pag12

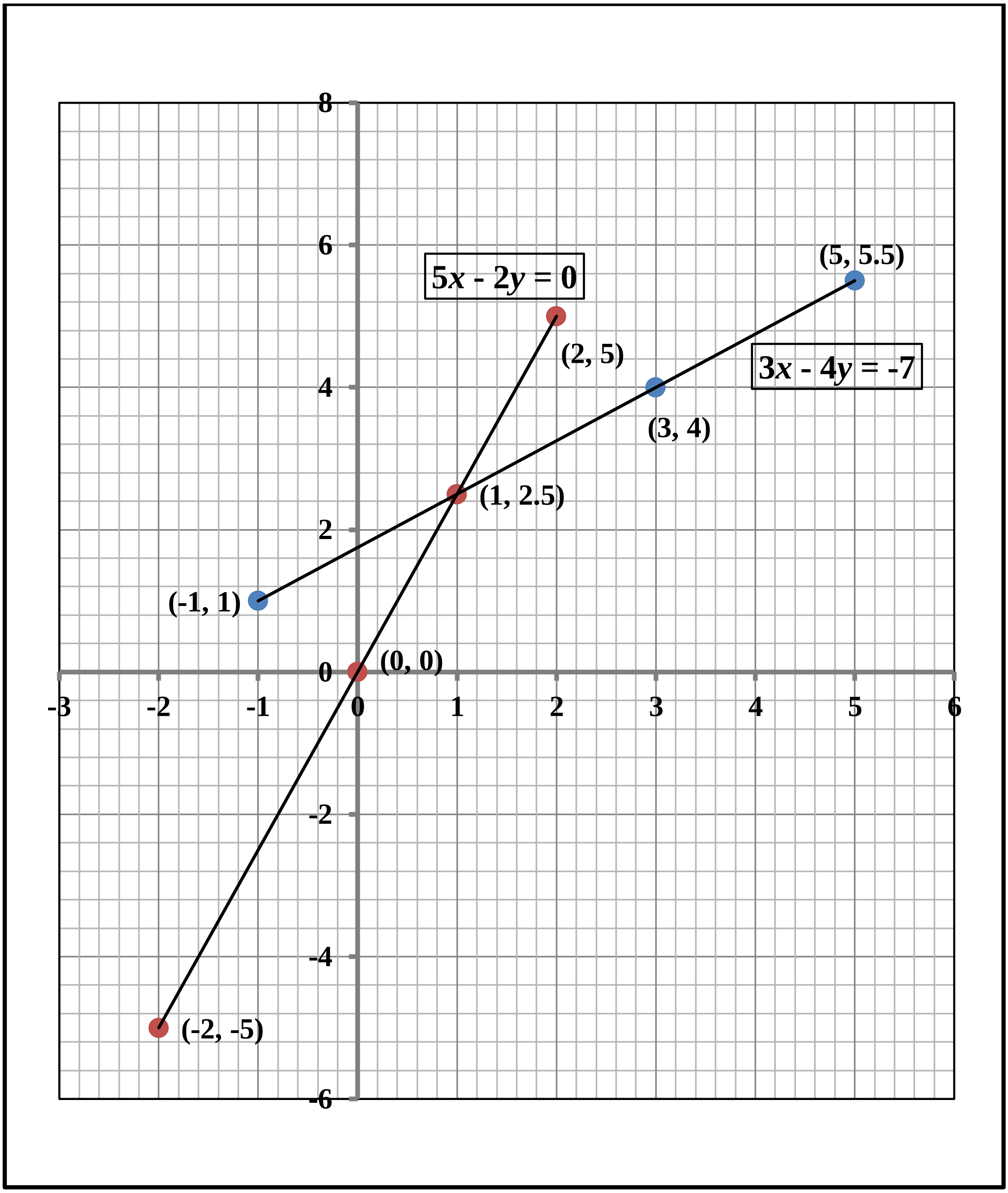
By plotting the graphs solve the simultaneous equations given below

$3x - 4y = -7$ & $5x - 2y = 0$

SOLUTION:

x , y co-ordinate chart given below

$3x - 4y = -7$			$5x - 2y = 0$	
x	y		x	y
-1	1		-2	-5
1	2.5		0	0
3	4		1	2.5
5	5.5		2	5



Intersection point is (1, 2.5)

Ans.: The solution of simultaneous equation is x = 1, y = 2.5

Q. 46 target page6

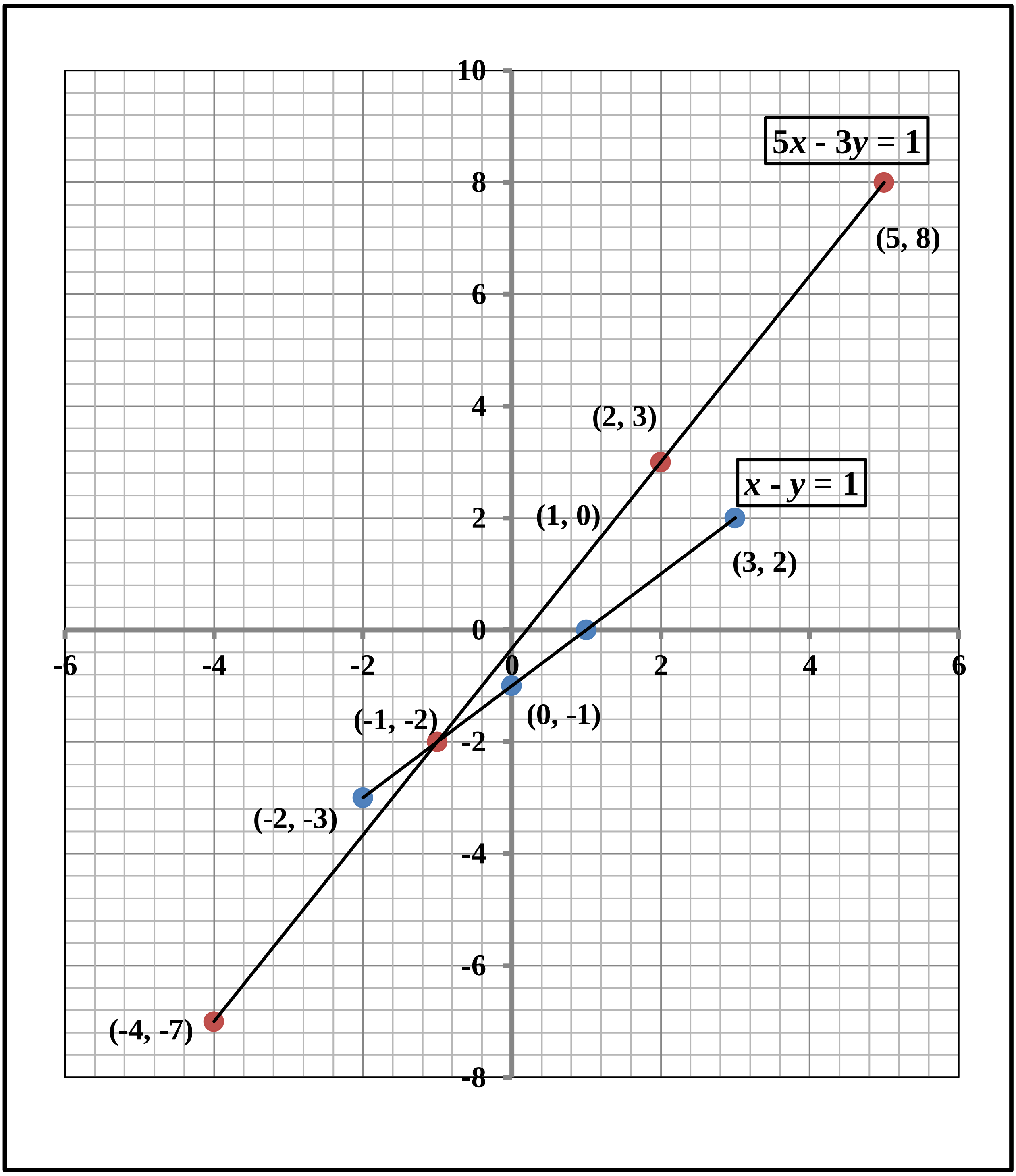
Solve the simultaneous equations graphically

$x - y = 1$ and $5x - 3y = 1$

SOLUTION:

Following are the co-ordinates of points for graphical representation of the equations:

$x - y = 1$			$5x - 3y = 1$	
x	y		x	y
0	-1		2	3
1	0		5	8
3	2		-1	-2
-2	-3		-4	-7



The co ordinates of point of intersection are (-1,-2)

Ans.: The solution of simultaneous equation is

$x = -1, y = -2$

Q. 47 navneet page 12

Use graphical method solve the simultaneous equations

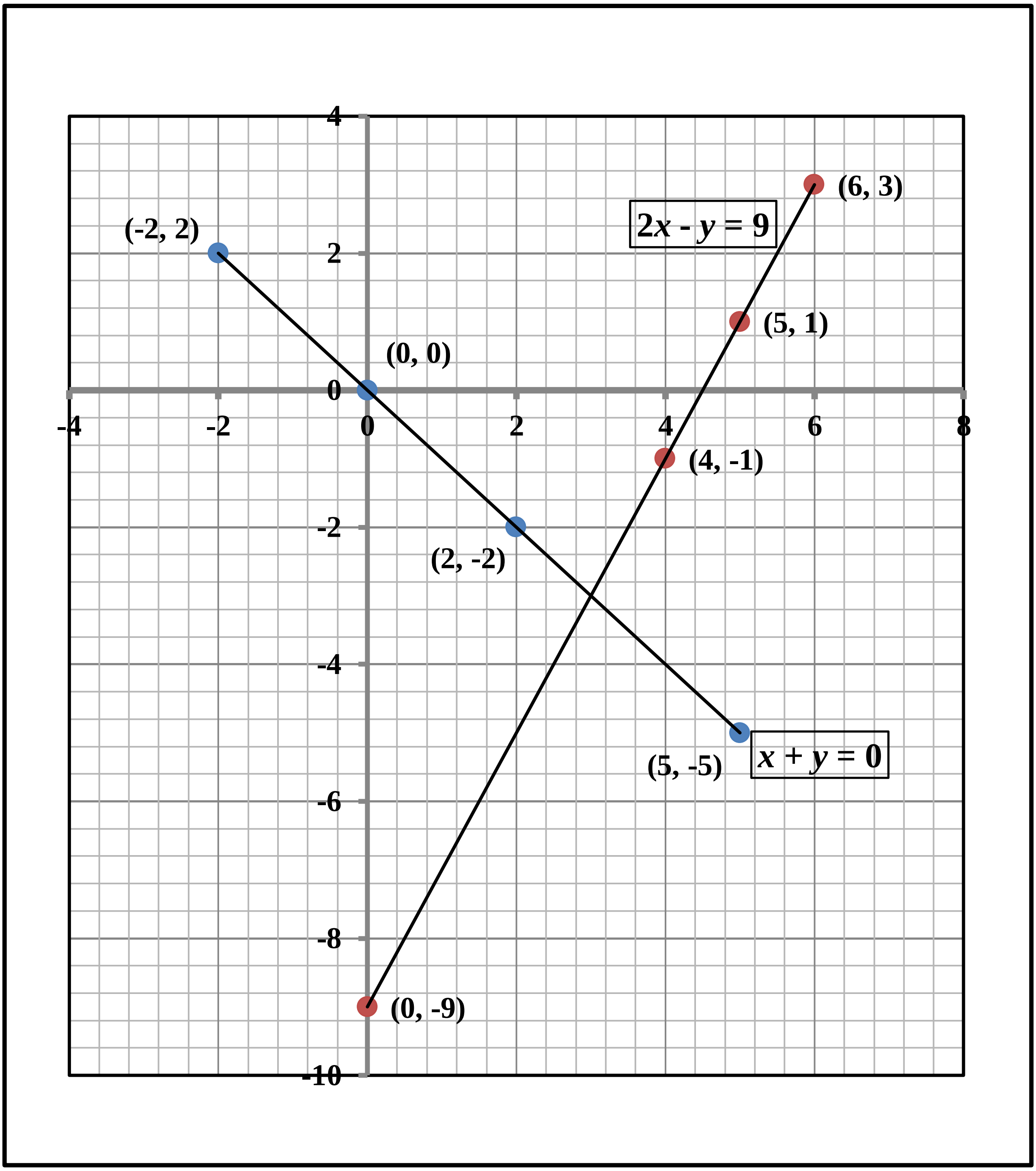
$x + y = 0$ and

$2x - y = 9$

SOLUTION:

Table for x, y co-ordinates is as below

$x + y = 0$			$2x - y = 9$	
x	y		x	y
-2	2		0	-9
0	0		4	-1
2	-2		5	1
5	-5		6	3



Point of intersection is (3 -3)

Ans.: The solution of simultaneous equation is

$x = 3, y = -3$

Q. 48 target page8

Solve the simultaneous equations graphically

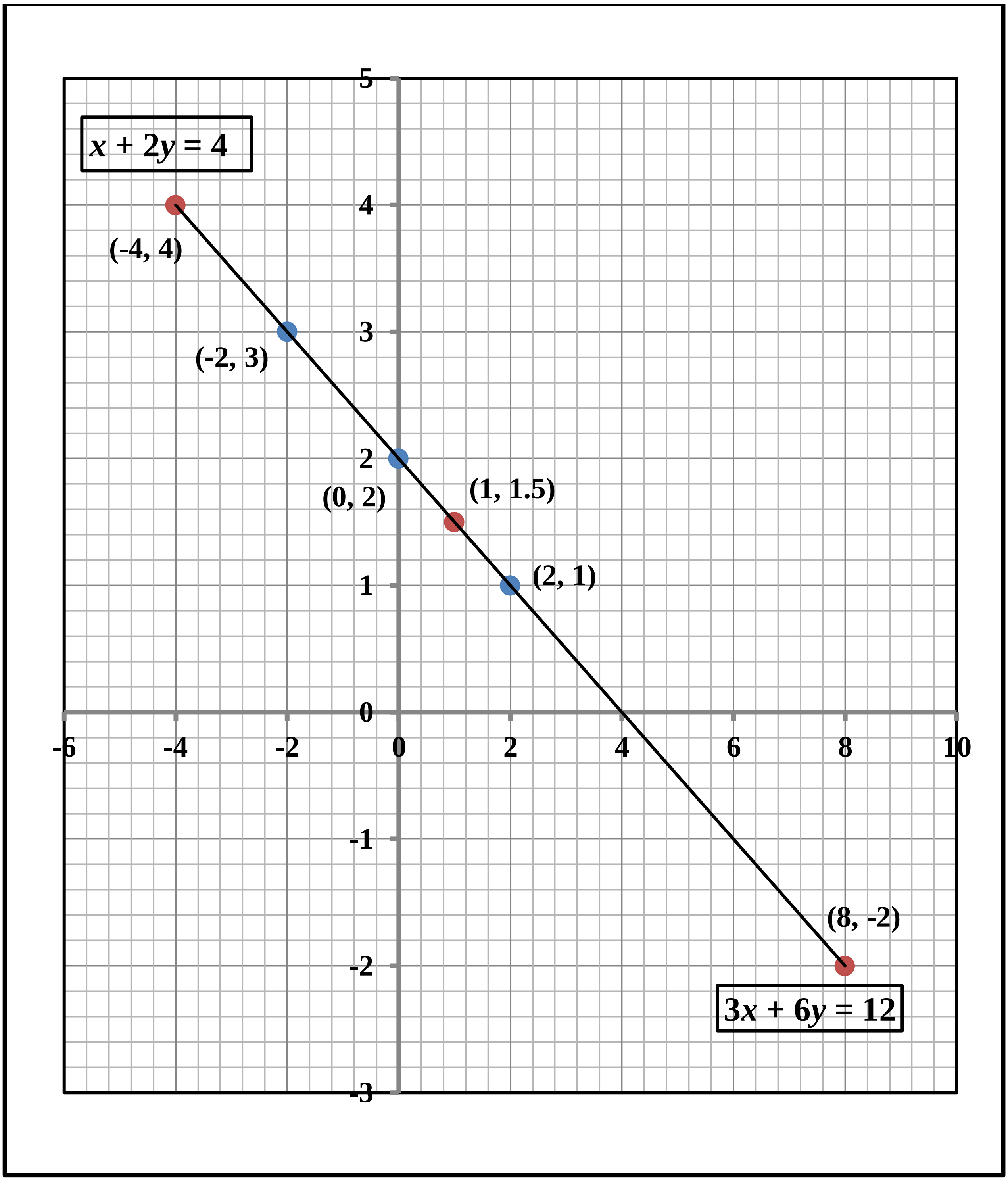
$x + 2y = 4$ **and**

$3x + 6y = 12$

SOLUTION:

Following are the co-ordinates of points for graphical representation of the equations:

$x + 2y = 4$			$3x + 6y = 12$	
x	y		x	y
-2	3		- 4	4
0	2		1	1.5
2	1		8	- 2



The graph of both equations is same

Ans.: The solution of simultaneous equation are (2, -3), (0, 2), (1, 1.5) etc.

Q. 49.

A rectangular ground has length 12 m more than the width and its perimeter is 120m. Find the length and width of the ground.

SOLUTION:

Suppose the length of ground be x m & width of ground be y m.

From the condition length 12m more than the width,

$x = y + 12$

$x - y = 12 \quad \ldots (1)$

Perimeter = 120 m, hence

$2(x + y) = 120$

$x + y = 60 \quad \ldots (2)$

Adding (1) & (2)

$x + y + x - y = 60 + 12$

$\therefore\ 2x = 72$

$\therefore\ x = 36$

Putting $x = 36$ in Eqn (2)

$x + y = 60$

$36 + y = 60$

$\therefore\ y = 24$

Ans.: Length = 36m & width= 24 m

Q. 50. target page15

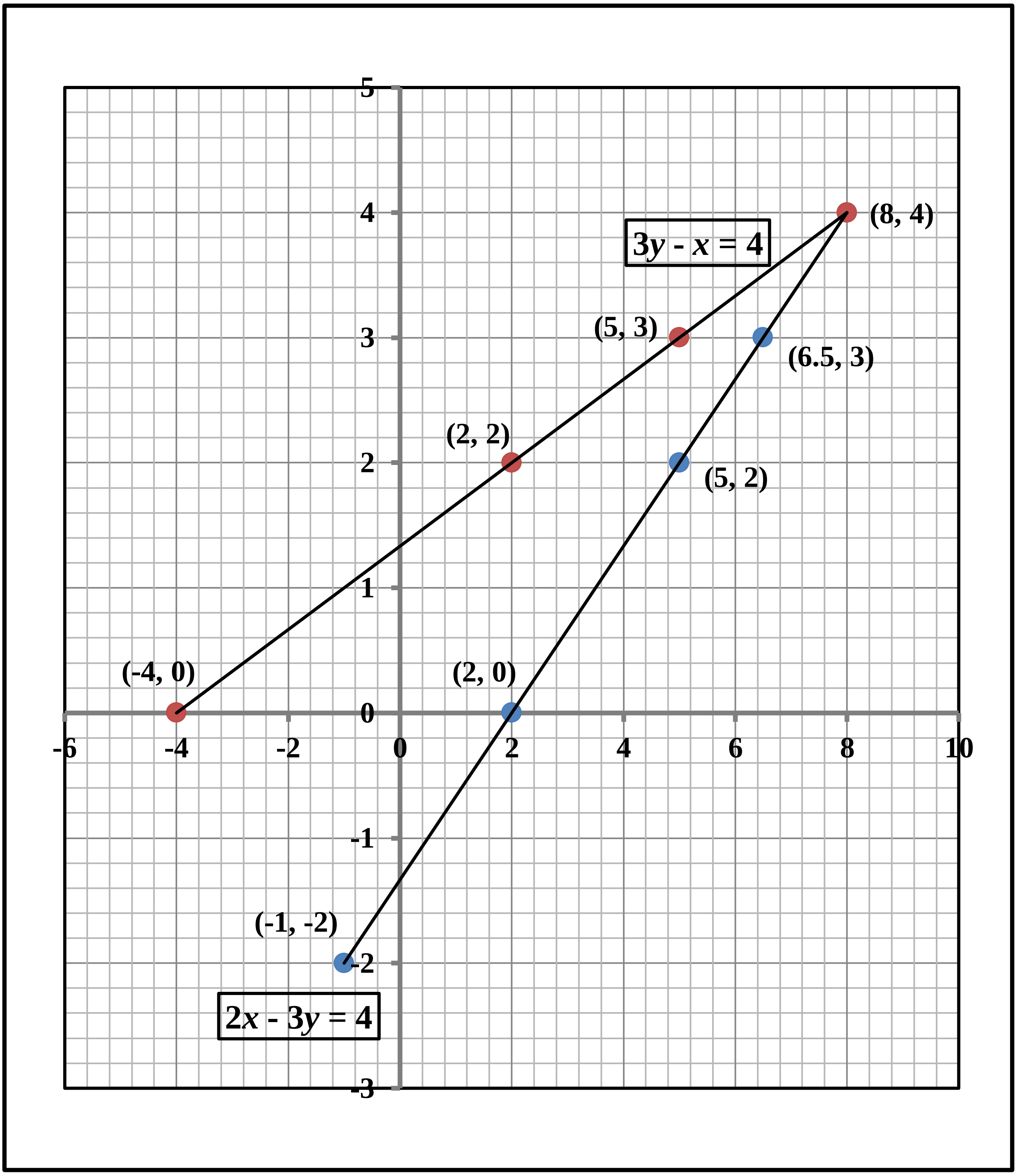
Solve the simultaneous equations graphically

$2x - 3v = 4$ and $3y - x = 4$

SOLUTION:

Following are the co-ordinates of points for graphical representation of the equations:

$2x - 3y = 4$			$3y - x = 4$	
x	y		x	y
2	0		2	2
-1	-2		-4	0
5	2		5	3
6.5	3		8	4
8	4			



The co ordinates of point of intersection are (8, 4)

Ans.: The solution of simultaneous equation is $x = 8$, $y = 4$