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## [NCERT Solutions for Class 10 Maths](#)

<b>Board</b>	CBSE
<b>Textbook</b>	NCERT
<b>Class</b>	Class 10
<b>Subject</b>	Maths
<b>Chapter</b>	Chapter 3
<b>Chapter Name</b>	Pair of Linear Equations in Two Variables
<b>Exercise</b>	Ex 3.1, Ex 3.2, Ex 3.3, Ex 3.4, Ex 3.5, Ex 3.6, Ex 3.7,
<b>Number of Questions Solved</b>	29
<b>Category</b>	<u><a href="#">NCERT Solutions</a></u>

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NCERT Solutions for Class 10 Maths Pair of Linear Equations in Two Variables

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3.3 Graphical Method Of Solution Of A Pair Of Linear Equations

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**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.1**

**Question-1**

Aftab tells his daughter, "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be,"(Isn't this interesting?) Represent this situation algebraically and graphically.

**Solution:**

Let the present age of Aftab be  $x$  years and her daughter age be  $y$  years  
Seven years ago

$$\text{Aftab's age} = (x - 7)$$

$$\text{His daughter's age} = (y - 7)$$

$$(x - 7) = 7(y - 7) \dots\dots\dots (1)$$

Three years from now

$$\text{Aftab's age} = x + 3$$

$$\text{His daughter age} = y + 3$$

$$x + 3 = 3(y + 3) \dots\dots\dots (2)$$

(1) becomes,

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

$$x - 7 = 7y - 49$$

$$x - 7y = - 42 \dots\dots\dots (3)$$

(2) becomes

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

$$= 3y + 9$$

$$x - 3y = 6 \dots\dots\dots (4)$$

Algebraically the two situations can be represented as follows:

$x - 7y + 42 = 0$ ,  $x - 3y - 6 = 0$  where  $x$  and  $y$  are respectively the ages of Aftab and his daughter.

Graphic Representation :

$$x - 7y = -42 \dots\dots\dots(1)$$

$$x - 3y = 6 \dots\dots\dots(2)$$

$$\Rightarrow x - 7y = -42$$

$$-7y = -42 - x$$

$$y = \frac{-42 - x}{-7}$$

when  $x = 0$ ,

$$y = \frac{-42 - 0}{-7} = \frac{-42}{-7} = 6$$

when  $x = 7$ ,

$$y = \frac{-42 - 7}{-7} = \frac{-49}{-7} = 7$$

when  $x = 14$ ,

$$y = \frac{-42 - 14}{-7} = \frac{-56}{-7} = 8$$

when  $x = -7$ ,

$$y = \frac{-42 + 7}{-7} = \frac{-35}{-7} = 5$$

when  $x = -14$ ,

$$y = \frac{-42 + 14}{-7} = \frac{-28}{-7} = 4$$

x	-14	-7	0	7	14
y	4	5	6	7	8

$$\Rightarrow x - 3y = 6$$

$$-3y = 6 - x$$

$$y = \frac{x-6}{3}$$

when  $x = 0$ ,

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

when  $x = 3$ ,

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

when  $x = 6$ ,

$$y = \frac{x-6}{3} = \frac{6-6}{3} = 0$$

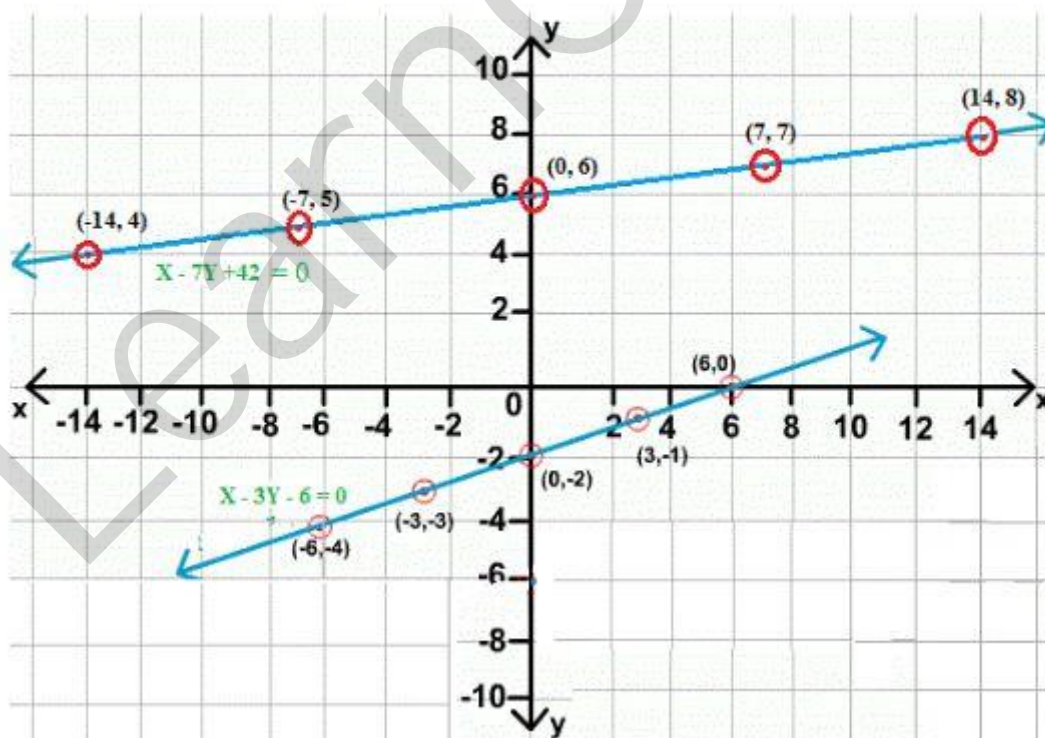
when  $x = -3$ ,

$$y = \frac{x-6}{3} = \frac{-3-6}{3} = \frac{-9}{3} = -3$$

when  $x = -6$ ,

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

x	-6	-3	0	3	6
y	-4	-3	-2	-1	0



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**Question-2**

The coach of a cricket team buys 3 bats and 6 balls for ₹3900. Later, she buys another bat and 2 more balls of the same kind for ₹1300. Represent this situation algebraically and geometrically.

**Solution:**

Let the cost of each bat be ₹x

Let the cost of each ball be ₹y

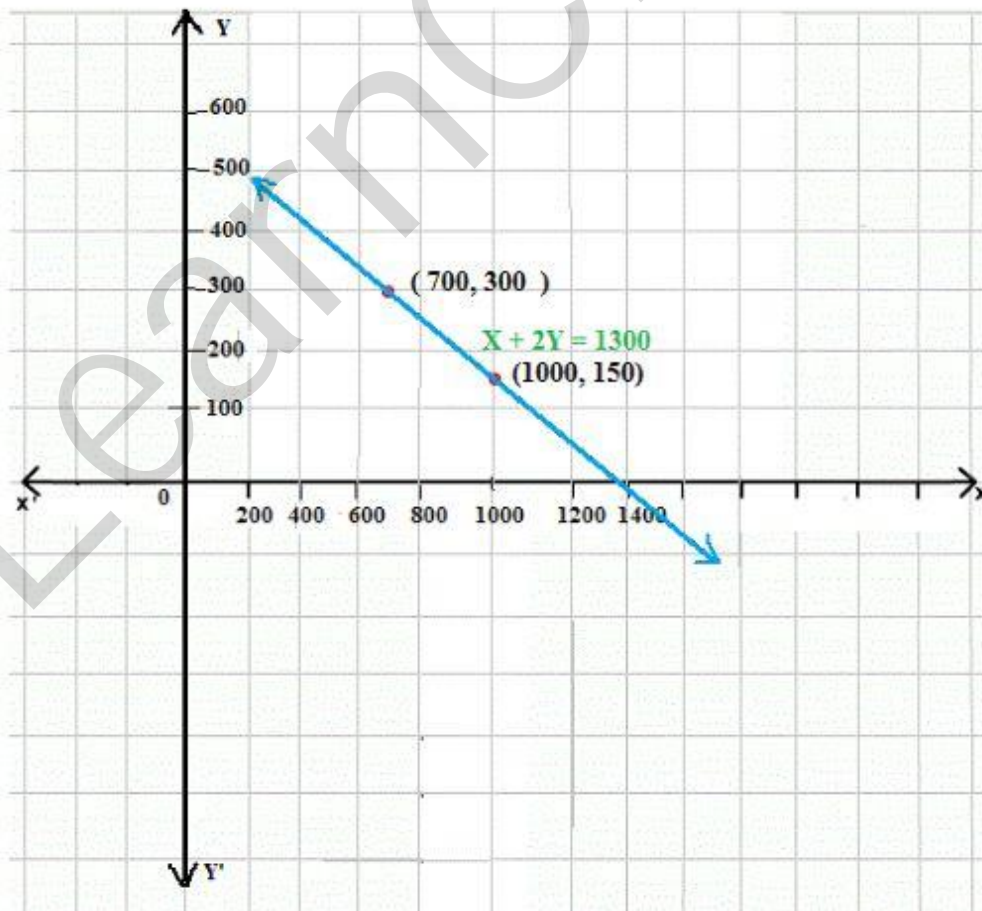
**Algebraically**

$$3x + 6y = 3900 \dots\dots\dots(1)$$

$$(1) \Rightarrow x + 2y = 1300$$

$$x + 2y = 1300 \dots\dots\dots(2)$$

X	1000	700
$y = \frac{1300 - x}{2}$	150	300





**Question-3**

The cost of 2 kg of apples and 1 kg of grapes on a day was found to be Rs. 160. After a month, the cost of 4 kg of apples and 2 kg of grapes is Rs. 300. Represent the situation algebraically and geometrically.

**Solution:**

Cost per kg of apple = Rs.  $x$

Cost per kg of grapes = Rs.  $y$

Algebraically  $2x + y = 160$  .....(1)

$4x + 2y = 300$  or  $2x + y = 150$ .....(2)

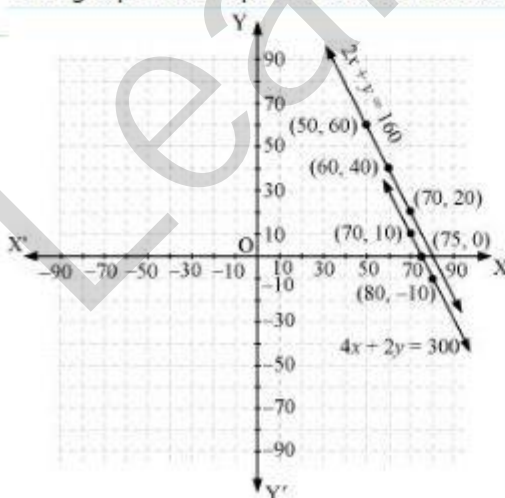
from (1)  $y = 160 - 2x$

$x$	50	60
$Y = 160 - 2x$	60	40

From (2),  $y = 150 - 2x$

$x$	50	60
$Y = 150 - 2x$	50	30

The graphical representation is as follows.



■ Comment



**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.2**

**Question-4**

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

**Solution:**

Let the number of boys be  $x$  and the number of girls be  $y$

$$x + y = 10 \dots\dots\dots (1) \text{ (given)}$$

$$y = x + 4 \dots\dots\dots (2) \text{ (given)}$$

$$x + y = 10 \dots\dots(1)$$

$$\Rightarrow y = 10 - x$$

$$\text{When } x = -1, y = 10 - (-1) = 11$$

$$\text{When } x = 0, y = 10 - 0 = 10$$

$$\text{When } x = 1, y = 10 - 1 = 9$$

$$\text{when } x = 2, y = 10 - 2 = 8$$

$$\text{when } x = 3, y = 10 - 3 = 7$$

$x$	-1	0	1	2	3
$y = 10 - x$	11	10	9	8	7

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

$$\text{Let } x = -1, \Rightarrow y = -1 + 4 = 3$$

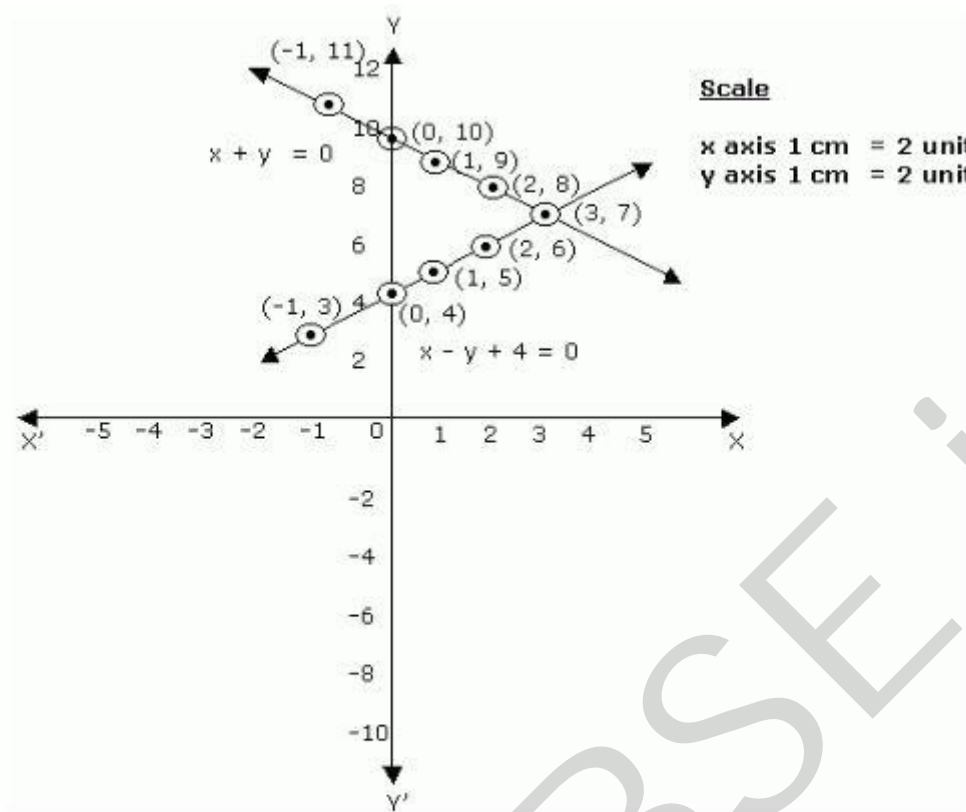
$$\text{Let } x = 0, y = 0 + 4 = 4$$

$$\text{Let } x = 1, y = 1 + 4 = 5$$

$$\text{Let } x = 2, y = 2 + 4 = 6$$

$$\text{Let } x = 3, y = 3 + 4 = 7$$

$x$	-1	0	1	2	3
$y = x + 4$	3	4	5	6	7



The solution thus obtained graphically is (3, 7). Number of girls = 7 and number of boys = 3.

**Question-5**

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

**Solution:**

Let the cost of one pencil be ₹x

Let the cost of one pen be ₹y

$$5x + 7y = 50$$

$$y = \frac{50 - 5x}{7} \dots\dots\dots (1)$$

When x = 3

$$y = \frac{50 - 15}{7} = \frac{35}{7} = 5$$

When x = 10

$$y = \frac{50 - 5(10)}{7} = \frac{0}{7} = 0$$

When x = -4

$$y = \frac{50 - 5(-4)}{7} = \frac{70}{7} = 10$$

x	-4	3	10
Y	10	5	0

Also,  $7x + 5y = 46$  .....(2)

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

When  $x = 0$ ,

$$y = \frac{46 - 7(0)}{5} = \frac{46}{5} = 9.2$$

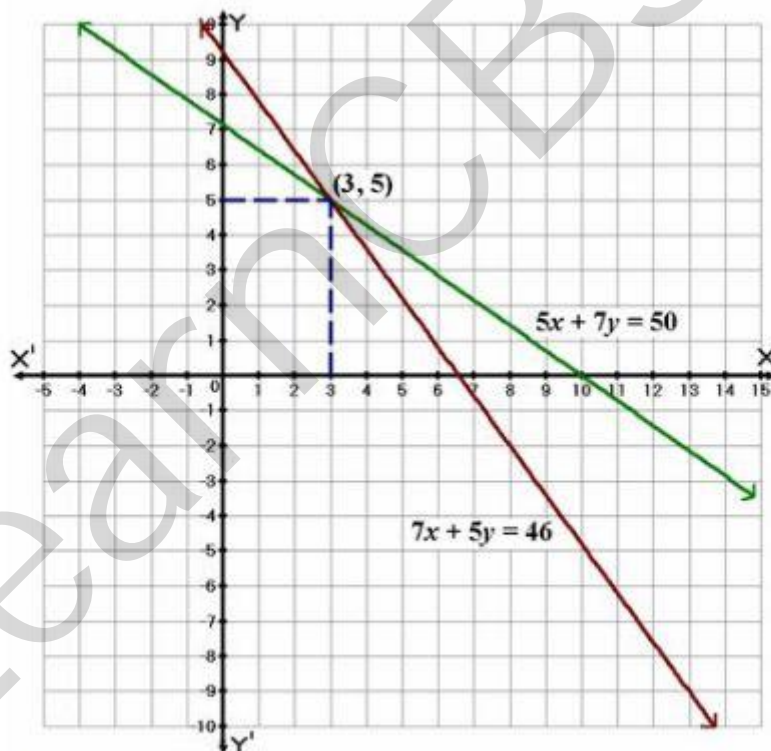
When  $x = 3$ ,

$$y = \frac{46 - 7(3)}{5} = \frac{46 - 21}{5} = \frac{25}{5} = 5$$

When  $x = 8$

$$y = \frac{46 - 7(8)}{5} = \frac{46 - 56}{5} = \frac{-10}{5} = -2$$

x	0	3	8
Y	9.2	5	-2



By solving graphically, cost of one pencil = `3, cost of one pen = `5.

**Question-6**

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

**Solution:**

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

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

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

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

$\therefore$  Lines are intersecting.

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

$18x + 6y + 24 = 0$

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

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

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

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

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

$2x - y + 9 = 0$

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

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

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

Since  $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ , the lines are parallel.

**Question-7**

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 are consistent, or inconsistent.

(i)  $3x + 2y = 5$   
 $2x - 3y = 17$

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

**Solution:**

(i)  $3x + 2y = 5$ ;  $2x - 3y = 17$

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

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

Since  $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ , equations are consistent.

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

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

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

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

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

$\therefore$  The equations are inconsistent.



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

$$9x - 10y = 14$$

$$\frac{a_1}{a_2} = \frac{\frac{3}{2}}{9} = \frac{3}{2 \times 9} = \frac{3}{18} = \frac{1}{6}$$

$$\frac{b_1}{b_2} = \frac{\frac{5}{3}}{-10} = \frac{5}{3 \times -10} = \frac{-1}{6}$$

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

∴ The equations are consistent.

(iv)  $5x - 3y = 11$

$$-10x + 6y = -22$$

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

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

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

Since  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ , the equations are consistent.

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

$$2x + 3y = 12$$

$$a_1 = \frac{4}{3}, a_2 = 2, c_1 = -8$$

$$a_1 = 2, b_2 = 3, c_2 = -12$$

$$\frac{a_1}{a_2} = \frac{\frac{4}{3}}{2} = \frac{4}{6} = \frac{2}{3}$$

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

$$\frac{c_1}{c_2} = \frac{8}{-12} = \frac{-2}{3}$$

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

The equations are consistent.

**Question-8**

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

**Solution:**

$x + y = 5$ ,  $2x + 2y = 10$

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

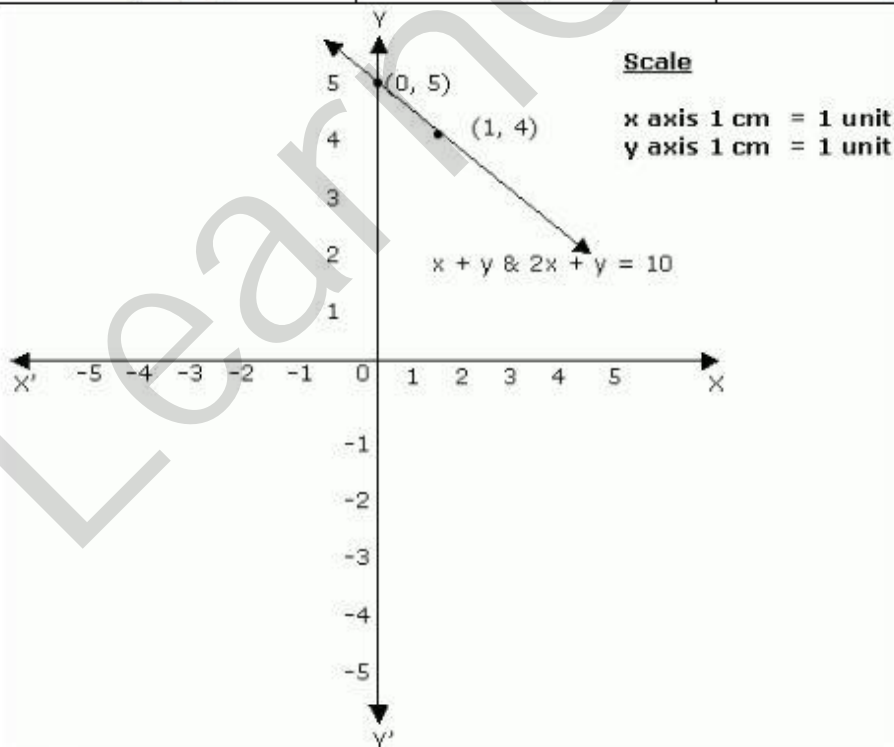
∴ Equations are consistent .

We have to draw the graphs of both the given equations  $x + y = 5$

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

$2x + 2y = 10 \Rightarrow y = 5 - x$

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



Hence the lines represented by both the equations are coincident. Thus both the equations have infinitely many solutions.

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

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

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

∴ The equations are inconsistent.

$$2x + y - 6 = 0$$

$$4x - 2y - 4 = 0$$

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

Thus as  $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ , the equations are consistent.

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

when  $x = 1, y = 6 - 2x = 4$

$x = 0, y = 6$

$x = -1, y = 8$

x	2	0	-1
$y = 6 - 2x$	2	6	8

$$4x - 2y - 4 = 0$$

$$4x - 2y = 4$$

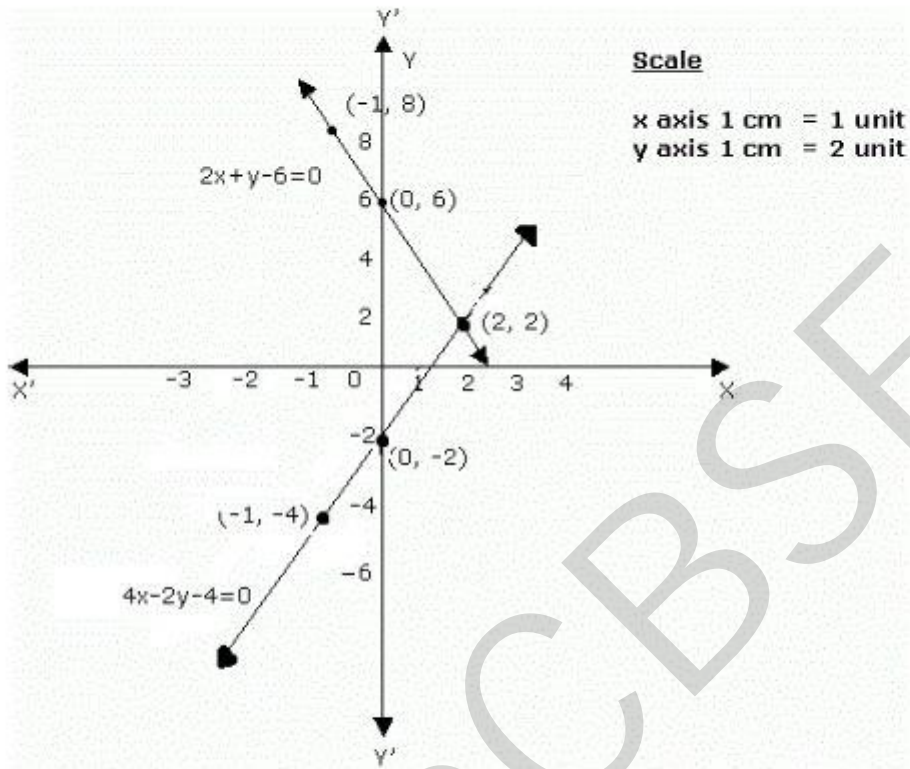
$$y = \frac{4x - 4}{2} = 2x - 2$$

When  $x = 1, y = 2 - 2 = 0$

$x = 0, y = -2$

$x = -1, y = -2 - 2 = -4$

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



(iv)  $2x - 2y - 2 = 0$

$4x - 4y - 5 = 0$

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

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

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

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

Equations are inconsistent

**Question-9**

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.

**Solution:**

Let  $l$  be the length and  $b$  be the breadth

$$l = b + 4$$

$$\Rightarrow l - b = 4 \dots\dots\dots(1)$$

$$\text{Perimeter} = 2(l + b)$$

$$\frac{1}{2} \times 2(l + b) = 36(\text{given}) \dots\dots\dots(2)$$

$$l - b = 4 \dots\dots\dots (1)$$

$$l + b = 36 \dots\dots\dots(2)$$

$$(1) + (2) \Rightarrow 2l = 40$$

$$l = \frac{40}{2} = 20 \text{ m}$$

Substitute  $l = 20$  in (1)

$$l - b = 4$$

$$20 - b = 4$$

$$b = 20 - 4 = 16 \text{ m.}$$

**Question-10**

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

**Solution:**

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

$$3x + 2y - 7 = 0 \text{ (intersecting lines)}$$

$$2x + 3y + 12 = 0 \text{ (parallel lines)}$$

$$4x + 6y - 16 = 0 \text{ (coincident lines)}$$

**Question-11**

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 the triangular region.

**Solution:**

$$x - y + 1 = 0$$

$$y = x + 1$$

x	-1	0	1	2
y = x + 1	0	1	2	3

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

$$2y = 12 - 3x$$

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

when  $x = 0$ ,

$$y = \frac{12 - 3(0)}{2} = \frac{12}{2} = 6$$

when  $x = 2$ ,

$$y = \frac{12 - 3(2)}{2} = \frac{12 - 6}{2} = \frac{6}{2} = 3$$

when  $x = 4$ ,

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

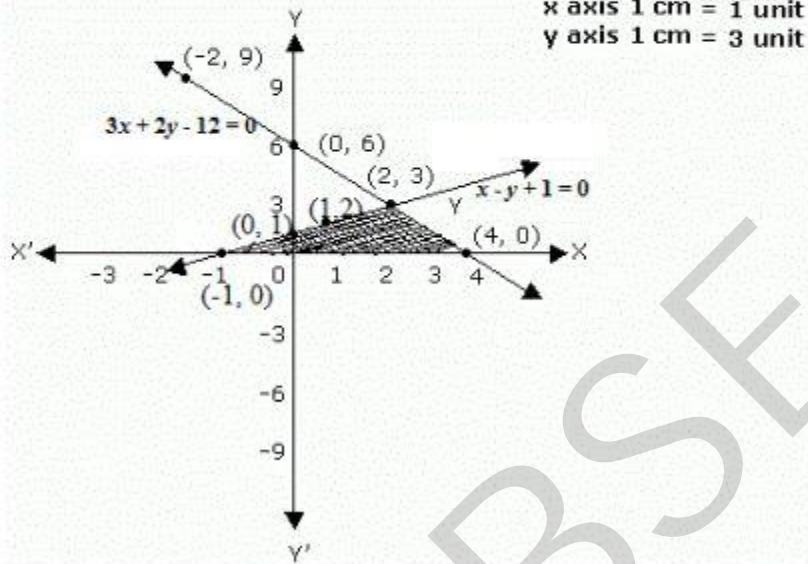
when  $x = -2$ ,

$$y = \frac{12 - 3(-2)}{2} = \frac{12 + 6}{2} = \frac{18}{2} = 9$$



x	-2	0	2	4
$y = \frac{12 - 3x}{2}$	9	6	3	0

**Scale**



**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.3**

**Question-12**

Solve the following pair of linear equation by the substitution method.

$$x + y = 14$$

$$x - y = 4$$

**Solution:**

$$x + y = 14 \dots\dots\dots (1)$$

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

from (2)

$$x = y + 4$$

$$\text{sub in (1)} \Rightarrow y + 4 + y = 14$$

$$2y = 10 \Rightarrow y = 5$$

$$x = 9$$

$$\therefore x = 9, y = 5$$



**Question-13**

Solve the following pair of linear equation by the substitution method.

$$s - t = 3$$

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

**Solution:**

$$s - t = 3 \dots\dots\dots (1)$$

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

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

$$\Rightarrow 2s + 3t = 36 \dots\dots\dots (2)$$

$$\text{from (1) } s = t + 3 \dots\dots\dots (3)$$

$$\text{sub in (1) } 2(t + 3) + 3t = 36$$

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

$$5t = 30 \Rightarrow t = 6$$

$$\therefore \text{ from (3), } s = 6 + 3 = 9$$

**Question-14**

Solve the following pair of linear equations by the substitution method

$$3x - y = 3$$

$$9x - 3y = 9$$

**Solution:**

$$3x - y = 3 \dots\dots\dots (1);$$

$$\text{from(1) } y = 3x - 3$$

Substitute  $y = 3x - 3$  in (2)

$$9x - 3y = 9 \dots\dots\dots (2)$$

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

$$9x - 9x + 9 = 9$$

This statement is true for all values of x. However, we do not have a specific value of x as a solution. Therefore, we cannot obtain a specific value of y. This situation has arisen because both the given equations are the same. Therefore, Equations (1) and (2) have infinitely many solutions.

**Question-15**

Solve the following pair of linear equations by the substitution method

$$0.2x + 0.3y = 1.3$$

$$0.4x + 0.5y = 2.3$$

**Solution:**

$$0.2x + 0.3y = 1.3 \dots\dots\dots (1)$$

$$0.4x + 0.5y = 2.3 \dots\dots\dots (2)$$

$$(1) \times 5 \Rightarrow 1x + 1.5y = 6.5$$

$$\therefore x = 6.5 - 1.5y$$

sub in (2)

$$0.4(6.5 - 1.5y) + 0.5y = 2.3$$

$$2.6 - 0.6y + 0.5y = 2.3$$

$$-0.1y = -0.3$$

$$y = 3$$

Substitute  $y = 3$  in  $x = 6.5 - 1.5y$

$$x = 6.5 - 1.5(3)$$

$$= 6.5 - 4.5 = 2$$

$$\therefore x = 2, y = 3$$

**Question-16**

Solve the following pair of linear equations by the substitution method

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

$$\sqrt{3}x - \sqrt{8}y = 0$$

**Solution:**

$$\sqrt{2}x + \sqrt{3}y = 0 \dots\dots\dots(1)$$

$$\sqrt{3}x - \sqrt{8}y = 0 \dots\dots\dots(2)$$

$$(1) \times \sqrt{2} \Rightarrow 2x + \sqrt{6}y = 0$$

$$\Rightarrow x = -\frac{\sqrt{6}}{2}y$$

sub in (2)

$$-\sqrt{3} \times \frac{\sqrt{6}}{2}y - \sqrt{8}y = 0$$

$$y\left(-\frac{\sqrt{18}}{2} - \sqrt{8}\right) = 0$$

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

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

$$\Rightarrow y = 0$$

Hence  $x = 0$

$\therefore x = 0, y = 0.$

**Question-17**

Solve the following pair of linear equations by the substitution method

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

$$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$$

**Solution:**

$$\frac{3x}{2} - \frac{5y}{3} = -2 \dots\dots\dots (1)$$

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

Multiply (1) and (2) by 6

$$3x \times 3 - 5y \times 2 = -12$$

$$\text{(i.e.) } 9x - 10y = -12 \dots\dots\dots (3)$$

$$2x + 3y = 13 \dots\dots\dots (4)$$

$$(3) \Rightarrow 9x = 10y - 12$$

$$x = \frac{10y - 12}{9} \text{ sub in (4)}$$

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

$$20y - 24 + 27y = 13 \times 9$$

$$47y = 117 + 24$$

$$47y = 141$$

$$\Rightarrow y = 3$$

$$x = \frac{10y - 12}{9} = \frac{10 \times 3 - 12}{9}$$

$$= \frac{18}{9} = 2$$

$$\therefore x = 2, y = 3$$

**Question-18**

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

$$y = mx + 3$$

**Solution:**

$$2x + 3y = 11 \dots\dots\dots (1)$$

$$2x - 4y = -24 \dots\dots\dots (2)$$

From (1)

$$x = \frac{11 - 3y}{2}, \text{ sub in (2)}$$

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

$$11 - 7y = -24$$

$$7y = 24 + 11 = 35$$

$$\Rightarrow y = 5$$

Substitute  $y = 5$  in  $x = \frac{11 - 3y}{2}$

$$x = \frac{11 - 15}{2} = -2$$

$$\therefore x = -2, y = 5.$$

For the equation  $y = mx + 3$

Substitute  $x = -2, y = 5$  then

$$5 = -2m + 3$$

$$-2m = 2$$

$$\therefore m = -1$$

**Question-19**

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.

(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 ₹3800. Later, she buys 3 bats and 5 balls for ₹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 ₹105 and for a journey of 15 km, the charge paid is ₹155. What are the fixed charge and the charge per km? 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

**Solution:**

(i) Let the 2 numbers be  $x, y$

$$x - y = 26 \dots\dots\dots(1)$$

$$x = 3y \dots\dots\dots(2)$$

By substitution method, substituting (2) in (1)

$$3y - y = 26$$

$$y = \frac{26}{2} = 13$$

Substituting  $y = 13$  in (2)

$$x = 39, y = 13$$



(ii) Let the 2 angles be  $x$  and  $y$

$$x + y = 180^\circ \dots\dots\dots(1)$$

$$x - y = 18^\circ \dots\dots\dots(2)$$

from (1)  $x = 180 - y$

Substituting in (2)  $180 - y - y = 18$

$$-2y = 18 - 180$$

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

Substituting  $y = 81$  in  $x = 180 - y$

$$x = 180 - 81$$

$$x = 99^\circ$$

$$\therefore x = 99^\circ, y = 81^\circ$$

(iii) Let the price of a bat be  $x$  and that of a ball be  $y$

$$7x + 6y = 3800 \dots\dots\dots(1)$$

$$3x + 5y = 1750 \dots\dots\dots(2)$$

Let us express  $x$  in terms of  $y$

From (1)  $7x = 3800 - 6y$

$$x = \frac{3800 - 6y}{7} \dots\dots\dots(3)$$

Substitute in (2)

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

$$11400 - 18y + 35y = 1750 \times 7$$

$$17y = 12250 - 11400 = 850$$

$$\therefore y = \frac{850}{17} = 50$$

$$\text{from(3) } x = \frac{3800 - (6 \times 50)}{7} = \frac{3500}{7} = 500$$

$$\therefore \text{ Cost of bat is `500}$$

$$\therefore \text{ Cost of ball is `50}$$



(iv) Let the fixed charge be `x and charge per km be `y

$$\text{Total charges} = \frac{\text{For a distance of 10 km}}{\text{Fixed charge} + (\text{Charge per km} \times \text{Distance Travelled})}$$

$$x + 10y = 105 \dots\dots\dots (1)$$

$$x + 15y = 115 \dots\dots\dots (2)$$

$$\text{from (1), } x = 105 - 10y$$

Substituting in (2)

$$x + 15y = 115$$

$$105 - 10y + 15y = 115$$

$$5y = 115 - 105$$

$$y = \frac{10}{5} = 2$$

$$\therefore x = 105 - (2 \times 10) = 85$$

Fixed charges = `85/-

Charge per km = `5/-

For travelling a distance of 25km the person has to pay

$$x + 25y = 85 + 25(2)$$

$$= `35$$

(v) Let the fraction be  $\frac{x}{y}$ , x the numerator and y the denominator

$$\frac{x+2}{y+2} = \frac{9}{11} \dots\dots\dots (1)$$

$$\frac{x+3}{y+3} = \frac{5}{6} \dots\dots\dots (2)$$

$$\text{from (1) } (x+2)11 = 9(y+2)$$

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

$$11x - 9y = -4$$

$$x = \frac{9y - 4}{11} \dots\dots\dots (3)$$

$$\text{from (2) } (x+3)6 = (y+3)5$$

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

$$6x - 5y = -3 \dots\dots\dots (4)$$

Substituting (3) in (4)

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

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

$$\Rightarrow -y = -9$$

$$\therefore y = 9.$$

Substituting  $y = 9$  in (3) we get,

$$x = \frac{9y - 4}{11}$$

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

$$= \frac{81 - 4}{11} = \frac{77}{11} = 7$$

$\therefore$  The fraction is  $\frac{7}{9}$ .

(vi) Let Jacob's age be  $x$  and his son's age be  $y$

5 years hence,

$$\text{Jacob's age} = x + 5$$

$$\text{Jacob's son's age} = y + 5$$

$$(x + 5) = 3(y + 5) \dots\dots\dots (1)$$

5 years ago,

$$\text{Jacob's age} = x - 5$$

$$\text{Jacob's son's age} = y - 5$$

$$(x - 5) = 7(y - 5) \dots\dots\dots (2)$$

$$(1) \text{ becomes } x + 5 = 3y + 15$$

$$x - 3y = 10 \Rightarrow x = 3y + 10 \dots\dots\dots (3)$$

$$(2) \text{ becomes } x - 5 = 7y - 35$$

$$x - 7y = -30 \dots\dots\dots (4)$$

sub for  $x$  from (3) in (4)

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

$$-4y = -10 - 30 = -40$$

$$\therefore y = 10$$

$$(3) \Rightarrow x = 3y + 10 = 40$$

$$= 30 + 10 = 40$$

$\therefore$  Jacob age = 40 and his son's age = 10.

**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.4**

**Question-20**

Solve the following pair of linear 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  $x - \frac{y}{3} = 3$

**Solution:**

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

Elimination method:

$$x + y = 5 \dots\dots\dots (1)$$

$$2x - 3y = 4 \dots\dots\dots (2)$$

$$(1) \times 2 \Rightarrow 2x + 2y = 10 \dots\dots\dots (3)$$

$$(2) \Rightarrow 2x - 3y = 4$$

$$(3) - (2) \Rightarrow 5y = 6$$

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

Substitute  $y = \frac{6}{5}$  in (1)

$$x + y = 5$$

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

$$= \frac{25 - 6}{5} = \frac{19}{5}$$

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

Substitution method:

From (1) :  $x = 5 - y$

Substituting in (2) :  $2(5 - y) - 3y = 4$

$$10 - 2y - 3y = 4$$

$$-5y = 4 - 10$$

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

$$x = 5 - y$$

$$= 5 - \left(\frac{6}{5}\right) = \frac{25 - 6}{5} = \frac{19}{5}$$

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

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

Elimination method:

$$3x + 4y = 10 \dots\dots\dots (1)$$

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

Multiply (2) with 2 and adding with (1) we get,

$$3x + 4y = 10 \dots\dots\dots (1)$$

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

$$\Rightarrow 7x = 14$$

$$x = \frac{14}{7} = 2$$

Substitute  $x = 2$  in (2)

$$2x - 2y = 2$$

$$\Rightarrow 2(2) - 2y = 2$$

$$2y = 4 - 2 = 2$$

$$\therefore y = 1$$

Thus  $x = 2, y = 1$ .

Substitution method:

$$3x + 4y = 10 \dots\dots\dots (1)$$

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

$$\text{from (2) } x - y = 1$$

$$\Rightarrow x = 1 + y$$

$$\text{Substitute in (1) } \Rightarrow 3(1+y) + 4y = 10$$

$$3 + 3y + 4y = 10$$

$$7y = 7 \Rightarrow y = 1$$

$$\text{Substitute in (1) } \Rightarrow 3x + 4 = 10$$

$$3x = 6$$

$$\Rightarrow x = 2$$

Thus  $x = 2, y = 1$ .

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

Elimination method:

$$3x - 5y = 4 \dots\dots\dots(1)$$

$$9x - 2y = 7 \dots\dots\dots(2)$$

Multiply (1) with 3 and adding with (2) we get,

$$9x - 15y = 12 \dots\dots\dots(1)$$

$$9x - 2y = 7 \dots\dots\dots(2)$$

$$-13y = 5$$

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

Substitute  $y = \frac{-5}{13}$  in (1)

$$3x - 5y = 4$$

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

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

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

$$\Rightarrow x = \frac{27}{13 \times 3} = \frac{9}{13}$$

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

Substitution method:

$$3x = 5y + 4 \dots\dots\dots(1)$$

$$9x = 2y + 7 \dots\dots\dots(2)$$

$$\text{from (1) } x = \frac{5y + 4}{3}$$

sub in (2)

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

$$15y + 12 - 2y - 7 = 0$$

$$13y = -5$$

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

$$x = \frac{5\left(\frac{-5}{13}\right) + 4}{3} = \frac{-25 + 52}{39} = \frac{-27}{39} = \frac{-9}{13}$$

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

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

Elimination method:

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

$$x - \frac{y}{3} = 3 \dots\dots\dots (2)$$

Multiply by 6 on both sides in equation (1)

Multiply by 3 in both sides in equation (2)

$$3x + 4y = -6 \dots\dots\dots (3)$$

$$3x - y = 9 \dots\dots\dots (4)$$

$$(3) - (4) \Rightarrow 5y = -15$$

$$y = -3$$

Substituting  $y = -3$  in (3) we get,

$$3x + 4y = -6$$

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

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

$$x = 2$$

Thus  $x = 2, y = -3$ .

Substitution method:

Multiply by 6 on both sides in equation (1)

Multiply by 3 in both sides in equation (2)

$$3x + 4y = -6 \dots\dots\dots (3)$$

$$3x - y = 9 \dots\dots\dots (4)$$

$$\Rightarrow y = 3x - 9 \text{ from (4)}$$

Substitute in (3)

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

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

$$15x = 30$$

$$\therefore x = 2$$

Since,  $y = 3x - 9$

$$y = 3(2) - 9$$

$$y = 6 - 9 = -3.$$

Thus  $x = 2, y = -3$ .



**Question-21**

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.

**Solution:**

(i) Let the fraction be  $\frac{x}{y}$ , x is the numerator and y is the denominator

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

$$\frac{x}{y+1} = \frac{1}{2} \dots\dots\dots (2)$$

becomes  $x + 1 = y - 1$

(i.e.,)  $x - y = -2$

$$\Rightarrow x = y - 2 \dots\dots\dots (3)$$

(2) becomes,

$$2x = y + 1 \dots\dots\dots (4)$$

sub x in (4)

$$2(y - 2) = y + 1$$

$$2y - 4 = y + 1$$

$$2y - y = 4 + 1$$

$$y = 5$$

$$\therefore x = y - 2 \text{ from (3)}$$

$$= 3$$

$\therefore$  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?

Nuri's age =  $x$

Sonu's age =  $y$

$$5 \text{ years ago, } x - 5 = 3(y - 5) \dots\dots\dots (1)$$

$$10 \text{ years later, } x + 10 = 2(y + 10) \dots\dots\dots (2)$$

$$x - 5 = 3y - 15$$

$$x = 3y - 10 \dots\dots\dots (3)$$

sub  $x$  in (2)

$$3y - 10 + 10 = 2y + 20$$

$$3y - 2y = 20$$

$$y = 20$$

$$\begin{aligned} \therefore \text{Nuri's age } x &= 3y - 10 \\ &= 3(20) - 10 \\ &= 60 - 10 = 50 \end{aligned}$$

Nuri's age  $x = 50$  years

Sonu's age  $y = 20$  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.

Let  $x, y$  be the 2 digits of the number

$$x + y = 9 \dots\dots\dots (1)$$

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

$$(2) \Rightarrow 90x + 9y = 20y + 2x$$

$$88x - 11y = 0$$

$$\Rightarrow 8x - y = 0 \dots\dots\dots (3)$$

Solving (1) and (3) we get,

$$x + y = 9 \dots\dots\dots (4)$$

$$8x - y = 0 \dots\dots\dots (3)$$

$$\Rightarrow 9x = 9$$

$$\therefore x = 1$$

Substituting  $x = 1$  in (1)

$$x + y = 9$$

$$1 + y = 9$$

$$y = 8.$$

The two-digit number is 18.

**Question-22**

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

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

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

**Solution:**

(i) 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.

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

$$x + y = 25 \dots\dots\dots (1)$$

$$50x + 100y = 2000 \dots\dots\dots (2)$$

simplifying (2)

$$x + 2y = 40 \dots\dots\dots (3)$$

$$x + y = 25$$

$$\underline{x + 2y = 40}$$

$$y = 15$$

sub for  $y = 15$  in (1)

$$x + 15 = 25$$

$$x = 10$$

Number of Rs. 50 notes = 10

Number of Rs. 100 notes = 15

(ii) 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.

Let  $x$  be the fixed charge for first three days and  $y$  be the additional charge. Saritha had the book for 7 days, so she pays additional charges for 4 days. Susy had the book for 5 days so she pays additional charges for 2 days.

Saritha paid

$$x + 4y = 27 \dots\dots\dots (1)$$

$$\text{Susy paid, } x + 2y = 21 \dots\dots\dots (2)$$

Subtracting (1) and (2)

$$2y = 6$$

$$\therefore y = 3$$

$$\text{Eqn. (1)} \Rightarrow x + 4(3) = 27$$

$$x + 12 = 27$$

$$x = 15$$

Fixed charges = Rs. 15

Additional charges = Rs. 3 per day

**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.5**

**Question-23**

Which of the following pairs of linear equations has unique solution, no solution, or infinitely many solutions. In case there is a unique solution, find it by using cross multiplication method.

(i)  $x - 3y - 3 = 0$

$$3x - 9y - 2 = 0$$

(ii)  $2x + y = 5$

$$3x + 2y = 8$$

(iii)  $3x - 5y = 20$

$$6x - 10y = 40$$

(iv)  $x - 3y - 7 = 0$

$$3x - 3y - 15 = 0$$

**Solution:**

(i)  $\frac{a_1}{a_2} = \frac{1}{3}$ ,  $\frac{b_1}{b_2} = \frac{-3}{-9} = \frac{1}{3}$  and  $\frac{c_1}{c_2} = \frac{3}{2}$

Since  $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ , there is no solution.

(ii)  $2x + y = 5$

$$3x + 2y = 8$$

$$\frac{a_1}{a_2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-5}{-8}$$

Since  $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ , we have a unique solution.

By cross multiplication method

$$2x + y = 5$$

$$3x + 2y = 8$$

$$\begin{array}{r} x \quad y \quad 1 \\ 1 \quad -5 \quad 2 \quad 1 \\ 2 \quad -8 \quad 3 \quad 2 \end{array}$$

$$\frac{x}{-8+10} = \frac{y}{-15+16} = \frac{1}{4-3}$$

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

$$\Rightarrow x = 2, y = 1.$$

(iii)  $3x - 5y = 20$

$6x - 10y = 40$

$$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{5}{10} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{20}{40} = \frac{1}{2}$$

Since  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ , there are infinitely many solutions

(iv)  $x - 3y - 7 = 0$

$3x - 3y - 15 = 0$

$$\frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{-3}{-3} = 1,$$

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

∴ It has a unique solution

By cross multiplication method

$$x - 3y - 7 = 0$$

$$3x - 3y - 15 = 0$$

$$\begin{array}{r} x \quad y \quad 1 \\ -3 \quad -7 \quad 1 \quad -3 \\ -3 \quad -15 \quad 3 \quad -3 \end{array}$$

$$\frac{x}{45 - 21} = \frac{y}{-21 + 15} = \frac{1}{-3 + 9}$$

$$\Rightarrow \frac{x}{24} = \frac{y}{-6} = \frac{1}{6}$$

$$\Rightarrow x = 4, y = -1.$$



**Question-24**

(i) For which values of a and b does the following pair of linear equations have an infinite number of solutions?

$$2x + 3y = 7$$

$$(a - b)x + (a + b)y = 3a + b - 2$$

(ii) For which value of k will the following pair of the linear equations have no solution?

$$3x + y = 1$$

$$(2k - 1)x + (k - 1)y = 2k + 1$$

**Solution:**

(i) If the above equation should have an infinite number of solution.

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

$$\text{(i.e.,)} \quad \frac{2}{a-b} = \frac{3}{a+b} = \frac{7}{3a+b-2}$$

$$\frac{2}{a-b} = \frac{3}{a+b}$$

$$\text{(i.e.,)} \quad 2(a+b) = 3(a-b)$$

$$2a - 3a = -3b - 2b$$

$$-a = -5b$$

$$a = 5b$$

$$\frac{3}{a+b} = \frac{7}{3a+b-2} \dots\dots\dots(1)$$

Substitute  $a = 5b$  in (1)

$$\frac{3}{6b} = \frac{7}{3(5b)+b-2}$$

$$16b - 2 = 14b$$

$$2b = 2$$

$$b = 1$$

Substitute  $b = 1$  in  $a = 5b$

$$a = 5(1)$$

$$= 5$$

$$a = 5, b = 1.$$



(ii) For which value of  $k$  will the following pair of the linear equations have no solution?

$$3x + y = 1$$

$$(2k - 1)x + (k - 1)y = 2k + 1$$

If the two equation should have no solution then  $\frac{a_1}{a_2} = \frac{b_1}{b_2}$

$$\text{(i.e.,)} \quad \frac{3}{2k - 1} = \frac{1}{k - 1}$$

$$\text{(i.e.,)} \quad 3(k - 1) = (2k - 1)$$

$$3k - 3 = 2k - 1$$

$$3k - 2k = 3 - 1$$

$$k = 2$$

Hence  $k = 2$  satisfies the above condition

**Question-25**

Solve the following pair of linear equations by the substitutions and cross multiplication methods:

$$8x + 5y = 9$$

$$3x + 2y = 4$$

**Solution:**

By substitution method

$$8x + 5y = 9 \dots\dots\dots (1)$$

$$3x + 2y = 4 \dots\dots\dots (2)$$

$$\text{from(2) } y = \frac{4 - 3x}{2} \dots\dots\dots (3)$$

Substitute in (1)

$$8x + 5\left(\frac{4 - 3x}{2}\right) = 9$$

$$16x + 20 - 15x = 18$$

$$x = 18 - 20$$

$$= -2$$

Substitute  $x = -2$  in (3)

$$y = \frac{4 - 3(-2)}{2}$$

$$= \frac{4 + 6}{2} = 5$$

$$\therefore x = -2, y = 5$$

By cross multiplication method:

$$8x + 5y = 9$$

$$3x + 2y = 4$$

$$\frac{x}{-20 + 18} = \frac{y}{-27 + 32} = \frac{1}{16 - 15}$$

$$\frac{x}{-2} = \frac{y}{5} = 1$$

$$\Rightarrow x = -2, y = 5$$

**Question-26**

Form the pair of linear equations in the following problem and find its solution (if they exist) by any algebraic method:

A part of monthly hostel charges is fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 20 days she has to pay ₹1000 as hostel charges whereas a student B, who takes food for 26 days, pays ₹1180 as hostel charges. Find the fixed charges and the cost of food per day.

**Solution:**

Let the fixed charges be  $x$  and cost of food per day be  $y$

In the case of student A

$$x + 20y = 1000 \dots\dots\dots (1)$$

In the case of student B

$$x + 26y = 1180 \dots\dots\dots (2)$$

Subtracting

(1) from (2)

$$26y - 20y = 1180 - 1000$$

$$6y = 180$$

$$y = 30$$

substituting  $y = 30$  in (1) we get,

$$x + 20(30) = 1000$$

$$x = 1000 - 600 = 400$$

∴ Fixed charges = ₹400 and cost of food per day = ₹30

**Question-27**

Form the pair of linear equations in the following problem and find its solution (if they exist) by any algebraic method:

A fraction becomes  $\frac{1}{3}$  when 1 is subtracted from the numerator and it becomes  $\frac{1}{4}$  when 8 is added to its denominator. Find the fraction.

**Solution:**

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

$$\frac{x-1}{y} = \frac{1}{3} \text{ (given) } \dots\dots\dots(1)$$

$$\frac{x}{y+8} = \frac{1}{4} \text{ (given) } \dots\dots\dots(2)$$

from (1)  $3(x-1) = y$

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

from (2)  $4x = y + 8$

$$4x - y = 8 \dots\dots\dots(4)$$

subtracting (4) from (3)

$$(3x - y) - (4x - y) = 3 - 8$$

$$-x = -5$$

$$x = 5$$

sub  $x = 5$  in (3)

$$3x - y = 3$$

$$3 \times 5 - y = 3$$

$$y = -3 + 15 = 12$$

$\therefore$  The fraction is  $\frac{5}{12}$

**Question-28**

Form the pair of linear equations in the following problem and find it's solution (if they exist) by any algebraic method:

Yash scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each incorrect answer, then Yash would have scored 50 marks. How many questions were there in the test?

**Solution:**

Let x be the no of right answers and y be the no of wrong answers written by Yash respectively.

$$3x - y = 40 \dots\dots\dots (1)$$

$$4x - 2y = 50 \dots\dots\dots (2)$$

$$(1) \times 2 \Rightarrow 6x - 2y = 80 \dots\dots\dots (3)$$

$$(2) \Rightarrow 4x - 2y = 50$$

$$(3) - (2) \Rightarrow 2x = 30$$

$$\therefore x = 15$$

$$\text{From (1), } 3(15) - y = 40$$

$$y = 45 - 40 = 5$$

$\therefore$  Number of right answers be 15 and number of wrong answers be 5.



**Question-29**

Form the pair of linear equations in the following problem and find it's solution (if they exist) by any algebraic method:

Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5 hours. If they travel towards each other, they meet in 1 hour. What are the speeds of the two cars?

**Solution:**

Let  $x$  be the speed of 1<sup>st</sup> car and  $y$  be the speed of the 2<sup>nd</sup> car

If car (1) meets (2) at C

Distance traveled by car(1) is  $5x$

Distance traveled by car(2) is  $5y$

We know that

$$5x - 5y = 100$$

when they travel in the opposite direction (towards each other) they meet at C in 1 hour.

Since distance between A and B = 100

$$AB = AC - BC$$

Distance traveled by car (1) =  $x$

Distance traveled by car (2) =  $y$

We know that  $x + y = 100$  ( $AC + BC = 100$ )

$$5x - 5y = 100 \dots\dots\dots(1)$$

$$x + y = 100 \dots\dots\dots(2)$$

$$(1) \Rightarrow 5x - 5y = 100$$

$$5 \times (2) \Rightarrow 5x + 5y = 500$$

$$10x = 600$$

$$x = 60$$

$$\text{from (1) } 5y = 5x - 100$$

$$= 5(60) - 100 = 300 - 100$$

$$5y = 200$$

$$\therefore y = 40$$

$$\therefore \text{Speed of car (1) = 60 km/ hr}$$

$$\text{Speed of car (2) = 40 km/ hr}$$



**Question-30**

Form the pair of linear equations in the following problem and find its solution (if they exist) by any algebraic method:

The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and breadth is increased by 3 units. If we increase the length by 3 units and the breadth by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle.

**Solution:**

Area of rectangle =  $lb$

Let  $l$  be the length and  $b$  be the breadth of the rectangle.

$$(l - 5)(b + 3) = lb - 9 \dots\dots\dots(1)$$

$$(l + 3)(b + 2) = lb + 67 \dots\dots\dots(2)$$

becomes

$$(l - 5)(b + 3) = lb - 9$$

$$lb + 3l - 5b - 15 = lb - 9$$

$$3l - 5b = 6 \dots\dots\dots(3)$$

becomes

$$(l + 3)(b + 2) = lb + 67$$

$$lb + 2l + 3b + 6 = lb + 67$$

$$2l + 3b = 61 \dots\dots\dots(4)$$

Multiply (3) by 2 and (4) by 3,

$$6l - 10b = 12$$

$$\underline{6l + 9b = 183}$$

$$-19b = -171$$

$$b = 9$$

$$\text{from (3)} \Rightarrow 3l - 5(9) = 6$$

$$3l = 45 + 6$$

$$l = \frac{51}{3} = 17$$

$$\therefore l = 17, b = 9.$$

Thus the length and breadth of the rectangle are 17 units and 9 units respectively.

**NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.6**

**Question-31**

Solve the following pairs of equations by reducing them to a pair of linear equation:

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

$\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$

(ii)  $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$

$\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

**Solution:**

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

$\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$  .....(2)

Let  $\frac{1}{x} = a, \frac{1}{y} = b$

$\frac{a}{2} + \frac{b}{3} = 2$  ..... (3)

$\frac{a}{3} + \frac{b}{2} = \frac{13}{6}$  ..... (4)

Multiplying (3) and (4) by 6

$\Rightarrow 3a + 2b = 12$  ..... (5)

$\Rightarrow 2a + 3b = 13$  ..... (6)

(5)  $\times 2$  and (6)  $\times 3$

$6a + 4b = 24$

$6a + 9b = 39$

Subtracting  $-5b = -15$

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

put  $b = 3$  in (5)

$3a + 2(3) = 12$

$3a = 6$

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

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

$$(ii) \frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$$

$$\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$$

$$\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2 \dots\dots\dots (1)$$

$$\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1 \dots\dots\dots (2)$$

$$\text{Let } \frac{1}{\sqrt{x}} = a, \frac{1}{\sqrt{y}} = b$$

$$2a + 3b = 2 \dots\dots\dots (3)$$

$$4a - 9b = -1 \dots\dots\dots (4)$$

$$(3) \times 2 \Rightarrow 4a + 6b = 4$$

$$\underline{(4) \Rightarrow 4a - 9b = 1}$$

$$15b = 5$$

$$\therefore b = \frac{5}{15} = \frac{1}{3}$$

$$\Rightarrow b = \frac{1}{\sqrt{y}} = \frac{1}{3}$$

$$\therefore \sqrt{y} = 3$$

$$\Rightarrow y = 9$$

$$(3) \Rightarrow 2a + 3\left(\frac{1}{3}\right) = 2$$

$$2a + 1 = 2$$

$$2a = 2 - 1$$

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

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

$$\Rightarrow \sqrt{x} = 2, x = 4$$

$$\therefore x = 4, y = 9$$

**Question-32**

Solve the following pairs of equations by reducing them to a pair of linear equation:

(i)  $\frac{4}{x} + 3y = 14$

$$\frac{3}{x} - 4y = 23$$

(ii)  $\frac{5}{x-1} + \frac{1}{y-2} = 2$

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

**Solution:**

(i)  $\frac{4}{x} + 3y = 14$

$$\frac{3}{x} - 4y = 23$$

Let  $\frac{1}{x} = a$

$$4a + 3y = 14 \dots\dots\dots (3)$$

$$3a - 4y = 23 \dots\dots\dots (4)$$

$$(3) \times 4 \Rightarrow 16a + 12y = 56$$

$$(4) \times 3 \Rightarrow 9a - 12y = 69$$

Adding  $25a = 125$

$$a = \frac{125}{25} = 5, a = \frac{1}{x} = 5$$

$$\therefore x = \frac{1}{5}$$

Substituting in (3),  $a = 5$  we get

$$4(5) + 3y = 14$$

$$3y = 14 - 20 = -6$$

$$y = -2$$

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

$$(ii) \frac{5}{x-1} + \frac{1}{y-2} = 2$$

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

$$\frac{5}{x-1} + \frac{1}{y-2} = 2 \dots\dots\dots (1)$$

$$\frac{6}{x-1} - \frac{3}{y-2} = 1 \dots\dots\dots (2)$$

$$\text{Let } \frac{1}{x-1} = a, \frac{1}{y-2} = b$$

Substituting a, b in (1) and (2) we get,

$$5a + b = 2 \dots\dots\dots (3)$$

$$6a - 3b = 1 \dots\dots\dots (4)$$

$$(3) \times 3 \Rightarrow 15a + 3b = 6$$

$$(4) \Rightarrow \frac{6a - 3b = 1}{21a = 7}$$

$$\therefore a = \frac{7}{21} = \frac{1}{3}$$

Substituting in eq. (3)

$$\frac{5}{3} + b = 2$$

$$\Rightarrow b = 2 - \frac{5}{3} = \frac{1}{3}$$

$$\therefore a = \frac{1}{3}, b = \frac{1}{3}$$

Substitute in  $\frac{1}{x-1} = a$

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

$$x - 1 = 3 \Rightarrow x = 4$$

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

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

$$\Rightarrow y - 2 = 3$$

$$\Rightarrow y = 5$$

Hence  $x = 4, y = 5$ .

**Question-33**

Solve the following pairs of equations by reducing them to a pair of linear equation:

(i)  $\frac{7x - 2y}{xy} = 5$   
 $\frac{8x + 7y}{xy} = 15$

(ii)  $6x + 3y = 6xy$   
 $2x + 4y = 5xy$

**Solution:**

(i)  $\frac{7x - 2y}{xy} = 5$   
 $\frac{8x + 7y}{xy} = 15$   
 $\frac{7x - 2y}{xy} = 5$  ..... (1)  
 $\frac{8x + 7y}{xy} = 15$  ..... (2)

Separating the fraction

$\frac{7x}{xy} - \frac{2y}{xy} = 5$   
 $\frac{7}{y} - \frac{2}{x} = 5 \Rightarrow \frac{2}{x} + \frac{7}{y} = 5$   
 $\frac{8x}{xy} + \frac{7y}{xy} = 15$   
 $\frac{8}{y} + \frac{7}{x} = 15 \Rightarrow \frac{7}{x} + \frac{8}{y} = 15$

Let  $\frac{1}{x} = a$ ,  $\frac{1}{y} = b$

$-2a + 7b = 5$  ..... (1)

$7a + 8b = 15$  ..... (2)

Multiply (1) with 7, (2) with 2, we get.

$-14a + 49b = 35$

$14a + 16b = 30$

$65b = 65$

$b = 1$

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



$$\Rightarrow y = 1$$

Substitute  $b = 1$  in (1)

$$-2a + 7(1) = 5$$

$$-2a = 5 - 7$$

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

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

$$\Rightarrow x = 1$$

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

$$(ii) 6x + 3y = 6xy$$

$$2x + 4y = 5xy$$

$$6x + 3y = 6xy$$

$$2x + 4y = 5xy$$

$\div$  by  $xy$

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

$$\frac{6}{y} + \frac{3}{x} = 6 \dots\dots\dots(1)$$

$$2x + 4y = 5xy$$

$\div$  by  $xy$

$$\frac{2x}{xy} + \frac{4y}{xy} = \frac{5xy}{xy}$$

$$\frac{2}{y} + \frac{4}{x} = 5 \dots\dots\dots(2)$$

substituting  $\frac{1}{y} = a$  and  $\frac{1}{x} = b$  in eq. (1) and (2)

$$a + 2b = 2 \dots\dots\dots(3)$$

$$4a + 2b = 5 \dots\dots\dots(4)$$

$$-3a = -3$$

$$a = 1$$

Substituting  $a = 1$  in (3) we get,

$$1 + 2b = 2$$

$$2b = 1$$

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

$$\text{Thus if } a = \frac{1}{x} = 1$$

$$\Rightarrow x = 1.$$

$$\text{Thus if } b = \frac{1}{y} = \frac{1}{2}$$

$$y = 2$$

$$\text{Hence } x = 1, y = 2.$$

**Question-34**

Solve the following pairs of equations by reducing them to a pair of linear equation:

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

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

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

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

**Solution:**

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

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

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

$$10a + 2b = 4 \dots\dots (1)$$

$$15a - 5b = -2 \dots\dots (2)$$

Multiply (1) with 3 and (2) with 2, we get

$$30a + 6b = 12$$

$$30a - 10b = -4$$

$$16b = 16$$

$$b = 1$$

Substituting  $b = 1$  in (1) we get,

$$10a + 2(1) = 4$$

$$10a = 4 - 2$$

$$10a = 2$$

$$a = \frac{2}{10} = \frac{1}{5}$$

as  $\frac{1}{x+y} = a = \frac{1}{5}$

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

and  $\frac{1}{x-y} = b$

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

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

Solving (3) and (4)

$$x + y = 5$$

$$x - y = 1$$

$$2x = 6$$

$$x = 3$$

when  $x = 3$

$$3 + y = 5$$

$$y = 5 - 3 = 2$$

Thus  $x = 3, y = 2$ .

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

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

$$\text{Let } \frac{1}{3x + y} = a \text{ and } \frac{1}{3x - y} = b$$

$$a + b = \frac{3}{4}$$

$$\Rightarrow 4a + 4b = 3 \dots\dots\dots (1)$$

$$\frac{a}{2} - \frac{b}{2} = \frac{-1}{8}$$

$$\frac{a - b}{2} = \frac{-1}{8}$$

$$a - b = \frac{-2}{8} = \frac{-1}{4}$$

$$4a + 4b = 3$$

$$4a - 4b = -1$$

$$8a = 2$$

$$a = \frac{2}{8}$$

$$a = \frac{1}{4}$$

substituting in (1)

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

$$4b = 2$$

$$b = \frac{2}{4} = \frac{1}{2}$$

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

$$3x + y = 4 \dots\dots\dots (3)$$

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

$$3x - y = 2 \dots\dots\dots (4)$$

$$(3) + (4) \Rightarrow$$

$$3x + y = 4$$

$$3x - y = 2$$

$$6x = 6$$

$$x = 1$$

substituting  $x = 1$  in (3) we get

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

$$y = 1$$

Thus  $x = 1, y = 1$ .

**Question-35**

Formulate the following problems as a pair of equations, and hence find their solutions:

(i) Ritu can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.

(ii) 2 woman and 5 men can together finish an embroidery work in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the work, and also that taken by 1 man alone.

**Solution:**

(i) Let the speed of rowing in still water be 'x' and the speed of the current be y km/hr.

$$\therefore \text{Speed upstream} = (x - y) \text{ km/hr}$$

$$\therefore \text{Speed downstream} = (x + y) \text{ km/hr}$$

case 1

Where Ritu rows 20 km downstream in 2 hours, the equation is

$$\frac{20}{x + y} = 2$$

$$2(x + y) = 20$$

$$x + y = 10 \dots\dots\dots(1)$$

case 2

When Ritu rows 4 km downstream in 2 hours, the equation is

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

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

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

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

solving (1) and (2)

$$2x = 12$$

$$x = 6$$

Substitute x = 6 in (1)

$$x + y = 10$$

$$6 + y = 10$$

$$y = 10 - 6$$

$$= 4$$

Therefore speed of the rowing in still water = 6 km/hr

And speed of the current = 4 km/hr.

(ii) 2 woman and 5 men can together finish an embroidery work in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the work, and also that taken by 1 man alone.

Let a woman take  $x$  days to complete the work.

$$\text{One women's one day work} = \left(\frac{1}{x}\right)$$

Similarly let one man take ' $y$ ' days to complete the work.

$$\text{Therefore one man's one day work} = \frac{1}{y}$$

$$\therefore \frac{2}{x} + \frac{5}{y} = \frac{1}{4}$$

$$\text{Let } \frac{1}{x} = a, \frac{1}{y} = b$$

$$2a + 5b = \frac{1}{4}$$

$$8a + 20b = 1 \dots\dots\dots (1)$$

$$\frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

$$\text{Let } \frac{1}{x} = a, \frac{1}{y} = b$$

$$3a + 6b = \frac{1}{3}$$

$$9a + 18b = 1 \dots\dots\dots (2)$$

$$((1) \times 9) \Rightarrow 72a + 180b = 9$$

$$((2) \times 8) \Rightarrow \underline{72a + 144b = 8}$$

$$36b = 1$$

$$b = \frac{1}{36}, \text{ Substitute } b = \frac{1}{36} \text{ in (1)}$$

$$3a + 6\left(\frac{1}{36}\right) = \frac{1}{3}$$

$$3a = \frac{1}{3} - \frac{1}{6}$$

$$3a = \frac{2-1}{6}$$

$$3a = \frac{1}{6}$$

$$a = \frac{1}{18}$$

$$\text{when } a = \frac{1}{18}$$

$$\frac{1}{x} = \frac{1}{18} \text{ or } x = 18$$

$$\text{when } b = \frac{1}{36}$$

$$\frac{1}{y} = \frac{1}{36}$$

$$y = 36$$

$\therefore$  Time taken by 1 woman to do the work = 18 days.

$\therefore$  Time taken by 1 man to do the work = 36 days.



**Question-36**

Formulate the following problem as a pair of equations, and hence find it's solution

Roohi travels 300 km to her home partly by train and partly by bus. She takes 4 hours if she travels 60 km by train and the remaining by bus. If she travels 100 km by train and the remaining by bus, she takes 10 minutes longer. Find the speed of the train and the bus separately.

**Solution:**

Let the speed of the train be 'x' km/hr

Let the speed of the bus be 'y' km/hr

Case (i)

Distance traveled by train = 60 km

Distance traveled by bus = 300 - 60 = 240 km

Time taken by Roohi in train =  $\frac{60}{x}$  (Time taken =  $\frac{\text{Distance}}{\text{Speed}}$ )

Time taken by Roohi in bus =  $\frac{240}{y}$

Total time = 4 hrs

$$= \frac{60}{x} + \frac{240}{y} = 4 \dots\dots\dots (1)$$

case (ii)

Distance traveled by train = 100 km

Distance traveled by bus = 300 - 100 = 200 km

Time taken by Roohi in Train =  $\frac{100}{x}$  (Time taken =  $\frac{\text{Distance}}{\text{Speed}}$ )

Time taken by Roohi in Bus =  $\frac{200}{y}$

Total time is 10 more minutes

$$\text{Longer than time taken in case (i)} \therefore 4 + \frac{10}{60} = 4 + \frac{1}{6} = \frac{25}{6}$$

$$\therefore \frac{100}{x} + \frac{200}{y} = \frac{25}{6} \dots\dots\dots (2)$$

Solving (1) and (2)

$$\frac{60}{x} + \frac{240}{y} = 4 \dots\dots\dots (1)$$

$$\frac{100}{x} + \frac{200}{y} = \frac{25}{6} \dots\dots\dots (2)$$



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

Rewrite (1) and (2) as follows

$$60a + 240b = 4$$

$$100a + 200b = \frac{25}{6}$$

Multiply (1) with 5, and (2) with 6

$$300a + 1200b = 20 \dots\dots (3)$$

$$600a + 1200b = 25 \dots\dots (4)$$

$$(3) - (4) \Rightarrow -300a = -5$$

$$a = \frac{-5}{-300} = \frac{1}{60} \text{ in (1)}$$

Substituting  $a = \frac{1}{60}$  in (1)

$$60 \times \frac{1}{60} + 240b = 4$$

$$240b = 4 - 1$$

$$240b = 3$$

$$\Rightarrow b = \frac{1}{80}$$

$$\text{when } a = \frac{1}{60}$$

$$\text{(or) } \frac{1}{x} = \frac{1}{60} \Rightarrow x = 60 \text{ km/hr}$$

$$\text{when } b = \frac{1}{80}$$

$$\text{(or) } \frac{1}{y} = \frac{1}{80} \Rightarrow y = 80 \text{ km/hr}$$

$\therefore$  speed of train = 60 km/hr

and speed of bus = 80 km/hr

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