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.

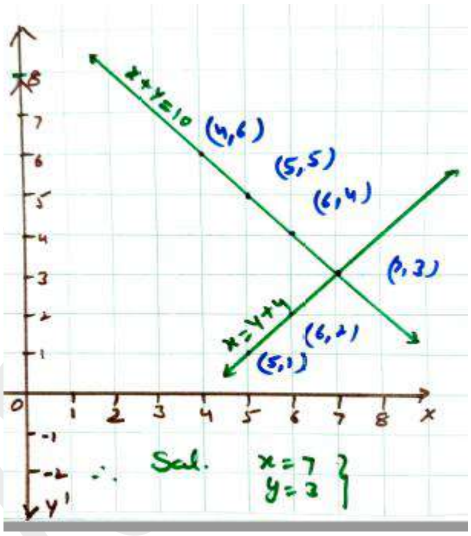
Sol. Let the number of girls = x
and the number of boys = y
a. t. q. $x + y = 10$ ……………………………(i)
and no. of girls = no. of boys + 4
$x = y + 4$……………………………(ii)

(i) $x + y = 10$

X	4	5	6
Y	6	5	4

(ii) $x = y + 4$

X	5	6	7
Y	1	2	3



∴ the number of girls = 7
and the number of boys = 3 Ans.

(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.

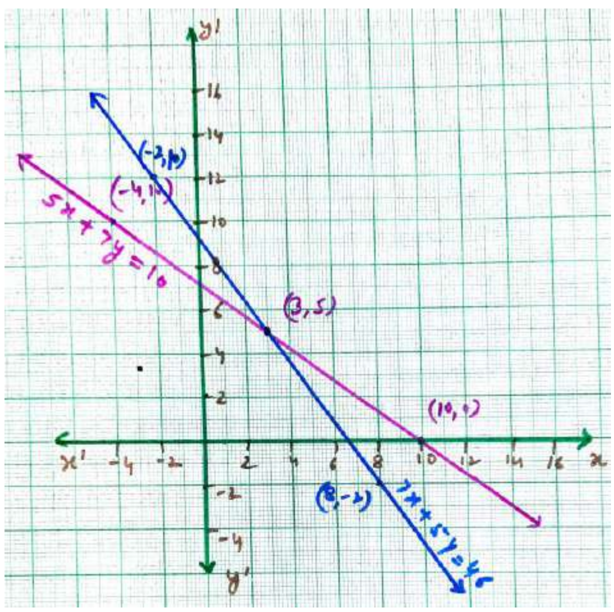
Sol. Let the cost of a pencil = Rs. x
and the cost of a pen = Rs. y
a.t.q. $5x + 7y = 50$ ……………………………(i)
and $7x + 5y = 46$……………………………(ii)

(i) $5x + 7y = 50$

X	3	10	-4
Y	5	0	10

(ii) $7x + 5y = 46$

X	8	3	-2
Y	-2	5	12



the cost of a pencil = Rs. 3
∴ and the cost of a pen = 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 intersect at a point, are parallel or coincident:

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

Sol. $5x - 4y + 8 = 0$
$7x + 6y - 9 = 0$

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

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

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

So, the lines intersect at a point. Ans

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

Sol. $9x + 3y + 12 = 0$
$18x + 6y + 24 = 0$

Here $\frac{a_1}{a_2} = \frac{9}{18} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$

and $\frac{c_1}{c_2} = \frac{12}{24} = \frac{1}{2}$

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

So, the lines intersect are coincident. Ans

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

Sol. $6x - 3y + 10 = 0$
$2x - y + 9 = 0$

Here $\frac{a_1}{a_2} = \frac{6}{2} = \frac{3}{1}$

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

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

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

So, the lines are parallel. Ans.

3. On comparing the ratios, find out whether the following pair of linear equations are consistent, or inconsistent.

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

Sol. $3x + 2y = 5$;

$2x - 3y = 7$

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

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

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

So, the lines intersect at a point.

∴ the given pair of linear equations is consistent. Ans.

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

Sol. $2x - 3y = 8$;

$4x - 6y = 9$

Here $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$

and $\frac{b_1}{b_2} = \frac{-3}{-6} = \frac{1}{2}$

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

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

So, the lines are parallel and have no solution.

∴ the given pair of linear equations is inconsistent. Ans.

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

Sol. $\frac{3}{2}x + \frac{5}{3}y = 7$ Or, $9x + 10y = 42$ after taking LCM

and $9x - 10y = 14$

Here $\frac{a_1}{a_2} = \frac{9}{9} = \frac{1}{1}$

and $\frac{b_1}{b_2} = \frac{-10}{10} = \frac{-1}{1}$

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

So, the lines intersect at a point.

∴ the given pair of linear equations is consistent. Ans.

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

Sol. $5x - 3y = 11;$

$-10x + 6y = -22$

Here $\frac{a_1}{a_2} = \frac{5}{-10} = \frac{-1}{2}$

$\frac{b_1}{b_2} = \frac{-3}{6} = \frac{-1}{2}$

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

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

So, the lines are coincident.

∴ the given pair of linear equations is consistent. Ans

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

Sol. $\frac{4}{3}x + 2y = 8$ or, $4x + 6y = 24$ after taking LCM

$2x + 3y = 12$

Here $\frac{a_1}{a_2} = \frac{4}{2} = \frac{2}{1}$

$\frac{b_1}{b_2} = \frac{6}{3} = \frac{2}{1}$

and $\frac{c_1}{c_2} = \frac{24}{12} = \frac{2}{1}$

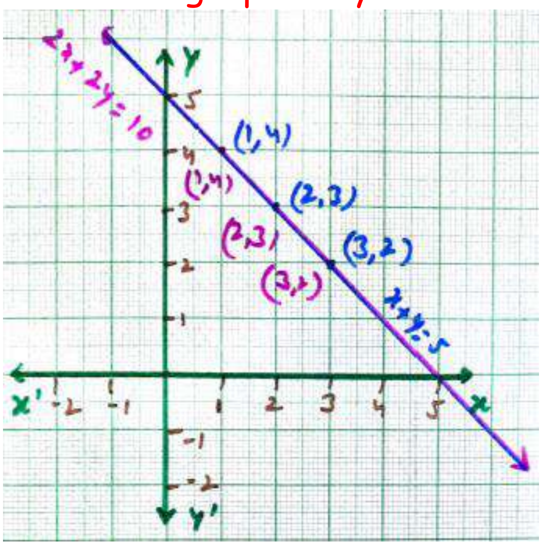
Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

So, the lines are coincident.

∴ the given pair of linear equations is consistent. Ans

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

(i) $x + y = 5, 2x + 2y = 10$



Sol. $x + y = 5,$

$2x + 2y = 10$

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

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

and $\frac{c_1}{c_2} = \frac{5}{10} = \frac{1}{2}$

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

So, the lines are coincident.

∴ the given pair of linear equations is consistent. Ans.

(i) x + y= 5

X	1	2	3
Y	4	3	2

(i) 2x + 2y= 10

X	1	2	3
Y	4	3	2

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

Sol. $x - y = 8$,

$3x - 3y = 16$

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

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

and $\frac{c_1}{c_2} = \frac{8}{16} = \frac{1}{2}$

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

So, the lines are parallel and have no solution.

∴ the given pair of linear equations is inconsistent. Ans.

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

Sol. $2x + y - 6 = 0$,

$4x - 2y - 4 = 0$

Here $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$

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

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

So, the lines intersect at a point.

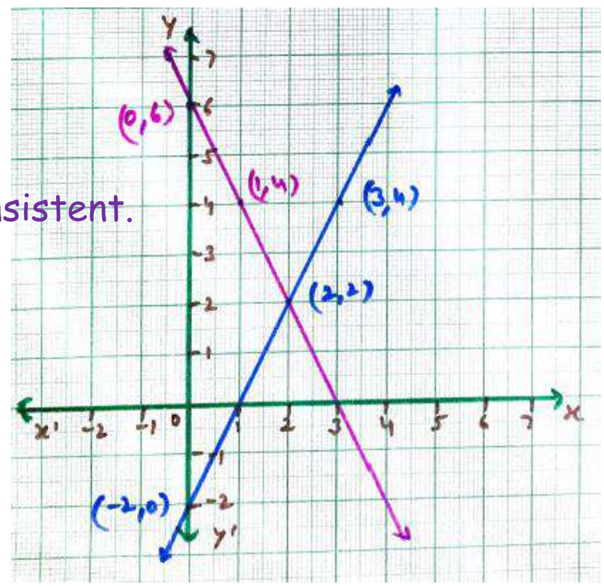
∴ the given pair of linear equations is consistent.

(i) $2x + y - 6 = 0$

X	0	1	2
Y	6	4	2

(ii) $4x - 2y - 4 = 0$

X	0	3	2
Y	-2	4	2



(iv) $2x - 2y - 2 = 0$, $4x - 4y - 5 = 0$

Sol. $2x - 2y - 2 = 0$,

$4x - 4y - 5 = 0$

Here $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{-2}{-4} = \frac{1}{2}$

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

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

So, the lines are parallel and have no solution.

∴ the given pair of linear equations is inconsistent. Ans.

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.

Sol. Let the length of rectangular garden = x m

And the breadth of garden = y m

Half the perimeter of a rectangular garden = 36m

$\Rightarrow \frac{1}{2} . 2$ (length + breadth) = 36 m

$\Rightarrow x + y = 36$……………………………(i)

and length is 4 m more than its width

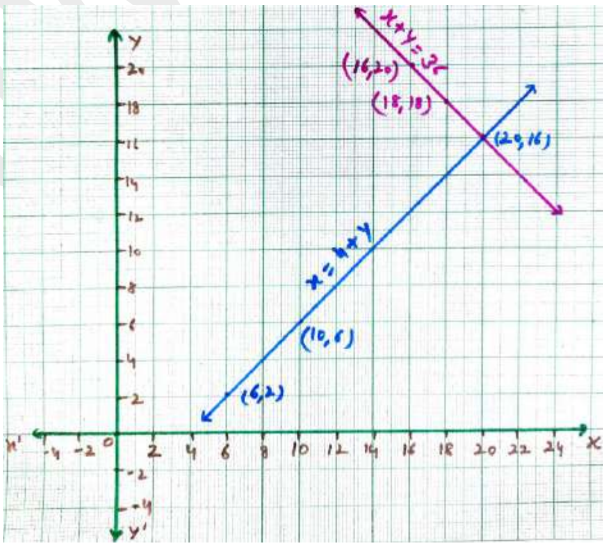
$\Rightarrow x = 4 + y$ …………………………(ii)

(i) $x + y = 36$

X	20	16	18
y	16	20	18

(ii) $x = 4 + y$

X	6	10	20
y	2	6	16



6. 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

Sol. Given linear equation is

$2x + 3y - 8 = 0.$

∴ another linear equation in two variables such that the geometrical representation of the pair so formed is intersecting lines is

$4x + 5y = 3$

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

So, the lines intersect at a point.

(ii) parallel lines

Sol. Given linear equation is

2x + 3y – 8 = 0

∴ another linear equation in two variables such that the geometrical representation of the pair so formed is intersecting lines is

4x + 6y + 3 = 0

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

So, the lines are parallel and have no solution.

(iii) coincident lines

Sol. Given linear equation is

2x + 3y – 8 = 0

∴ another linear equation in two variables such that the geometrical representation of the pair so formed is intersecting lines is

4x + 6y - 16 = 0

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

So, the pair of linear equations is inconsistent.

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.

Sol. The given equations are

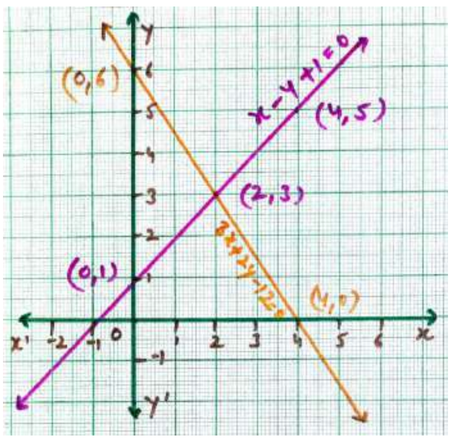
$x - y + 1 = 0$ and $3x + 2y - 12 = 0$

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

X	4	0	2
Y	5	1	3

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

X	4	0	2
Y	0	6	3



lines are intersecting each other at point (2, 3) and x-axis at (–1, 0) and (4, 0). Therefore, the vertices of the triangle are (2, 3), (–1, 0), and (4, 0).

EXERCISE 3.2

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

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

Sol. Given equations are

$x + y = 14$……………………………….(i)

and $x - y = 4$……………………………(ii)

From (i) equation, we get,

$x = 14 - y$ ……………………………….(iii)

Put the value of x in equation (ii), we have

$14 - y - y = 4$

Or, $14 - 2y = 4$

Or, $-2y = 4 - 14$

Or, $-2y = -10$

Or, $y = 5$

Put the value of 'y' in equation (iii)

$x = 14 - y$

$\therefore x = 14 - 5$

Or $x = 9$

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

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

Sol. Given equations are

$s - t = 3$…………………………………….(i)

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

Or, $2s + 3t = 36$…………………………(ii)

From equation (i), we get,

$s = 3 + t$ …………………………………….(iii)

Now, put the value of 's' in second equation, we have,

$2(3 + t) + 3t = 36$

Or, $6 + 2t + 3t = 36$

Or, $5t = 30$

Or, $t = 6$

Put the value of 't' in equation (iii)

$\therefore s = 3 + 6$

Or, $s = 9$

$\therefore$ Solution, $s = 9$ and $t = 6$. Ans.

(iii) 3x – y = 3 and 9x – 3y = 9 are the two equations.

Sol. 3x – y = 3……………………….(i)

and 9x – 3y = 9…………………….(ii)

From (i) y = 3x - 3

Put the value of y in equation (ii)

9x – 3(3x – 3) = 9

9x – 9x + 9 = 9

⇒9 = 9 is true for every value of x.

∴ we do not get a specific value of *x* as well as y.

∴ Equations (1) and (2) have infinitely many solutions. Ans.

(iv) 0.2x + 0.3y = 1.3 and 0.4x + 0.5y = 2.3are the two equations.

Sol. 0.2x + 0.3y = 1.3 or 2x + 3y = 13………………………………(i)

and 0.4x + 0.5y = 2.3 or 4x + 5y = 23………………………………(ii)

From equation (i), we get,

x = $\frac{13-3y}{2}$ …………………….(iii)

Put the value of x in equation (ii)

$4\left(\frac{13-3y}{2}\right)$ + 5y = 23

$2(13-3y)$ + 5y = 23

26 – 6y + 5y = 23

– 6y + 5y = 23 – 26

– y = – 3

⇒ y = 3

Put the value of y in equation (iii), we get,

x = $\frac{13-3 .3}{2}$ = $\frac{13-9}{2}$ = $\frac{4}{2}$ = 2

∴ Solution, x = 2 and y = 3. Ans.

(v) √2 x + √3 y = 0 and √3 x – √8 y = 0 are the two equations.

Sol. √2 x + √3 y = 0 ……………………….(i)

and √3 x – √8 y = 0 …………………….(ii)

From (ii) √3 x = √8 y

x = $\frac{\sqrt{8}\,y}{\sqrt{3}}$

Put the value of x in equation (i)

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

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

$\Rightarrow y = 0$

Put the value of y in equation (iii), we get,

$x = \frac{\sqrt{8}\,.\,0}{\sqrt{3}}$

x = 0

∴ Solution, x = 0 and y = 0. Ans.

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$ and $\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ are the two equations.

Sol. Sol. $\frac{3x}{2} - \frac{5y}{3} = -2$ Or 9x – 10y = - 12……………………….(i)

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

From (ii) $x = \frac{13-3y}{2}$ ………………..……………(iii)

Put the value of x in equation (i)

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

117 – 27y – 20y = -24

–47y = -24 – 117

$y = \frac{-141}{-47}$

y = 3

Put the value of y in equation (iii)

$x = \frac{13-3\,.\,3}{2}$

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

x = 2

Therefore, x = 2 and y = 3.

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

Sol. The given equations are

2x + 3y = 11…………………………(I)

2x – 4y = -24…………………… (II)

From equation (II), we get

$x = \frac{4y-24}{2}$

x = 2y - 12 ………………………(III)

Substituting the value of x in equation (I), we get

2 (2y - 12) + 3y = 11

4y – 24 + 3y = 11

7y = 35

y = 5

Putting the value of y in equation (III), we get

$x = 2 . 5 - 12$

$x = 10 - 12$

$x = -2$

Hence, $x = -2$ and $y = 5$

Also,

$y = mx + 3$

$5 = -2m +3$

$-2m = 2$

$m = -1$

∴ the value of m is -1. Ans.

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.

Sol. Let the two numbers are x and y respectively, such that $x > y$.

A. t. q. $x - y = 26$ ……………………(i)

And $x = 3y$ …………… ……………… (ii)

Put the value of x in equation (i), we get

$3y - y = 26$

$2y = 26$

$y = 13$

Put the value in equation (ii)

$x = 3 \times 13$

$x = 39$

∴ the numbers are 39 and 13. Ans.

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

Sol. Let the angle are x and y.

A. t. q. since the angles are supplementary

$x + y = 180^\circ$……………. (i)

and $x = y + 18^\circ$ …………….(ii)

Put the value of x in equation (i) we get

$y + 18^\circ + y =180^\circ$

$2y = 180^\circ - 18^\circ$

$2y = 162^\circ$

$y = 81^\circ$

Put the value of y in (ii), we get

$x = 81^\circ + 18^\circ$

$= 99^\circ$

Hence, the angles are 99° and 81°. Ans.

(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.

Sol. Let the cost of a bat is Rs. X

And the cost of one ball is Rs. Y

A.T.Q. cost of 7 bats and 6 balls = Rs.3800

$\Rightarrow 7x + 6y = 3800$ ……………………..(i)

And cost of 3bats and 5 balls =Rs. 1750

$\Rightarrow 3x + 5y = 1750$ ……………… (ii)

From (ii), we get

$3x = 1750 - 5y$

$x = \frac{1750 - 5y}{3}$ ……………………………(iii)

Put the value of x in equation (i) we get,

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

$12250 - 35y + 18y = 11400$

$-17y = 11400 - 12250$

$-17y = -850$

$\therefore y = 50$

Put the value of y in (iii), we get

$x = \frac{1750 - 5 . 50}{3}$

$x = \frac{1750 - 250}{3}$

$x = \frac{1500}{3}$

$x = 500$

∴ The cost of a bat is Rs. 500 and the cost of one ball is Rs. 50 Ans.

(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 km? How much does a person have to pay for travelling a distance of 25 km?

Sol. Let the fixed charges are Rs x
and charges per km are Rs y.
A.T.Q. charges for 10km are Rs. 105
⇒ x + 10y = 105…………………………… (i)
And charges for 25km is Rs. 155
⇒ x + 15y = 155 ………………………. (ii)
From (1), we get
x = 105 – 10y …………………………. (iii)
Put the value of x in (ii), we get
105 – 10y + 15y = 155
⇒ 5y = 50
⇒ y = 10
Put the value of y in (iii), we get
x = 105 – 10 × 10
= 5
the fixed charges are Rs 5 and charges per km are Rs 10.
Charges for 25 km = x + 25y
= 5 + 250
= Rs 255 Ans.

(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.

Sol. Let the fraction = $\frac{x}{y}$
A.T.Q $\frac{x+2}{y+2} = \frac{9}{11}$
⇒ 11x + 22 = 9y + 18
⇒ 11x - 9y = 18 -22
⇒ 11x - 9y = - 4……………………………(i)
And $\frac{x+3}{y+3} = \frac{5}{6}$
⇒ 6x + 18 = 5y + 15
6x – 5y = 15 – 18
6x – 5y = -3
From(i)
⇒ 11x = 9y – 4
⇒ x = $\frac{9y-4}{11}$ ………………………………(iii)

Put the value of x in (ii), we get

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

54y – 24 - 55y = -33

-y = -9

y = 9 ………………… (4)

Put the value of y in (iii), we get

x = $\frac{9.9-4}{11}$

= $\frac{77}{11}$

y = 7

∴ The fraction is $\frac{7}{9}$ Ans.

(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. Let the present age of Jacob = x years

and the age of his son = y years

After 5 years age of Jacob = (x + 5) years

And age of his son = (y + 5) years

A. T.Q. age of Jacob will be 3 times age of his son

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

x + 5 = 3y + 15

x – 3y = 10 ……………………………………. (i)

and 5 years ago, age of Jacob = (x - 5) years

And age of his son = (y - 5) years

A. T.Q. age of Jacob was 7 times age of his son

(x – 5) = 7(y – 5)

x – 5 = 7y - 35

x – 7y = -30 ……………………………………… (ii)

From (1), we get x = 3y + 10 …………………… (iii)

Put the value of x in (ii), we get

3y + 10 – 7y = -30

-4y = -40

y = 10

Put the value of y in (iii), we get

x = 3 x 10 + 10

= 40

Hence, the present age of Jacob's is 40 years and his son is 10 years Ans.

EXERCISE 3.3

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

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

Sol. The given equations are

$x + y = 5$ ……………………….(i)

and $2x - 3y = 4$……………………….(ii)

Multiplying equation (i) by 2 and (ii) by 1, we have

$2x + 2y = 10$

$2x - 3y = 4$

$-\quad +\quad -$

$5y = 6$

$y = \frac{6}{5}$

put the value of y in eq. (i) we get,

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

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

$= \frac{19}{5}$

$\therefore x = \frac{19}{5}, y = \frac{6}{5}$ Ans.

By the substitution method

From the equation (i), we have

$x = 5 - y$……………………………….. (v)

put the value in equation (ii) we get,

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

$-5y = -6$

$y = \frac{6}{5}$

When the values are substituted in equation (v), we have

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

$= \frac{19}{5}$

$\therefore x = \frac{19}{5}, y = \frac{6}{5}$ Ans.

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

Sol. The given equations are

$3x + 4y = 10$ ……………………….(i)

and $2x - 2y = 2$…………………………(ii)

Multiplying equation (i) by 1 and (ii) by 2, we have

$3x + 4y = 10$

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

$7x = 14$

$x = \frac{14}{7}$

$\therefore x = 2$

put the value of y in eq. (i) we get,

$3 \times 2 + 4y = 10$

$6 + 4y = 10$

$4y = 10 - 6$

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

$\therefore y = 1$

$\therefore x = 2, y = 1$ Ans.

By the method of Substitution

The given equations are

$3x + 4y = 10$ ……………………….(i)

and $2x - 2y = 2$…………………………(ii)

From the equation (ii), we have

$2x = 2 + 2y$

$x = 1 + y$ ……………………………………….(iii)

put the value of x in equation (i) we get,

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

$3 + 3y + 4y = 10$

$7Y = 10 - 3$

$7y = 7$

$\therefore Y = 1$

Put the value of y in equation (iii), we have

$x = 1 + 1$

$x = 2$

$\therefore x = 2, y = 1$ Ans.

(iii) 3x – 5y – 4 = 0 and 9x = 2y + 7

Sol. The given equations are

3x - 5y – 4 = 0 Or 3x – 5y = 4 …………………………(i)

and 9x = 2y + 7 Or 9x – 2y = 7…………………………………(ii)

Multiplying equation (i) by 3 and (ii) by 1, we have

9x - 15y = 12

9x – 2y = 7

-    +   -

- 13y = 5

∴ y = $\frac{-5}{13}$

Put the value of y in eq. (i) we get,

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

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

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

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

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

∴ $x = \frac{9}{13}$ and $y = \frac{-5}{13}$ Ans.

By the method of Substitution

The given equations are

3x – 5y = 4………………………………(i)

And 9x – 2y = 7………………………………(ii)

From the equation (i), we have

3x = 4 + 5y

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

put the value of x in equation (i) we get,

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

12 + 15y - 2y = 7

13Y = 7 - 12

∴ $Y = \frac{-5}{13}$

Put the value of y in equation (iii), we have

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

$x = \frac{52-25}{39}$

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

∴ $x = \frac{9}{13}$ and $y = \frac{-5}{13}$ Ans.

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

Sol. The given equations are

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

Or, $3x + 4y = -6$ ………………………… (i)

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

or, $3x - y = 9$ …………………………… (ii)

$3x + 4y = -6$

$3x - y = 9$

$-\quad +\qquad -$

$5y = -15$

$\therefore y = \frac{-15}{5}$

$\therefore y = -3$

Put the value of y in eq. (ii) we get,

$3x - (-3) = 9$

$3x + 3 = 9$

$3x = 9 - 3$

$3x = 6$

$x = 2$

$\therefore x = 2, y = -3$ Ans.

By the method of Substitution

The given equations are

$3x + 4y = -6$……………………………….(i)

And $3x - y = 9$……………………………….(ii)

From the equation (ii), we have

$3x - y = 9$

$Y = 3x - 9$ ……………………………………….(iii)

put the value of y in equation (i) we get,

$3x + 4(3x - 9) = -6$

$3x + 12x - 36 = -6$

$15x = -6 + 36$

$15x = 30$

$\therefore x = 2$

Put the value of y in equation (iii), we have

$Y = 3 \times 2 - 9$

$y = 6 - 9$

$y = -3$

$\therefore x = 2, y = -3$ Ans.

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?

Solution: Let the fraction be $\frac{x}{y}$

According to the given information,

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

=> x + 1 = y - 1

=> x - y = - 2 ……………………………….(i)

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

=> 2x = y + 1

=> 2x - y = 1 ……………………………….(ii)

x - y = -2

2x – y = 1

\- + -

\- x = - 3

∴ x = 3

Put the value of x in eq. (i) we get,

=> 3 - y = - 2

– y = -2 - 3

-y = -5

y = 5

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?

Solution: Let the present age of Nuri is x years and present age of Sonu is y years.

According to the given condition, we can write as;

x – 5 = 3(y – 5)

x – 5 = 3y – 15

x – 3y = -10…………………………………..(1)

and x + 10 = 2(y +10)

x + 10 = 2y +20

x – 2y = 10…………………………………..(2)

x – 3y = -10

$x - 2y = 10$
$\underline{- \quad + \quad -}$
$-y = -20$
$\therefore y = 20$
Put the value of y in eq. (i) we get,
$x - 3.20 = -10$
$x - 60 = -10$
$x = -10 + 60$
$x = 50$
Therefore,
Age of Nuri is 50 years and age of Sonu is 20 years. Ans.

(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.
Solution: Let the unit digit and tens digit of a number be x and y respectively.
$\therefore$ Number = $10y + x$
Number on reversing order of the digits = $10x + y$
A. t. q., $x + y = 9$………………………………………….(i)
And $9(10y + x) = 2(10x + y)$
$90y + 9x = 20x + 2y$
$-11x + 88y = 0$
$-x + 8y = 0$ ……………………………………… (ii)
Adding the equations (i) and (ii) we get,
$x + y = 9$
$\underline{-x + 8y = 0}$
$9y = 9$
$\therefore y = 1$
Put the value of y in eq. (i) we get,
$x + 1 = 9$
$x = 8$
Hence the number is $10y + x = 10 \times 1 + 8 = 18$

(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.

Solution: Let the number of Rs.50 notes be x and the number of Rs.100 notes be y

A. t. q., x + y = 25 ………………………………………………………… (i)

50x + 100y = 2000

Or x + 2y = 40………………………………………………………………(ii)

x + y = 25

x + 2y = 40

\- \- \-

\- y = - 15

∴ y = 15

Put the value of y in eq. (i) we get,

x + 15 = 25

x = 25 – 15

x = 10

Hence, Meena has 10 notes of Rs.50 and 15 notes of Rs.100. Ans.

(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. Let the fixed charge for the first three days be Rs. x and the charge for each day extra be Rs. y.

A. t. q., x + 4y = 27 ……………………………………………………………… (i)

and x + 3y = 21 ……………………………………………………………… (ii)

x + 4y = 27

x + 3y = 21

\- \- \-

y = 6

Put the value of y in eq. (i) we get,

x + 4 × 6 = 27

x + 24 = 27

x = 27 - 24

x = 3

Hence, the fixed charge is Rs.15

And the Charge per day is Rs.3 Ans.