pair of linear equations in two variables

3 Chapter

Exercise 3.1

1. Form the pair of linear equations in the following problems, and find their solutions graphically.

(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.

Ans: Assuming that the number of girls and boys be x and y respectively.

Writing the algebraic representation using the information given in the question:

$x+y=10$

$x-y=4$

Solution table for $x+y=10$:

$x=10-y$

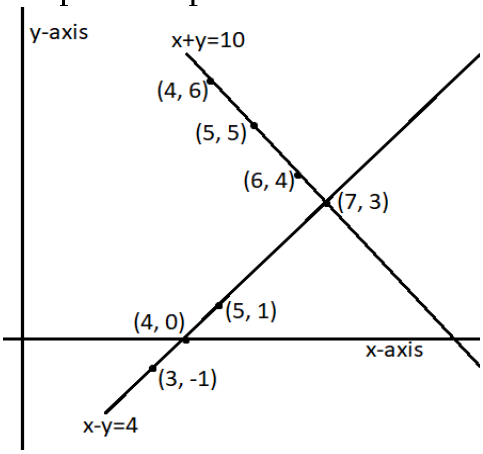
x	5	4	6
y	5	6	4

Solution table for $x-y=4$:

$x=4+y$

x	5	4	3
y	1	0	–1

Graphical representation:



As we can see from the graph above, the point of intersection for the lines is $(7,3)$. Therefore, we can say that there are 7 girls and 3 boys in the class.

(ii) 5 pencils and 7 pens together cost Rs 50, whereas 7 pencils and 5 pens together cost Rs 46. Find the cost of one pencil and that of one pen.

Ans: Assuming that the cost of 1 pencil and 1 pen be x and y respectively.
Writing the algebraic representation using the information given in the question:

$5x+7y=50$

$7x+5y=46$

Solution table for $5x+7y=50$:

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

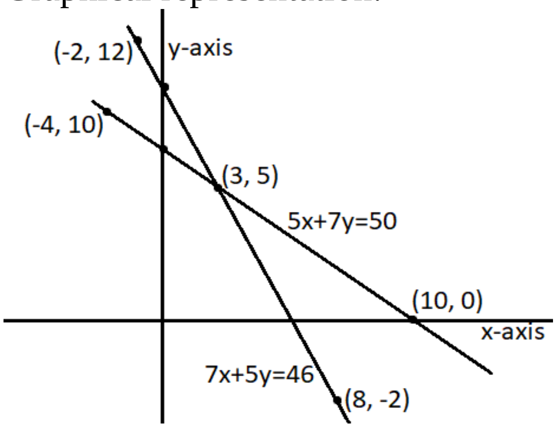
x	3	10	–4
y	5	0	10

Solution table for $7x+5y=46$:

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

x	8	3	–2
y	–2	5	12

Graphical representation:



As we can see from the graph above, the point of intersection for the lines is $(3,5)$. Therefore, we can say that the cost of a pencil is Rs 3 and the cost of a pen is Rs 5.

2. 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 at a point, are parallel or coincident:

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

$7x+6y-9=0$

Ans: $5x - 4y + 8 = 0$

$7x + 6y - 9 = 0$

Calculating the values of a_1, b_1, c_1, a_2, b_2 and c_2 by comparing the above equations with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$,

$a_1 = 5$, $b_1 = -4$, $c_1 = 8$

$a_2 = 7$, $b_2 = 6$, $c_2 = -9$

$$\frac{a_1}{a_2} = \frac{5}{7}$$

$$\frac{b_1}{b_2} = \frac{-4}{6} = \frac{-2}{3}$$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

Therefore, the given pair of equations have a unique solution, that is, the lines intersect at exactly one point.

(ii) $\mathbf{9x + 3y + 12 = 0}$

$\mathbf{18x + 6y + 24 = 0}$

Ans: Calculating the values of a_1, b_1, c_1, a_2, b_2 and c_2 by comparing the above equations with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$,

$a_1 = 9$, $b_1 = 3$, $c_1 = 12$

$a_2 = 18$, $b_2 = 6$, $c_2 = 24$

$$\frac{a_1}{a_2} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{1}{2}$$

$$\frac{c_1}{c_2} = \frac{1}{2}$$

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

Therefore, the lines representing the given pair of equations have infinite solutions as they are coincident.

(iii) $\mathbf{6x - 3y + 10 = 0}$

$\mathbf{2x - y + 9 = 0}$

Ans: Calculating the values of a_1, b_1, c_1, a_2, b_2 and c_2 by comparing the above equations with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$,

$a_1 = 6$, $b_1 = -3$, $c_1 = 10$

$a_2 = 2$, $b_2 = -1$, $c_2 = 9$

$$\frac{a_1}{a_2} = \frac{3}{1}$$

$\frac{b_1}{b_2} = \frac{3}{1}$

$\frac{c_1}{c_2} = \frac{10}{9}$

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

Therefore, the lines representing the given pair of equations have no solutions as they are parallel to each other.

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

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{3}{2}$

$\frac{b_1}{b_2} = \frac{-2}{3}$

$\frac{c_1}{c_2} = \frac{5}{7}$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

So, the given pair of equations have a unique solution, that is, the lines intersect at exactly one point.

Therefore, the given pair of lines is consistent.

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

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{1}{2}$

$\frac{c_1}{c_2} = \frac{8}{9}$

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

So, the lines representing the given pair of equations have no solutions as they are parallel to each other.

Therefore, the given pair of lines is inconsistent.

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

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{1}{6}$

$\frac{b_1}{b_2} = \frac{-1}{6}$

$\frac{c_1}{c_2} = \frac{1}{4}$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

So, the given pair of equations have a unique solution, that is, the lines intersect at exactly one point.

Therefore, the given pair of lines is consistent.

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

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{-1}{2}$

$\frac{b_1}{b_2} = \frac{-1}{2}$

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

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

So, the lines representing the given pair of equations have infinite number of solutions as they are coincident.

Therefore, the given pair of lines is consistent.

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

Ans: For the given equations**:**

$\frac{a_1}{a_2}=\frac{2}{3}$

$\frac{b_1}{b_2}=\frac{2}{3}$

$\frac{c_1}{c_2}=\frac{2}{3}$

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

So, the lines representing the given pair of equations have infinite number of solutions as they are coincident.

Therefore, the given pair of lines is consistent.

4. Which of the following pairs of linear equations are consistent/ inconsistent? If consistent, obtain the solution graphically:

(i) $\mathbf{x+y=5; 2x+2y=10}$

Ans: For the given equations**:**

$\frac{a_1}{a_2}=\frac{1}{2}$

$\frac{b_1}{b_2}=\frac{1}{2}$

$\frac{c_1}{c_2}=\frac{1}{2}$

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

So, the lines representing the given pair of equations have infinite number of solutions as they are coincident.

Therefore, the given pair of lines is consistent.

Solution table for $x+y=5$:

$x=5-y$

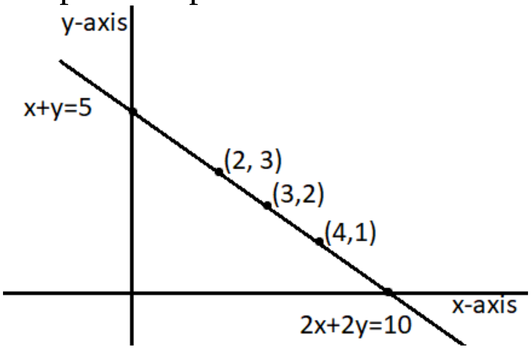
x	4	3	2
y	1	2	3

Solution table for $2x+2y=10$:

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

x	4	3	2
y	1	2	3

Graphical representation:



As shown in the graph above, the two lines are overlapping each other.
Hence, they have infinite solutions.

(ii) $x - y = 8; 3x - 3y = 16$

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{1}{3}$

$\frac{b_1}{b_2} = \frac{1}{3}$

$\frac{c_1}{c_2} = \frac{1}{2}$

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

So, the lines representing the given pair of equations have no solutions as they are parallel to each other.
Therefore, the given pair of lines is inconsistent.

(iii) $2x + y - 6 = 0; 4x - 2y - 4 = 0$

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{-1}{2}$

$\frac{c_1}{c_2} = \frac{3}{2}$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

So, the given pair of equations have a unique solution, that is, the lines intersect at exactly one point.

Therefore, the given pair of lines is consistent.

Solution table for $2x + y - 6 = 0$:

$y = 6 - 2x$

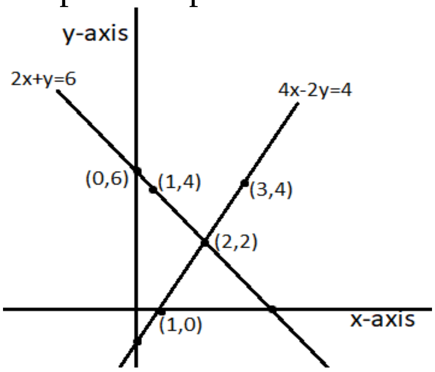
x	0	1	2
y	6	4	2

Solution table for $4x - 2y - 4 = 0$:

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

x	1	2	3
y	0	2	4

Graphical representation:



As shown in the graph above, the two lines intersect each other at only one point $(2, 2)$.

(iv) $\mathbf{2x - 2y - 2 = 0; 4x - 4y - 5 = 0}$

Ans: For the given equations**:**

$\frac{a_1}{a_2} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{1}{2}$

$$\frac{c_1}{c_2} = \frac{2}{5}$$

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

So, the lines representing the given pair of equations have no solutions as they are parallel to each other.

Therefore, the given pair of lines is inconsistent.

5. 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.

Ans: Assuming that the width and length of the garden be x and y respectively.

Writing the algebraic representation using the information given in the question:

$y - x = 4$

$x + y = 36$

Solution table for $y - x = 4$:

$y = x + 4$

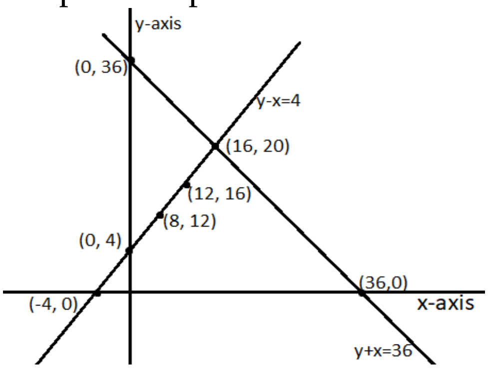
x	0	80	12
y	4	12	16

Solution table for $x + y = 36$:

$y = 36 - x$

x	0	36	16
y	36	0	20

Graphical representation:



As shown in the graph above, the two lines intersect each other at only one point $(16, 20)$. Therefore the length of the garden is 20 m and its breadth is 16 m.

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

(i) Intersecting lines

Ans: If two lines are intersecting then:

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

So, taking the second line as $2x+4y-6=0$,

Now,

$$\frac{a_1}{a_2} = 1$$

$$\frac{b_1}{b_2} = \frac{3}{4}$$

As $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, the two lines are interesting each other.

(ii) Parallel lines

Ans: If two lines are intersecting then:

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

So, taking the second line as $4x+6y-8=0$,

Now,

$$\frac{a_1}{a_2} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{1}{2}$$

$$\frac{c_1}{c_2} = 1$$

As $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the two lines are parallel to each other.

(iii) Coincident lines

Ans: If two lines are intersecting then:

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

So, taking the second line as $6x+9y-24=0$, Now,

$\frac{a_1}{a_2} = \frac{1}{3}$

$\frac{b_1}{b_2} = \frac{1}{3}$

$\frac{c_1}{c_2} = \frac{1}{3}$

As $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, the two lines are coincident.

7. 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.

Ans: Solution table for $x - y + 1 = 0$:

$x = y - 1$

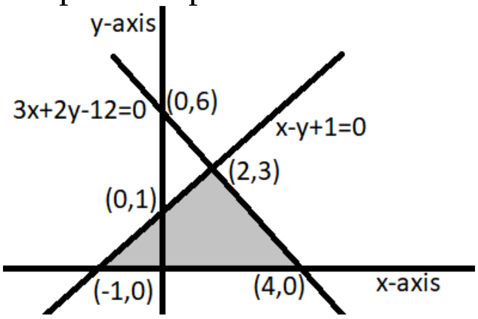
x	0	1	2
y	1	2	3

Solution table for $3x + 2y - 12 = 0$:

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

x	4	2	0
y	0	3	6

Graphical representation:



As shown in the graph above, the lines are intersecting each other at point $(2,3)$ and $x -$ axis at $(-1,0)$ and $(4,0)$. So the obtained triangle has vertices $(2,3)$, $(-1,0)$ and $(4,0)$.

Exercise 3.2

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

(i) $\mathbf{x+y=14; x-y=4}$

Ans: The given equations are:

$x+y=14$ …… (i)

$x-y=4$ …… (ii)

From equation (i):

$x=14-y$ …… (iii)

Substituting (iii) in equation (ii), we get

$(14-y)-y=4$

$14-2y=4$

$10=2y$

$y=5$ …… (iv)

Substituting (iv) in (iii), we get

$x=9$

Therefore, $x=9$ and $y=5$.

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

Ans: The given equations are:

$s-t=3$ …… (i)

$\frac{s}{3}+\frac{t}{2}=6$ …… (ii)

From equation (i):

$s=t+3$ …… (iii)

Substituting (iii) in equation (ii), we get

$\frac{t+3}{3}+\frac{t}{2}=6$

$2t+6+3t=36$

$5t=30$

$t=6$ …… (iv)

Substituting (iv) in (iii), we get

$s=9$

Therefore, $s=9$ and $t=6$.

(iii) $\mathbf{3x-y=3; 9x-3y=9}$

Ans: The given equations are:

$3x - y = 3$ …… (i)

$9x - 3y = 9$ …… (ii)

From equation (i):

$y = 3x - 3$ …… (iii)

Substituting (iii) in equation (ii), we get

$9x - 3(3x - 3) = 9$

$9x - 9x + 9 = 9$

$9 = 9$

For all x and y.

Therefore, the given equations have infinite solutions. One of the solution is $x = 1, y = 0$.

(iv) $\mathbf{0.2x - 0.3y = 1.3; 0.4x + 0.5y = 2.3}$

Ans: The given equations are:

$0.2x - 0.3y = 1.3$ …… (i)

$0.4x + 0.5y = 2.3$ …… (ii)

From equation (i):

$x = \frac{1.3 - 0.3y}{0.2}$ …… (iii)

Substituting (iii) in equation (ii), we get

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

$2.6 - 0.6y + 0.5y = 2.3$

$2.6 - 2.3 = 0.1y$

$y = 3$ …… (iv)

Substituting (iv) in (iii), we get

$x = \frac{1.3 - 0.3(3)}{0.2}$

$x = 2$

Therefore, $x = 2$ and $y = 3$.

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

Ans: The given equations are:

$\sqrt{2}x - \sqrt{3}y = 0$ …… (i)

$\sqrt{3}x - \sqrt{8}y = 0$ …… (ii)

From equation (i):

$x = \frac{-\sqrt{3}y}{\sqrt{2}}$ …… (iii)

Substituting (iii) in equation (ii), we get

$\sqrt{3}\left(\frac{-\sqrt{3}y}{\sqrt{2}}\right) - \sqrt{8}y = 0$

$\frac{-\sqrt{3}y}{\sqrt{2}} - 2\sqrt{2}y = 0$

$y\left(\frac{-\sqrt{3}}{\sqrt{2}} - 2\sqrt{2}\right) = 0$

$y = 0$ …… (iv)

Substituting (iv) in (iii), we get

$x = 0$

Therefore, $x = 0$ and $y = 0$.

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

Ans: The given equations are:

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

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

From equation (i):

$x = \frac{-12 + 10y}{9}$ …… (iii)

Substituting (iii) in equation (ii), we get

$\frac{\left(\frac{-12 + 10y}{9}\right)}{3} + \frac{y}{2} = \frac{13}{6}$

$\frac{-12 + 10y}{27} + \frac{y}{2} = \frac{13}{6}$

$\frac{-24 + 20y + 27y}{54} = \frac{13}{6}$

$47y = 141$

$y = 3$ …… (iv)

Substituting (iv) in (iii), we get

$x = 2$

Therefore, $x=0$ and $y=3$.

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

Ans: The given equations are:

$2x+3y=11$ …… (i)

$2x-4y=-24$ …… (ii)

From equation (i):

$x=\frac{11-3y}{2}$ …… (iii)

Substituting (iii) in equation (ii), we get

$2\left(\frac{11-3y}{2}\right)-4y=-24$

$11-3y-4y=-24$

$-7y=-35$

$y=5$ …… (iv)

Substituting (iv) in (iii), we get

$x=-2$

Therefore, $x=-2$ and $y=5$.

Calculating the value of m:

$y=mx+3$

$5=-2m+3$

$m=-1$

3. Form 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.

Ans: Assuming one number be x and another number be y such that $y>x$,

Writing the algebraic representation using the information given in the question:

$y=3x$ …… (i)

$y-x=26$ …… (ii)

Substituting the value of y from equation (i) in equation (ii), we get

$3x-x=26$

$2x=26$

$x=13$ …… (iii)

Substituting (iii) in (i), we get

$y = 39$

Therefore, $x = 13$ and $y = 39$.

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

Ans: Assuming the larger angle be x and smaller angle be y.

The sum of a pair of supplementary angles is always 180°.

Writing the algebraic representation using the information given in the question:

$x + y = 180$ …… (i)

$x - y = 18$ …… (ii)

Substituting the value of x from equation (i) in equation (ii), we get

$180 - y - y = 18$

$162 = 2y$

$y = 81$ …… (iii)

Substituting (iii) in (i), we get

$x = 99$

Therefore, the two angles are $x = 99^{\circ}$ and $y = 81^{\circ}$.

(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.

Ans: Assuming the cost of a bat is x and the cost of a ball is y.

Writing the algebraic representation using the information given in the question:

$7x + 6y = 3800$ …… (i)

$3x + 5y = 1750$ …… (ii)

From equation (i):

$y = \frac{3800 - 7x}{6}$ …… (iii)

Substituting (iii) in equation (ii):

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

$$3x + \frac{9500}{3} - \frac{35x}{6} = 1750$$

$$3x - \frac{35x}{6} = 1750 - \frac{9500}{3}$$

$$\frac{18x-35x}{6}=\frac{5250-9500}{3}$$

$$\frac{17x}{6}=\frac{-4250}{3}$$

$$x=500 \qquad \ldots\ldots \text{(iv)}$$

Substituting (iv) in (iii), we get

$$y=\frac{3800-7(500)}{6}$$

$$y=50$$

Therefore, the bat costs $\text{Rs } 500$ and the ball costs $\text{Rs } 50$.

(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 $\text{Rs } 105$ and for a journey of 15 km, the charge paid is $\text{Rs } 155$. What are the fixed charges and the charge per km? How much does a person have to pay for travelling a distance of 25 km.

Ans: Assuming the fixed charge be $\text{Rs } x$ and the per km charge be $\text{Rs } y$.

Writing the algebraic representation using the information given in the question:

$$x+10y=105 \qquad \ldots\ldots \text{(i)}$$

$$x+15y=155 \qquad \ldots\ldots \text{(ii)}$$

From equation (i):

$$x=105-10y \qquad \ldots\ldots \text{(iii)}$$

Substituting (iii) in equation (ii):

$$105-10y+15y=155$$

$$5y=50$$

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

Substituting (iv) in (iii), we get

$$x=105-10(10)$$

$$x=5$$

Therefore, the fixed charge is $\text{Rs } 5$ and the per km charge is $\text{Rs } 10$.

So, charge for 25 km will be:

$$=\text{Rs } (x+25y)$$

$$=\text{Rs } 255$$

(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.

Ans: Assuming the fraction be $\frac{x}{y}$.

Writing the algebraic representation using the information given in the question:

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

$$11x+22=9y+18$$

$$11x-9y=-4 \qquad \ldots\ldots \text{(i)}$$

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

$$6x+18=5y+15$$

$$6x-5y=-3 \qquad \ldots\ldots \text{(ii)}$$

From equation (i):

$$x=\frac{-4+9y}{11} \qquad \ldots\ldots \text{(iii)}$$

Substituting (iii) in equation (ii):

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

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

$$y=9 \qquad \ldots\ldots \text{(iv)}$$

Substituting (iv) in (iii), we get

$$x=\frac{-4+9(9)}{11}$$

$$x=7$$

Therefore, the fraction is $\frac{7}{9}$.

(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?

Ans: Assuming the age of Jacob be x and the age of his son be y.

Writing the algebraic representation using the information given in the question:

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

$$x-3y=10 \qquad \ldots\ldots \text{(i)}$$

$\left(x-5\right)=7\left(y-5\right)$

$x-7y=-30$ …… (ii)

From equation (i):

$x=3y+10$ …… (iii)

Substituting (iii) in equation (ii):

$3y+10-7y=-30$

$-4y=-40$

$y=10$ …… (iv)

Substituting (iv) in (iii), we get

$x=3\left(10\right)+10$

$x=40$

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

Exercise 3.3

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

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

Ans: Elimination method

The given equations are:

$x+y=5$ …… (i)

$2x-3y=4$ …… (ii)

Multiplying equation (ii) by 2, we get

$2x+2y=10$ …… (iii)

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

$5y=6$

$y=\frac{6}{5}$ …… (iv)

Substituting the value of (iv) in equation (i), we get

$x=5-\frac{6}{5}$

$x=\frac{19}{5}$

Therefore, $x=\frac{19}{5}$ and $y=\frac{6}{5}$.

Substitution method:

From equation (i) we get

$x=5-y$ …… (v)

Substituting (v) in equation (ii), we get

$2(5-y)-3y=4$

$-5y=-6$

$y=\frac{6}{5}$ …… (vi)

Substituting (vi) in equation (v), we obtain

$x=5-\frac{6}{5}$

$x=\frac{19}{5}$

Therefore, $x=\frac{19}{5}$ and $y=\frac{6}{5}$.

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

Ans: Elimination method

The given equations are:

$3x+4y=10$ …… (i)

$2x-2y=2$ …… (ii)

Multiplying equation (ii) by 2, we get

$4x-4y=4$ …… (iii)

Adding equation (ii) and (iii), we obtain

$7x=14$

$x=2$ …… (iv)

Substituting the value of (iv) in equation (i), we get

$6+4y=10$

$4y=4$

$y=1$

Therefore, $x=2$ and $y=1$.

Substitution method:

From equation (ii) we get

$x=1+y$ …… (v)

Substituting (v) in equation (i), we get

$3(1+y)+4y=10$

$7y=7$

$y=1$ …… (vi)

Substituting (vi) in equation (v), we obtain

$x = 1 + 1$

$x = 2$

Therefore, $x = 2$ and $y = 1$.

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

Ans: Elimination method

The given equations are:

$3x - 5y - 4 = 0$ …… (i)

$9x = 2y + 7$

$9x - 2y = 7$ …… (ii)

Multiplying equation (i) by 3, we get

$9x - 15y - 12 = 0$ …… (iii)

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

$13y = -5$

$y = -\frac{5}{13}$ …… (iv)

Substituting the value of (iv) in equation (i), we get

$3x + \frac{25}{13} - 4 = 0$

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

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

Therefore, $x = \frac{9}{13}$ and $y = -\frac{5}{13}$.

Substitution method:

From equation (i) we get

$x = \frac{5y + 4}{3}$ …… (v)

Substituting (v) in equation (ii), we get

$9\left(\frac{5y + 4}{3}\right) - 2y - 7 = 0$

$13y = -5$

$y = \frac{-5}{13}$ …… (vi)

Substituting (vi) in equation (v), we obtain

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

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

Therefore, $x = \frac{9}{13}$ and $y = \frac{-5}{13}$.

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

Ans: Elimination method

The given equations are:

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

$$3x + 4y = -6 \quad \ldots\ldots \text{(i)}$$

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

$$3x - y = 9 \quad \ldots\ldots \text{(ii)}$$

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

$$5y = -15$$

$$y = -3 \quad \ldots\ldots \text{(iv)}$$

Substituting the value of (iv) in equation (i), we get

$$3x + 4(-3) = -6$$

$$3x = 6$$

$$x = 2$$

Therefore, $x = 2$ and $y = -3$.

Substitution method:

From equation (ii) we get

$$x = \frac{y+9}{3} \quad \ldots\ldots \text{(v)}$$

Substituting (v) in equation (i), we get

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

$$5y = -15$$

$$y = -3 \quad \ldots\ldots \text{(vi)}$$

Substituting (vi) in equation (v), we obtain

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

$x = 2$

Therefore, $x = 2$ and $y = -3$.

2. 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?

Ans: Assuming the fraction be $\frac{x}{y}$.

Writing the algebraic representation using the information given in the question:

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

$x - y = -2$ …… (i)

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

$2x - y = 1$ …… (ii)

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

$x = 3$ …… (iii)

Substituting the value of (iii) in equation (i), we get

$3 - y = -2$

$y = 5$

Therefore, $x = 2$ and $y = -3$.

Hence the fraction is $\frac{3}{5}$.

(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?

Ans: Assuming the present age of Nuri be x and present age of Sonu be y.

Writing the algebraic representation using the information given in the question:

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

$x - 3y = -10$ …… (i)

$\left(x+10\right)=2\left(y+10\right)$

$x-2y=10$ …… (ii)

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

$y=20$ …… (iii)

Substituting the value of (iii) in equation (i), we get

$x-60=-10$

$x=50$

Therefore, $x=50$ and $y=20$.

Hence Nuri's present age is 50 years and Sonu's present age is 20 years.

(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.

Ans: Assuming the unit digit of the number be x and the tens digit be y.

Therefore, the number is $10y+x$

The number after reversing the digits is $10x+y$.

Writing the algebraic representation using the information given in the question:

$x+y=9$ …… (i)

$9\left(10y+x\right)=2\left(10x+y\right)$

$-x+8y=0$ …… (ii)

Adding equation (i) and (ii), we obtain

$9y=9$

$y=1$ …… (iii)

Substituting the value of (iii) in equation (i), we get

$x=8$

Therefore, $x=8$ and $y=1$.

Hence the number is $10y+x=18$.

(iv) Meena went to 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.

Ans: Assuming the number of Rs 50 notes be x and the number of Rs 100 be y.

Writing the algebraic representation using the information given in the question:

$x+y=25$ …… (i)

$50x+100y=2000$ …… (ii)

Multiplying equation (i) by 50, we obtain

$50x+50y=1250$ …… (iii)

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

$50y=750$

$y=15$ …… (iv)

Substituting the value of (iv) in equation (i), we get

$x=10$

Therefore, $x=10$ and $y=15$.

Hence Meena has 10 notes of $\text{Rs } 50$ and 15 notes of $\text{Rs } 100$.

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

Ans: Assuming that the charge for first three days is $\text{Rs } x$ and the charge for each day thereafter is $\text{Rs } y$.

Writing the algebraic representation using the information given in the question:

$x+4y=27$ …… (i)

$x+2y=21$ …… (ii)

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

$2y=6$

$y=3$ …… (iii)

Subtracting equation (iii) from equation (i), we obtain

$x+12=27$

$x=15$ …… (iv)

Therefore, $x=15$ and $y=3$.

Hence, fixed charges are $\text{Rs } 15$ and charges per day are $\text{Rs } 3$.