CLASS X: MATHS
Chapter 3: Pair of Linear Equations in Two Variables

Questions and Solutions | Exercise 3.1 - NCERT Books

Q1. Form the pair of linear equations in the following problems, and find their solutions graphi cally.

(i) 10 students of class X took part in a Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.

(ii) 5 pencils and 7 pens together cost ` 50, whereas 7 pencils and 5 pens together cost 46.

Find the cost of one pencil and that of one pen.

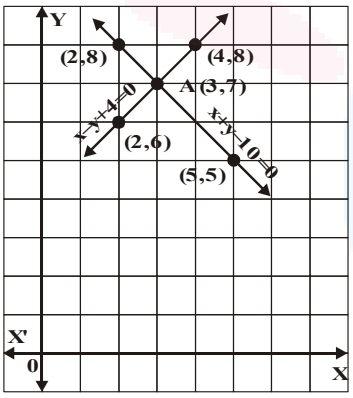
Sol. (i) Let the number of boys be x and the number of girls be y.

According to the given conditions

$x + y = 10$ and $y = x + 4$

We get the required pair of linear equations as

$x + y - 10 = 0$, $x - y + 4 = 0$



Graphical Solution

$x + y - 10 = 0$ ...(i)

x	2	5
$y = 10 - x$	8	5

$x - y + 4 = 0$ ...(ii)

x	2	4
$y = x + 4$	6	8

From the graph, we have : $x = 3$, $y = 7$ common solution of the two linear equations.

Hence, the number of boys = 3 and the number of girls = 7.

(ii) Let the cost of 1 pencil be Rs x and cost of 1 pen be Rs. y.

$5x + 7y = 50$

$7x + 5y = 46$

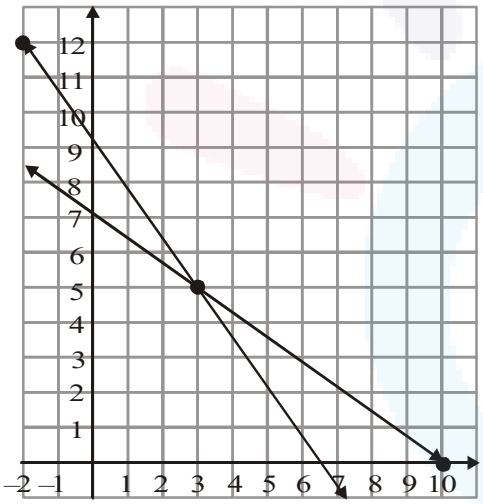
Graphical solution

$5x + 7y = 50°$ $7x + 5x = 46$

$y = \frac{50 - 5x}{7}$ $y = \frac{46 - 7x}{5}$

x	3	10
y	5	0

x	3	–2
y	5	12



From the graph we have x = 3, y = 5.

Hence, cost of one pencil = Rs.3 and cost of one pen = Rs.5

Q2. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincident.

(i) $5x - 4y + 8 = 0$; $7x + 6y - 9 = 0$

(ii) $9x + 3y + 12 = 0$; $18x + 6y + 24 = 0$

(iii) $6x - 3y + 10 = 0$; $2x - y + 9 = 0$

Sol. (i) $5x - 4y + 8 = 0$ ...(i)

$7x + 6y - 9 = 0$ ...(ii)

$\frac{a_1}{a_2} = \frac{5}{7}, \frac{b_1}{b_2} = \frac{-4}{6} = -\frac{2}{3}$ $\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow$ Lines represented by (i) and (ii) intersect at a point

(ii) $9x + 3y + 12 = 0$ .....(i)

$18x + 6y + 24 = 0$ ....(ii)

$\frac{a_1}{a_2} = \frac{9}{18}, \frac{b_1}{b_2} = \frac{3}{6}, \frac{c_1}{c_2} = \frac{12}{24}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\therefore$ Lines represented by (i) and (ii) are coincident.

(iii) $6x - 3y + 10 = 0$ .....(i)

$2x - y + 9 = 0$ .....(ii)

$\frac{a_1}{a_2} = \frac{6}{2} = \frac{3}{1}, \frac{b_1}{b_2} = \frac{-3}{-1} = \frac{3}{1}, \frac{c_1}{c_2} = \frac{10}{9}$

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

$\therefore$ Lines represented by (i) and (ii) are parallel

Q3. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the following pairs of linear equations are consistent, or inconsistent.

(i) $3x + 2y = 5$; $2x - 3y = 7$

(ii) $2x - 3y = 8$; $4x - 6y = 9$

(iii) $\frac{3}{2}x + \frac{5}{3}y = 7;\ 9x - 10y = 14$

(iv) $5x - 3y = 11;\ -10x + 6y = -22$

(v) $\frac{4}{3}x + 2y = 8;\ 2x + 3y = 12$

Sol. (i) $3x + 2y - 5 = 0$ ...(i)

$2x - 3y - 7 = 0$ ...(ii)

$\frac{a_1}{a_2} = \frac{3}{2}; \frac{b_1}{b_2} = \frac{2}{-3} = -\frac{2}{3}$

$\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow$ The equations have a unique solution.
Hence, consistent.

(ii) $2x - 3y = 8$ .....(i)

$4x - 6y = 9$ ....(ii)

$\frac{a_1}{a_2} = \frac{2}{4}, \frac{b_1}{b_2} = \frac{-3}{-6}, \frac{c_1}{c_2} = \frac{8}{9}$

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

$\therefore$ The equations have no solution. Hence inconsistent.

(iii) $\frac{3}{2}x + \frac{5}{3}y = 7$ .....(i)

$9x - 10y = 14$ .....(ii)

$\frac{a_1}{a_2} = \frac{3/2}{9} = \frac{1}{6}, \frac{b_1}{b_2} = \frac{5/3}{-10} = \frac{-1}{6}$

$\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow$ The equations have a unique solutions
Hence, consistent.

(iv) $5x - 3y = 11$ .....(i)
$-10x + 6y = -22$ .....(ii)

$\frac{a_1}{a_2} = \frac{5}{-10} = \frac{-1}{2}, \frac{b_1}{b_2} = \frac{-3}{6} = \frac{-1}{2},$

$\frac{c_1}{c_2} = \frac{11}{-22} = \frac{-1}{2}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

The equations have infinite solutions.
Hence, consistent.

(v) $\frac{4}{3}x + 2y = 8$ .....(i)

$2x + 3y = 12$ .....(ii)

$\frac{a_1}{a_2} = \frac{4/3}{2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{2}{3} = \frac{c_1}{c_2} = \frac{8}{12} = \frac{2}{3}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

The equations have infinite solutions.
Hence, consistent.

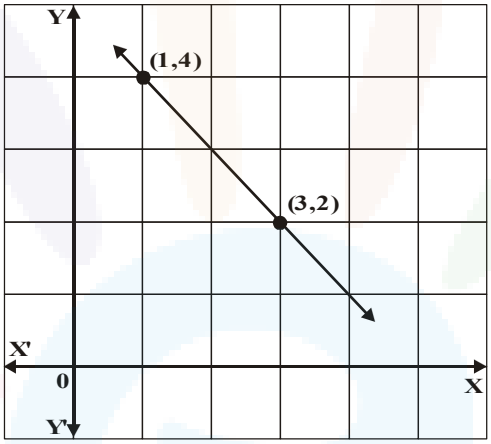
Q4. Which of the following pairs of linear equations are consistent/inconsistent? If consistent, obtain the solution graphically :
(i) $x + y = 5, 2x + 2y = 10$
(ii) $x - y = 8, 3x - 3y = 16$
(iii) $2x + y - 6 = 0, 4x - 2y - 4 = 0$
(iv) $2x - 2y - 2 = 0, 4x - 4y - 5 = 0$

Sol. (i) $x + y = 5$ ...(i)

$2x + 2y = 10$ ...(ii)

$\frac{a_1}{a_2} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-5}{-10} = \frac{1}{2}$

i.e., $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$



Hence, the pair of linear equations is consistent.
(i) and (ii) are same equations and hence the graph is coincident straight line.

x	1	3
y = 5 – x	4	2

(ii) $x - y = 8$ .....(i)

$3x - 3y = 16$ .....(ii)

$\frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{-1}{-3} = \frac{1}{3}, \frac{c_1}{c_2} = \frac{8}{16} = \frac{1}{2}$

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

Therefore, lines have no solution
Hence, inconsistent.

(iii) $2x + y = 6$ .....(i)

$4x - 2y = 4$ .....(ii)

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{-2} = \frac{-1}{2}, \frac{c_1}{c_2} = \frac{6}{4} = \frac{3}{2}$

$\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

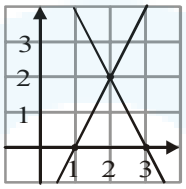
Therefore, lines have unique solution.

Hence, consistent

from (i) from (ii)

x	2	3
y	2	0

x	2	1
y	2	0



from graph $x = 2, y = 2$

(iv) $2x - 2y = 2$ .....(i)

$4x - 4y = 5$ .....(ii)

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{-2}{-4} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{2}{5}$

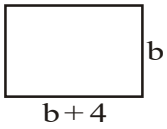
$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Therefore, lines have no solution.

Hence, Inconsistent.

Q5. Half the perimeter of a rectangular garden, whose length is 4 m more than its width, is 36 m. Find the dimensions of the garden

Sol.



Length, ℓ = b + 4 and Breadth = b

Perimeter of rectangle = 2 (ℓ + b)

$\frac{1}{2}$ [2 (ℓ + b)] = 36

(ℓ + b) = 36 .....(i)

As, ℓ = b + 4, so puting the value of ℓ in equation (i), we get

$\Rightarrow$ b + 4 + b = 36

2b + 4 = 36

2b = 32

b = 16m, ℓ = b + 4 = 16 + 4 = 20m

Thus, length of garden = 20m and breadth of garden = 16 m

Q6. Given the linear equation 2x + 3y – 8 = 0, write another linear equation in two variables such that the geometrical representation of the pair so formed is :

(i) Intersecting lines

(ii) Parallel lines

(iii) Coincident lines

Sol. (i) 2x + 3y – 8 = 0 (Given equation)

3x + 2y + 4 = 0 (New equation)

Here, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Hence, the graph of the two equations will be two intersecting lines.

(ii) $2x + 3y - 8 = 0$ (given equation)
$4x + 6y - 10 = 0$ (New equation)

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the graph of the two equations will be two parallel lines.

(iii) $2x + 3y - 8 = 0$ (given equation)
$4x + 6y - 16 = 0$ (New equation)

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Hence, the graph of the two equations will be two conicident lines.

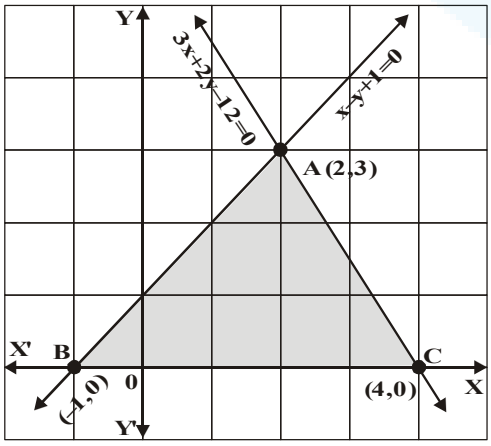
Q7. Draw the graphs of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Determine the coordinates of the vertices of the triangle formed by these lines and the x-axis, and shade the triangular region.

Sol. $x - y + 1 = 0$ ...(i)

x	–1	2
$y = x + 1$	0	3

$3x + 2y - 12 = 0$ ...(ii)

x	2	4
$y = \frac{12 - 3x}{2}$	3	0



The vertices of the triangle are
A (2, 3), B (–1, 0) and C (4, 0)

Questions and Solutions | Exercise 3.2 - NCERT Books

Q1. Solve the following pair of linear equations by the substitution method.

(i) $x + y = 14, x - y = 4$

(ii) $s - t = 3, \frac{s}{3} + \frac{t}{2} = 6$

(iii) $3x - y = 3, 9x - 3y = 9$

(iv) $0.2x + 0.3y = 1.3, 0.4x + 0.5y = 2.3$

(v) $\sqrt{2}x + \sqrt{3}y = 0, \sqrt{3}x - \sqrt{8}y = 0$

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2, \frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

Sol. (i) $x + y = 14$ ...(i)
$x - y = 4$ ...(ii)
From (ii) $y = x - 4$ ...(iii)
Substituting y from (iii) in (i), we get
$x + x - 4 = 14$
$\Rightarrow 2x = 18$
$\Rightarrow x = 9$
Substituting $x = 9$ in (iii), we get
$y = 9 - 4 = 5$,
i.e, $y = 5$
$x = 9, y = 5$

(ii) $s - t = 3$ ...(i)
$\frac{s}{3} + \frac{t}{2} = 6$ ...(ii)
From (i) $s = t + 3$ ...(iii)
Substituting s from (iii) in (ii), we get
$\frac{t+3}{3} + \frac{t}{2} = 6$
$\Rightarrow 2(t + 3) + 3t = 36$
$\Rightarrow 5t + 6 = 36$
$\Rightarrow t = 6$

From (iii), s = 6 +3 = 9,
Hence, s = 9, t = 6

(iii) $3x - y = 3$ .....(i)
$9x - 3y = 9$ .....(ii)
From (i) $y = 3x - 3$ .....(iii)
Substituting y from (iii) in (ii), we get
$9x - 3(3x - 3) = 9$
$9x - 9x + 9 = 9$
$9 = 9$
It means, equation have infinite solutions.

(iv) $0.2x + 0.3y = 1.3$ .....(i)
$0.4x + 0.5y = 2.3$ .....(ii)
From (i) $y = \frac{1.3 - 0.2x}{0.3}$ .....(iii)
Substituting y from (iii) in (ii), we get

$$0.4x + 0.5\left(\frac{1.3 - 0.2x}{0.3}\right) = 2.3$$

$$\Rightarrow 0.4x + \frac{13}{6} - \frac{x}{3} = 2.3$$

$$\Rightarrow \frac{2}{5}x - \frac{x}{3} = 2.3 - \frac{13}{6}$$

$$\Rightarrow \frac{x}{15} = \frac{4}{30}$$

$\Rightarrow x = 2$
Substituting x = 2 in (iii)
$y = 3 \times 2 - 3$
Hence, y = 3

(v) $\sqrt{2}x + \sqrt{3}y = 0$ .....(i)
$\sqrt{3}x - \sqrt{8}y = 0$ .....(ii)
From (ii) $y = \frac{\sqrt{3}x}{\sqrt{8}}$ .....(iii)
Substituting y from (iii) in (i), we get

$$\sqrt{2}x + \sqrt{3} \times \frac{\sqrt{3}x}{\sqrt{8}} = 0$$

$\Rightarrow \frac{4x+3x}{\sqrt{8}} = 0 \Rightarrow 7x = 0$

$x = 0$

Substituting $x = 0$ in (iii)

Hence, $y = 0$

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$ .....(i)

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ .....(ii)

From (i) $y = \frac{\frac{3x}{2}+2}{5/3} = \frac{9x+12}{10}$ ....(iii)

Substituting y from (iii) in (ii), we get

$\frac{x}{3} + \frac{9x+12}{10\times 2} = \frac{13}{6}$

$\Rightarrow \frac{x}{3} + \frac{9x}{20} + \frac{3}{5} = \frac{13}{6}$

$\Rightarrow \frac{47x}{60} = \frac{47}{30}$

$x = 2$

Substituting $x = 2$ in (iii)

$y = \frac{9\times 2+12}{10}$

Hence, $y = 3$.

Q2. Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$

Sol. $2x + 3y = 11$ .....(i)

$2x - 4y = -24$ .....(ii)

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

$2x + 3y - 2x + 4y = 11 + 24$

$7y = 35$

$y = 5$

Substituting value of y in equation (i), we get
$2x + 3 \times 5 = 11$
$2x = 11 - 15$

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

Now, $x = -2$, $y = 5$
Puting value of x & y in $y = mx + 3$
$5 = -2m + 3$
$\Rightarrow 2 = -2m$
$\Rightarrow m = -1$

Q3. From the pair of linear equations for the following problems and find their solution by substitution method.

(i) The difference between two numbers is 26 and one number is three times the other. Find them.

(ii) The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.

(iii) The coach of a cricket team buys 7 bats and 6 balls for Rs. 3800. Later, she buys 3 bats and 5 balls for Rs. 1750. Find the cost of each bat and each ball.

(iv) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is Rs. 105 and for a journey of 15 km, the charge paid is Rs. 155. What are the fixed charges and the charge per kilometer? How much does a person have to pay for travelling a distance of 25 km?

(v) A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator. If, 3 is added to both the numerator and the denominator it becomes $\frac{5}{6}$. Find the fraction.

(vi) Five years hence, the age of jacob will be three times that of his son. Five years ago, Jacob's age was seven times that of his son. What are their present ages?

Sol. (i) Let the two numbers be x and y ($x > y$). Then,
$x - y = 26$ ...(i)
$x = 3y$ ...(ii)
Substituting value of x from (ii) in (i)
$3y - y = 26$
$2y = 26$
$y = 13$

Substituting value of y in (ii) $x = 3 \times 13 = 39$
Thus, two numbers are 13 and 39.

(ii) Let the supplementary angles be x and y (x > y) Then,
$x + y = 180$ ...(i)
$x - y = 18$ ... (ii)
from (i) $x = 18 + y$ ...(iii)
Substituting value of x from (iii) in (i)
$18 + y + y = 180$
$2y = 180 - 18$

$y = \frac{162}{2} = 81$

from (iii) $x = 18 + 81 = 99$
Thus, the angles are 99° and 81

(iii) Let the cost price of 1 bat is Rs x
and the cost price of 1 ball is Rs y
$7x + 6y = 3800$ .....(i)
$3x + 5y = 1750$ .....(ii)
From (i)
$7x = 3800 - 6y$

$x = \frac{3800 - 6y}{7}$ ...(iii)

Substituting value of x from (iii) in (ii), we get

$3\left(\frac{3800 - 6y}{7}\right) + 5y = 1750$

$11400 - 18y + 35y = 12250$
$17y = 850$
$y = 50$

From (iii) $x = \frac{3800 - 300}{7} = 500$

Thus, cost price of 1 bat is Rs. 500 and 1 ball is Rs. 50

(iv) Let fixed charge be Rs x and charge per km be Rs y. Then,

$x + 10y = 105$ ...(i)

$x + 15y = 155$ ...(ii)

From equation (i)

$x = 105 - 10y$ ...(iii)

Substituting value of x from (iii) in (ii)

$105 - 10y + 15y = 155$

$105 + 5y = 155$

$5y = 50$

$y = 10$

from (iii) $x = 105 - 10 \times 10 = 5$

Thus, fixed charge is Rs. 10 and charge per km is Rs. 5

(v) Let $\frac{x}{y}$ be the fraction where x and y are positive integers.

$\frac{x+2}{y+2} = \frac{9}{11}$

$11x + 22 = 9y + 18$

$11x - 9y = -4$ ...(i)

$\frac{x+3}{y+3} = \frac{5}{6}$

$6x + 18 = 5y + 15$

$6x - 5y = -3$ ...(ii)

From (i)

$11x = 9y - 4$

$x = \frac{9y-4}{11}$ ...(iii)

Substituting value of x from (iii) in (ii)

$6\left(\frac{9y-4}{11}\right) - 5y = 3$

$54y - 24 - 55y = -33$

$y = 33 - 24$

$y = 9$

From (iii) $x = \frac{9 \times 9 - 4}{11} = 7$

Thus, fraction is 7/9.

(vi) Let x (in years) be the present age of Jacob's son and y (in years) be the present age of Jacob. Then,

$y + 5 = 3(x + 5)$

$3x - y = -10$ ...(i)

$y - 5 = 7(x - 5)$

$7x - y = 30$ ...(ii)

From (i) $y = 3x + 10$ ...(iii)

Substituting value of y from (iii) in (ii)

$7x - (3x + 10) = 30$

$4x = 40$

$x = 10$

From (iii) $y = 40$

Thus, Jacob's present age is 40 years and his son's the age is 10 years.

Questions and Solutions | Exercise 3.3 - NCERT Books

Q1. Solve the following pair of equations by the elimination method and the substitution method :

(i) $x + y = 5$ and $2x - 3y = 4$

(ii) $3x + 4y = 10$ and $2x - 2y = 2$

(iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$

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

Sol. (i) Solution By Elimination Method:
$x + y = 5$ ...(i)
$2x - 3y = 4$ ...(ii)
Multiplying (i) by 3 and (ii) by 1 and adding we get $3(x + y) + 1(2x - 3y) = 3 \times 5 + 1 \times 4$
$\Rightarrow 3x + 3y + 2x - 3y = 19$
$\Rightarrow 5x = 19 \Rightarrow x = \frac{19}{5}$
From (i), substituting $x = \frac{19}{5}$, we get
$\frac{19}{5} + y = 5 \Rightarrow y = 5 - \frac{19}{5} \Rightarrow y = \frac{6}{5}$
Hence, $x = \frac{19}{5}, y = \frac{6}{5}$

(i) Solution By Substitution Method :
$x + y = 5$ ...(i)
$2x - 3y = 4$ ...(ii)
From (i), $y = 5 - x$ ...(iii)
Substituting y from (iii) in (ii), $2x - 3(5 - x) = 4$
$\Rightarrow 2x - 15 + 3x = 4$
$\Rightarrow 5x = 19 \Rightarrow x = \frac{19}{5}$
Then from (iii), $y = 5 - \frac{19}{5} \Rightarrow y = \frac{6}{5}$
Hence, $x = \frac{19}{5}, y = \frac{6}{5}$

(ii) Solution by elimination method
$3x + 4y = 10$ ...(i)
$2x - 2y = 2$ ...(ii)
multiplying (ii) equation by 2, we get
$4x - 4y = 4$ ...(iii)
Add equation (i) and (iii), we get
$7x = 14$
$\Rightarrow x = 2$
Substituting, $x = 2$ in (i), we get
$3 \times 2 + 4 \times y = 10$
$\Rightarrow 4y = 4$
$\Rightarrow y = 1$
Hence, $x = 2, y = 1$

(ii) Solution by substitution method
$3x + 4y = 10$ ...(i)
$2x - 2y = 2$ ...(ii)

From (ii), $y = \frac{2x-2}{2} = x - 1$ ...(iii)

Substituting, $y = x - 1$ in (i), we get

$3x + 4(x - 1) = 10$

$\Rightarrow 3x + 4x - 4 = 10$

$\Rightarrow 7x = 14$

$x = 2$

Then from (iii)

$y = 2 - 1 = 1$

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

(iii) Solution by elimation method

$3x - 5y = 4$ ...(i)

$9x = 2y + 7$ ...(ii)

Multiplying (i) equation by 3, we get

$9x - 15y = 12$ ...(iii)

Subtracting (iii) from (ii), we get

$9x - 9x + 15y = 2y + 7 - 12$

$\Rightarrow 15y - 2y = 7 - 12$

$13y = -5$

$y = \frac{-5}{13}$

From (i) substituting value of $y = \frac{-5}{13}$

$3x = 5 \times \left(\frac{-5}{13}\right) + 4$

$\Rightarrow 3x = \frac{-25}{13} + 7$

$\Rightarrow 3x = \frac{-25+52}{13}$

$3x = \frac{27}{13}$

$x = \frac{9}{13}$

Hence, $y = \frac{-5}{13}$, $x = \frac{9}{13}$

(iii) Solution by substitution method

$3x - 5y = 4$ ...(i)

$9x = 2y + 7$ ...(ii)

From (i)

$x = \frac{4+5y}{3}$ ...(iii)

Substuting $x = \frac{4+5y}{3}$ in (ii)

$9 \times \frac{4+5y}{3} = 2y + 7$

$12 + 15y = 2y + 7$

$y = \frac{-5}{13}$

from (iii)

$x = \frac{4+5\left(\frac{-5}{13}\right)}{3} = \frac{27}{39}$

Hence, $y = \frac{-5}{13}$, $x = \frac{9}{13}$

(iv) Solution by elimination method

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

$x - \frac{y}{3} = 3$ ...(ii)

Multiplying (ii), we get

$2x - \frac{2y}{3} = 6$ ...(iii)

Adding (i) and (iii), we get

$2x + \frac{x}{2} = -1 + 6$

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

$\Rightarrow x = 2$

From (ii) substituting x = 2, in equation (ii), we get

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

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

$\Rightarrow y = -3$

Hence, x = 2, y = – 3

(iv) Solution by substitution method

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

$x - \frac{y}{3} = 3$ ...(ii)

from (ii), $x = 3 + \frac{y}{3}$ ...(iii)

Substituting x from (iii) in (i), we get

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

$\Rightarrow \frac{3}{2} + \frac{y}{6} + \frac{2y}{3} = -1$

$\Rightarrow \frac{y + 4y}{6} = -1 - \frac{3}{2}$

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

$\Rightarrow y = -3$

Substituting y = – 3 in equation (ii), we get

$\Rightarrow x - \frac{(-3)}{3} = 3$

$\Rightarrow x + 1 = 3$

$\Rightarrow x = 2$

Hence, x = 2, y = – 3

Q2. Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method :

(i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

(ii) Five years ago Nuri was thrice as old as Sonu. Ten years later, Nuri will be twice as old as Sonu. How old are Nuri and Sonu?

(iii) The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the number.

(iv) Meena went to a bank to withdraw Rs. 2000. She asked the cashier to give her Rs. 50 and Rs. 100 notes only. Meena got 25 notes in all. Find how many notes of Rs. 50 and Rs. 100 she received.

(v) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid Rs. 27 for a book kept for seven days, while Susy paid Rs. 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Sol. (i) Let fraction = $\frac{x}{y}$

$$\frac{x+1}{y-1} = 1,$$

$$x + 1 = y - 1$$

$$x - y = -2 \qquad ...(i)$$

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

$$2x = y + 1$$

$$2x - y = 1 \qquad ...(ii)$$

Multiplying (i) by 2 and (ii) by 1 and substracting we get

$$\begin{array}{r} 2x - 2y = -4 \\ 2x - y = 1 \\ \hline -y = -5 \end{array}$$

Subtracting,

$y = 5$

Substituting $y = 5$ in (ii), we get

$2x - 5 = 1 \Rightarrow x = 3$

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

(ii) Let present age of Nuri = x years

Let present age of Sonu = y years

Five years ago,

$x - 5 = 3(y - 5)$

$x - 5 = 3y - 15$

$x - 3y = -10$ ...(i)

Ten years later,

$(x + 10) = 2(y + 10)$

$x + 10 = 2y + 20$

$x - 2y = 10$ ...(ii)

Substracting (ii) from (i)

$x - 3y = -10$

$x - 2y = +10$

$-y = -20$

$\Rightarrow y = 20$

Substituting $y = 20$ in (ii), we get

$x - 2 \times 20 = 10$

$\Rightarrow x = 50$

So, present age of Nuri is 50 years

present age of Sonu is 20 years

(iii) Let unit digit = x, ten's digit = y

So, original number = $10y + x$

$9(10y + x) = 2(10x + y)$

$90y + 9x = 20x + 2y$

$88y = 11x$

$x = 8y$ ...(i)

Also given sum of digits = 9

$x + y = 9$ ...(ii)

from (i) and (ii)
$9y = 9$
$y = 1 \Rightarrow x = 8$
So, number $= 10 \times 1 + 8 = 18$

(iv) Let number of Rs.50 notes = x
and number of Rs.100 notes = y
total notes $= x + y = 25$ ...(i)
Also value of notes = Rs. 2000
$50x + 100y = 2000$
$x + 2y = 40$ ...(ii)
From (i) and (ii)
Number of Rs.50 notes = 10
Number of Rs.100 notes = 15

(v) Let fixed charge be Rs.x
and charge for each extra day by Rs.y
Then $x + 4y = 27$ ...(i)
$x + 2y = 21$ ...(ii)
Subtracting (ii) from (i)
$2y = 6$
$y = 3$
Substituting $y = 3$ in (i)
$\Rightarrow x = 15$
So fixed charge = Rs. 15
and charge for each extra day = Rs.3