CBSE Class–10 Mathematics

NCERT solution

Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.1

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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.

Ans. Let the present age of Aftab and his daughter be x years and y years respectively.

Seven years ago, Age of Aftab = (x - 7) years and Age of his daughter = (y - 7) years.

According to the given condition,

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

$$\Rightarrow x-7=7y-49$$

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

Again, Three years hence, Age of Aftab = x + 3 and Age of his daughter = y + 3

According to the given condition,

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

$$\Rightarrow x+3=3y+9$$

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

Thus, the given conditions can be algebraically represented as:

x - 7y = –42

$\Rightarrow$ x = –42 + 7y

Three solutions of this equation can be written in a table as follows:

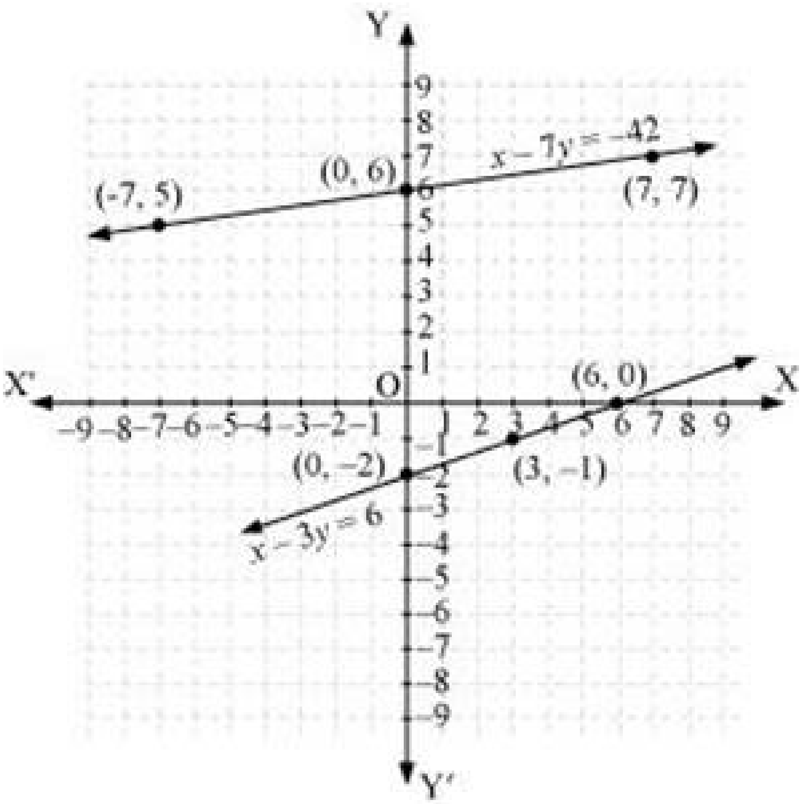
x	–7	0	7
y	5	6	7

And x – 3y = 6

$\Rightarrow x = 6 + 3y$

Three solutions of this equation can be written in a table as follows:

x	6	3	0
y	0	−1	−2



The graphical representation is as follows:

Concept insight: In order to represent the algebraic equations graphically the solution set of equations must be taken as whole numbers only for the accuracy. Graph of the two linear equations will be represented by a straight line.

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

Ans. Let cost of 1 cricket bat = Rs x and let cost of 1 cricket ball= Rs y

According to given conditions, we have

$3x + 6y = 3900 \Rightarrow x + 2y = 1300$... **(1)**

And $x + 3y = 1300$... **(2)**

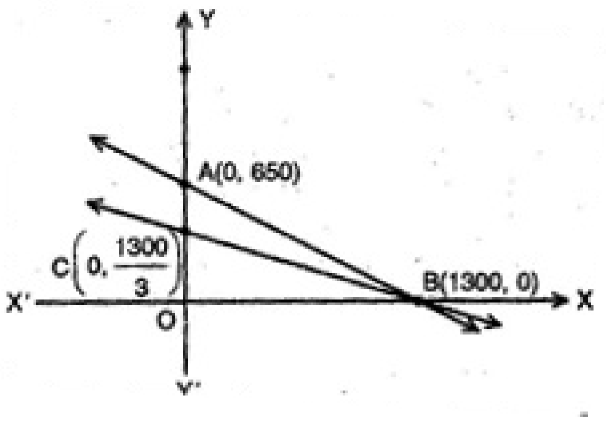
For equation $x + 2y = 1300$, we have following points which lie on the line

x	0	1300
y	650	0

For equation $x + 3y = 1300$, we have following points which lie on the line

x	0	1300
y	$\frac{1300}{3}$	0

We plot the points for both of the equations and it is the graphical representation of the given situation.



It is clear that these lines intersect at B (1300,0).

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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.

Ans. Let cost of 1 kg of apples = Rs x and let cost of 1 kg of grapes= Rs y

According to given conditions, we have

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

$4x + 2y = 300$

$\Rightarrow 2x + y = 150$... **(2)**

So, we have equations **(1)** and **(2),** $2x + y = 160$ and $2x + y = 150$ which represent given situation algebraically.

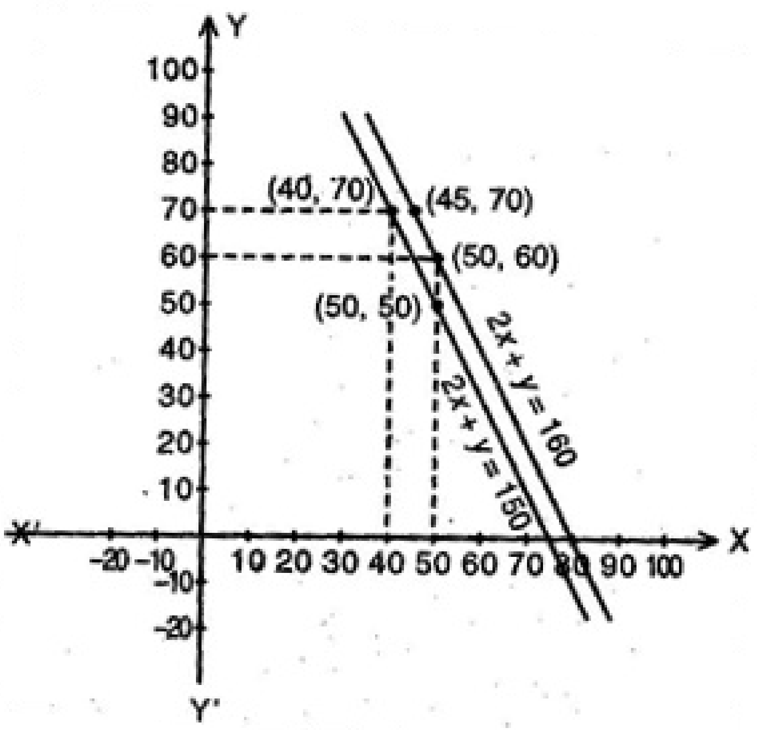
For equation 2x + y = 160, we have following points which lie on the line

x	50	45
y	60	70

For equation 2x + y = 150, we have following points which lie on the line

x	50	40
y	50	70

We plot the points for both of the equations and it is the graphical representation of the given situation.



CBSE Class–10 Mathematics

NCERT solution

Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.2

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.

(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. (i) Let number of boys who took part in the quiz = x

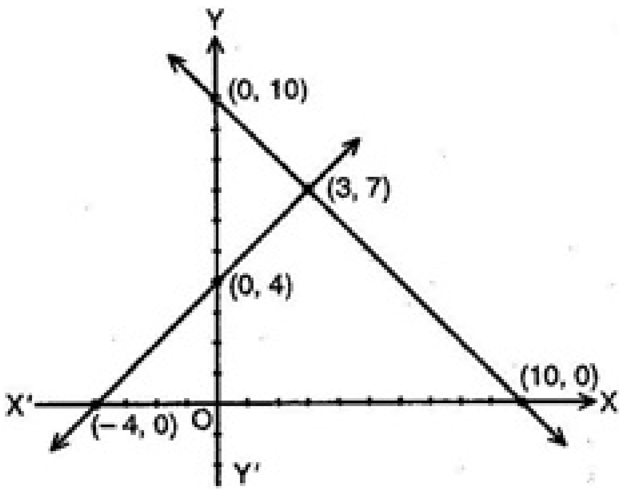
Let number of girls who took part in the quiz = y

According to given conditions, we have

$x + y = 10$... **(1)**

And, $y = x + 4$

$\Rightarrow x - y = -4$ ... **(2)**



For equation x + y = 10, we have following points which lie on the line

x	0	10
y	10	0

For equation x – y = –4, we have following points which lie on the line

x	0	- 4
y	4	0

We plot the points for both of the equations to find the solution.

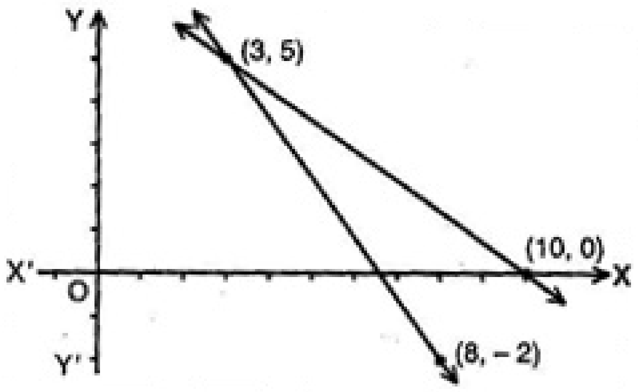
We can clearly see that the intersection point of two lines is **(3, 7).**

Therefore, number of boys who took park in the quiz = 3 and, number of girls who took part in the quiz = 7.

(ii) Let cost of one pencil = Rs x and Let cost of one pen = Rs y

According to given conditions, we have

$5x + 7y = 50$... **(1)**



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

For equation 5x + 7y = 50, we have following points which lie on the line

x	10	3
y	0	5

For equation 7x + 5y = 46, we have following points which lie on the line

x	8	3
y	−2	5

We can clearly see that the intersection point of two lines is **(3, 5).**

Therefore, cost of pencil = Rs 3 and, cost of 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 coincide:

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

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

(iii) 6*x* − 3*y* + 10 = 0; 2*x* – *y* + 9 = 0

Ans. (i) 5*x* − 4*y* + 8 = 0, 7*x* + 6*y* – 9 = 0

Comparing equation 5*x* − 4*y* + 8 = 0 with $a_1x+b_1y+c_1 = 0$ and 7*x* + 6*y* – 9 = 0 with $a_2x+b_2y+c_2 = 0$,

We get, $a_1 = 5, b_1 = -4, c_1 = 8, a_2 = 7, b_2 = 6, c_2 = -9$

We have $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ because $\frac{5}{7} \neq \frac{-4}{6}$

Hence, lines have unique solution which means they intersect at one point.

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

Comparing equation 9*x* + 3*y* + 12 = 0 with $a_1x+b_1y+c_1 = 0$ and 18*x* + 6*y* + 24 = 0 with $a_2x+b_2y+c_2 = 0$,

We get, $a_1 = 9, b_1 = 3, c_1 = 12, a_2 = 18, b_2 = 6, c_2 = 24$

We have $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ because $\frac{9}{18} = \frac{3}{6} = \frac{12}{24} \Rightarrow \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$

Hence, lines are coincide.

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

Comparing equation $6x - 3y + 10 = 0$ with $a_1x + b_1y + c_1 = 0$ and $2x - y + 9 = 0$ with $a_2x + b_2y + c_2 = 0$,

We get, $a_1 = 6$, $b_1 = -3$, $c_1 = 10$, $a_2 = 2$, $b_2 = -1$, $c_2 = 9$

We have $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ because $\frac{6}{2} = \frac{-3}{-1} \neq \frac{10}{9} \Rightarrow \frac{3}{1} = \frac{3}{1} \neq \frac{10}{9}$

Hence, lines are parallel to each other.

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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 pair of linear equations are consistent, or inconsistent.

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

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

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

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

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

Ans. (i) $3x + 2y = 5$, $2x - 3y = 7$

Comparing equation $3x + 2y = 5$ with $a_1x + b_1y + c_1 = 0$ and $2x - 3y = 7$ with $a_2x + b_2y + c_2 = 0$,

We get, $a_1 = 3, b_1 = 2, c_1 = -5$, $a_2 = 2, b_2 = -3, c_2 = -7$

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

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ which means equations have unique solution.

Hence they are consistent.

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

Comparing equation $2x - 3y = 8$ with $a_1x + b_1y + c_1 = 0$ and $4x - 6y = 9$ with $a_2x + b_2y + c_2 = 0$,

We get, $a_1 = 2, b_1 = -3, c_1 = -8, a_2 = 4, b_2 = -6, c_2 = -9$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ because $\frac{2}{4} = \frac{-3}{-6} \neq \frac{-8}{-9} \Rightarrow \frac{1}{2} = \frac{1}{2} \neq \frac{-8}{-9}$

Therefore, equations have no solution because they are parallel.

Hence, they are inconsistent.

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

Comparing equation $\frac{3}{2}x + \frac{5}{3}y = 7$ with $a_1x + b_1y + c_1 = 0$ and $9x - 10y = 14$ with $a_2x + b_2y + c_2 = 0$,

We get, $a_1 = \frac{3}{2}, b_1 = \frac{5}{3}, c_1 = -7, a_2 = 9, b_2 = -10, c_2 = -14$

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

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

Therefore, equations have unique solution.

Hence, they are consistent.

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

Comparing equation $5x - 3y = 11$ with $a_1x+b_1y+c_1 = 0$ and $-10x + 6y = -22$ with $a_2x+b_2y+c_2 = 0$,

We get, $a_1 = 5, b_1 = -3, c_1 = -11, a_2 = -10, b_2 = 6, c_2 = 22$

$$\frac{a_1}{a_2} = \frac{5}{-10} = \frac{-1}{2}, \frac{b_1}{b_2} = \frac{-3}{6} = \frac{-1}{2} \text{ and } \frac{c_1}{c_2} = \frac{-11}{22} = \frac{-1}{2}$$

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

Therefore, the lines have infinite many solutions.

Hence, they are consistent.

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

Comparing equation $\frac{4}{3}x + 2y = 8$ with $a_1x+b_1y+c_1 = 0$ and $2x + 3y = 12$ with $a_2x+b_2y+c_2 = 0$,

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

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

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

Therefore, the lines have infinite many solutions.

Hence, they are consistent.

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4. Which of the following pairs of linear equations are consistent/inconsistent? If

consistent, obtain the solution graphically:

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

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

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

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

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

For equation x + y = 5 we have following points which lie on the line

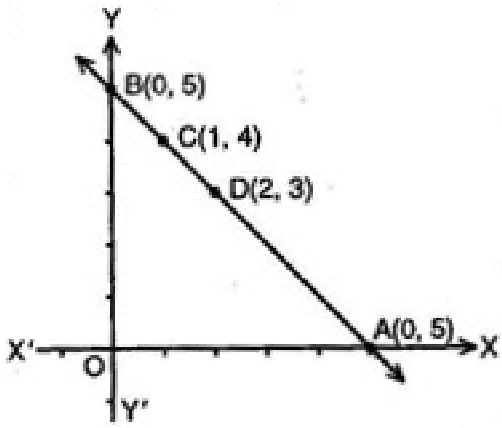
x	0	5
y	5	0

For equation 2x + 2y – 10 = 0, we have following points which lie on the line

x	1	2
y	4	3

We can see that both of the lines coincide. Hence, there are infinite many solutions. Any point which lies on one line also lies on the other. Hence, by using equation ($x + y - 5 = 0$), we can say that $x = 5 - y$

We can assume any random values for y and can find the corresponding value of x using the above equation. All such points will lie on both lines and there will be infinite number of such points.



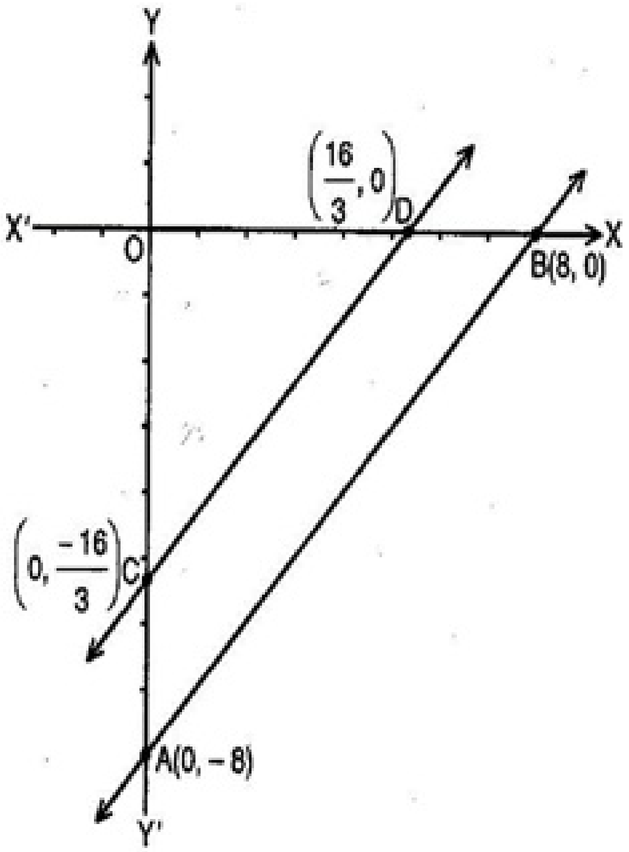
(ii) $x - y = 8$, $3x - 3y = 16$

For x – y = 8, the coordinates are:

x	0	8
y	– 8	0

And for 3x – 3y = 16, the coordinates

x	0	$\frac{16}{3}$
y	$\frac{-16}{3}$	0



Plotting these points on the graph, it is clear that both lines are parallel. So the two lines have no common point. Hence the given equations have no solution and lines are inconsistent.

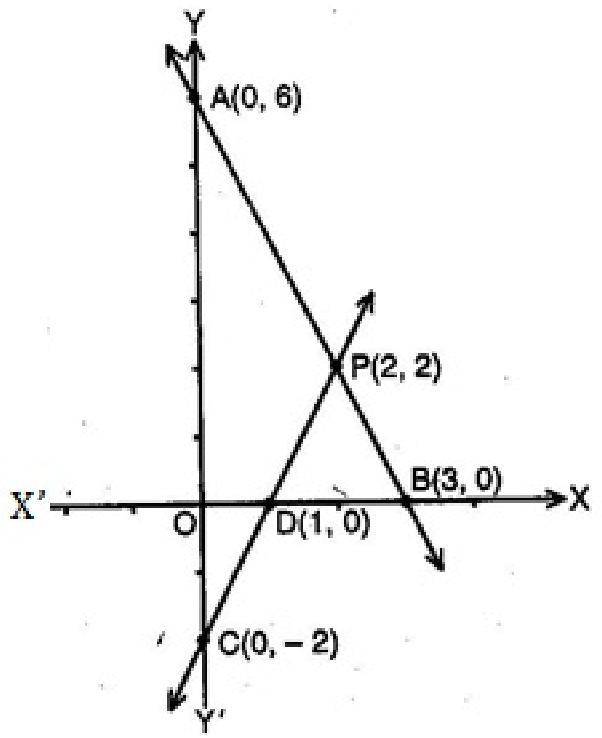
(iii) $2x + y - 6 = 0$, $4x - 2y - 4 = 0$

For equation 2x + y – 6 = 0, we have following points which lie on the line

x	0	3
y	6	0

For equation 4x – 2y – 4 = 0, we have following points which lie on the line

x	0	1
y	−2	0



We can clearly see that lines are intersecting at (2, 2) which is the solution.

Hence x = 2 and y = 2 and lines are consistent.

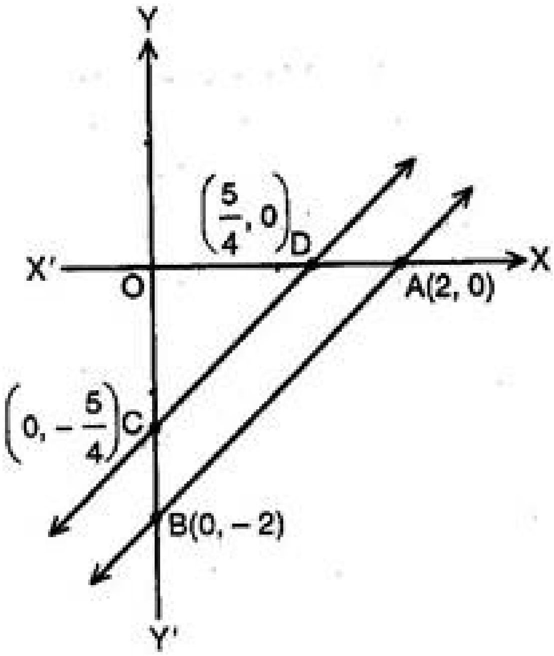
(iv) $2x - 2y - 2 = 0$, $4x - 4y - 5 = 0$

For 2x – 2y – 2 = 0, the coordinates are:

x	2	0
y	0	−2

And for 4x – 4y – 5 = 0, the coordinates

x	0	$\frac{5}{4}$
y	$\frac{-5}{4}$	0



Plotting these points on the graph, it is clear that both lines are parallel. So the two lines have no common point. Hence the given equations have no solution and lines are inconsistent.

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

Ans. Let length of rectangular garden = x metres

Let width of rectangular garden = y metres

According to given conditions, perimeter = 36 m

$\Rightarrow \frac{1}{2}\left[2\left(x+y\right)\right]=36$

$\Rightarrow$ x + y = 36 ……(i)

And x = y + 4

$\Rightarrow x - y = 4$........(ii)

Adding eq. (i) and (ii),

2x = 40

$\Rightarrow$ x = 20 m

Subtracting eq. (ii) from eq. (i),

2y = 32

$\Rightarrow$ y = 16 m

Hence, length = 20 m and width = 16 m

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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

(ii) Parallel lines

(iii) Coincident lines

Ans. (i) Let the second line be equal to $a_2x + b_2y + c_2 = 0$

Comparing given line **2x + 3y – 8 = 0** with $a_1x + b_1y + c_1 = 0$,

We get $a_1 = 2, b_1 = 3 \; and \; c_1 = -8$

Two lines intersect with each other if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

So, second equation can be **x** + **2y** = **3** because $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

(ii) Let the second line be equal to $a_2x + b_2y + c_2 = 0$

Comparing given line **2x** + **3y** – **8** = **0 with** $a_1x+b_1y+c_1 = 0$,

We get $a_1 = 2, b_1 = 3 \text{ and } c_1 = -8$

Two lines are parallel to each other if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

So, second equation can be **2x** + **3y** – **2** = **0** because $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

(iii) Let the second line be equal to $a_2x+b_2y+c_2 = 0$

Comparing given line **2x** + **3y** – **8** = **0 with** $a_1x+b_1y+c_1 = 0$,

We get $a_1 = 2, b_1 = 3 \text{ and } c_1 = -8$

Two lines are coincident if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

So, second equation can be **4x** + **6y** – **16** = **0** because $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

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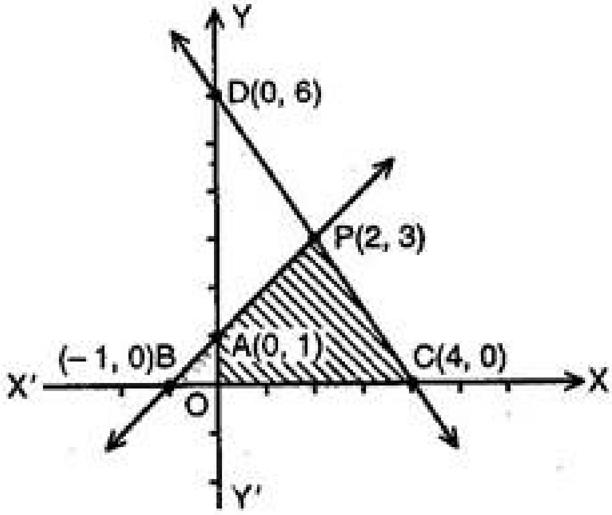
7. Draw the graphs of the equations x – y + 1 = 0 and 3x + 2y – 12 = 0. Determine the coordinates of the vertices of the triangle formed by these lines and the x-axis, and shade the triangular region.

Ans. For equation x – y + 1 = 0, we have following points which lie on the line

x	0	–1
y	1	0

For equation 3x + 2y – 12 = 0, we have following points which lie on the line

x	4	0
y	0	6



We can see from the graphs that points of intersection of the lines with the x–axis are (–1, 0), (2, 3) and (4, 0).

CBSE Class–10 Mathematics

NCERT solution

Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.3

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

(i) $x + y = 14$

$x - y = 4$

(ii) $s - t = 3$

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

(iii) $3x - y = 3$

$9x - 3y = 9$

(iv) $0.2x + 0.3y = 1.3$

$0.4x + 0.5y = 2.3$

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

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

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

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

Ans. (i) $x + y = 14$ ...(1)

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

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

Putting this in equation (1), we get

$4 + y + y = 14$

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

Putting value of y in equation (1), we get

$x + 5 = 14$

$\Rightarrow x = 14 – 5 = 9$

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

(ii) $s – t = 3$ ... (1)

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

Using equation (1), we can say that $s = 3 + t$

Putting this in equation (2), we get

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

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

$\Rightarrow 5t + 6 = 36$

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

Putting value of t in equation (1), we get

$s – 6 = 3 \Rightarrow s = 3 + 6 = 9$

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

(iii) $3x – y = 3$ ... (1)

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

Comparing equation $3x - y = 3$ with $a_1x+b_1y+c_1 = 0$ and equation $9x - 3y = 9$ with $a_2x+b_2y+c_2 = 0$,

We get $a_1 = 3, b_1 = -1, c_1 = -3, a_2 = 9, b_2 = -3 \text{ and } c_2 = -9$

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

Therefore, we have infinite many solutions for x and y

(iv) $0.2x + 0.3y = 1.3$ … (1)

$0.4x + 0.5y = 2.3$ … (2)

Using equation (1), we can say that

$0.2x = 1.3 - 0.3y$

$\Rightarrow x = \frac{1.3-0.3y}{0.2}$

Putting this in equation (2), we get

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

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

$\Rightarrow -0.1y = -0.3 \Rightarrow y = 3$

Putting value of y in (1), we get

$0.2x + 0.3\ (3) = 1.3$

$\Rightarrow 0.2x + 0.9 = 1.3$

$\Rightarrow 0.2x = 0.4 \Rightarrow x = 2$

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

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

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

Using equation (1), we can say that

$x = \dfrac{-\sqrt{3}y}{\sqrt{2}}$

Putting this in equation (2), we get

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

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

Putting value of y in (1), we get $x = 0$

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

(vi) $\dfrac{3x}{2}-\dfrac{5y}{3}=-2$ ... (1)

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

Using equation (2), we can say that

$$x = \left(\frac{13}{6}-\frac{y}{2}\right)\times 3$$

$$\Rightarrow x = \frac{13}{2}-\frac{3y}{2}$$

Putting this in equation (1), we get

$$\frac{3}{2}\left(\frac{13}{2}-\frac{3y}{2}\right)-\frac{5y}{3}=\frac{-2}{1}$$

$$\Rightarrow \frac{39}{4}-\frac{9y}{4}-\frac{5y}{3}=-2$$

$$\Rightarrow \frac{-27y-20y}{12}=-2-\frac{39}{4}$$

$$\Rightarrow \frac{-47y}{12}=\frac{-8-39}{4}$$

$$\Rightarrow \frac{-47y}{12}=\frac{-47}{4} \Rightarrow y = 3$$

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

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

$$\Rightarrow \frac{x}{3}=\frac{13}{6}-\frac{3}{2}=\frac{13-9}{6}=\frac{4}{6}=\frac{2}{3}$$

$$\Rightarrow \frac{x}{3}=\frac{2}{3}$$

$\Rightarrow$ x = 2

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

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

$y = mx + 3$.

Ans. $2x + 3y = 11$ ... (1)

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

Using equation (2), we can say that

$2x = -24 + 4y$

$\Rightarrow x = -12 + 2y$

Putting this in equation (1), we get

$2\,(-12 + 2y) + 3y = 11$

$\Rightarrow -24 + 4y + 3y = 11$

$\Rightarrow 7y = 35 \Rightarrow y = 5$

Putting value of y in equation (1), we get

$2x + 3\,(5) = 11$

$\Rightarrow 2x + 15 = 11$

$\Rightarrow 2x = 11 - 15 = -4 \Rightarrow x = -2$

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

Putting values of x and y in $y = mx + 3$, we get

$5 = m\,(-2) + 3$

$\Rightarrow 5 = -2m + 3$

$\Rightarrow -2m = 2 \Rightarrow m = -1$

---

3. Form a pair of linear equations for the following problems and find their solution by substitution method.

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

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

(iii)The coach of a cricket team buys 7 bats and 6 balls for Rs 3800. Later, she buys 3 bats

and 5 balls for Rs 1750. Find the cost of each bat and each ball.

(iv) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is Rs 105 and for a journey of 15 km, the charge paid is Rs 155. What are the fixed charges and the charge per 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 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?

Ans. (i) Let first number be x and second number be y.

According to given conditions, we have

$x - y = 26$ (assuming x > y) ... (1)

$x = 3y$(x > y)... (2)

Putting equation (2) in (1), we get

$3y - y = 26$

$\Rightarrow 2y = 26$

$\Rightarrow y = 13$

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

$x = 3y = 3 \times 13 = 39$

Therefore, two numbers are 13 and 39.

(ii) Let smaller angle $= x$ and let larger angle $= y$

According to given conditions, we have

$y = x + 18$ … (1)

Also, $x + y = 180^0$ (Sum of supplementary angles) … (2)

Putting (1) in equation (2), we get

$x + x + 18 = 180$

$\Rightarrow 2x = 180 - 18 = 162$

$\Rightarrow x = 81^0$

Putting value of x in equation (1), we get

$y = x + 18 = 81 + 18 = 99^0$

Therefore, two angles are 81^0 and 99^0 .

(iii) Let cost of each bat = Rs x and let cost of each ball = Rs y

According to given conditions, we have

$7x + 6y = 3800$ … (1)

And, $3x + 5y = 1750$ … (2)

Using equation (1), we can say that

$7x = 3800 - 6y \Rightarrow x = \dfrac{3800 - 6y}{7}$

Putting this in equation (2), we get

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

$\Rightarrow \left(\dfrac{11400 - 18y}{7}\right) + 5y = 1750$

$$\Rightarrow \frac{5y}{1} - \frac{18y}{7} = \frac{1750}{1} - \frac{11400}{7}$$

$$\Rightarrow \frac{35y - 18y}{7} = \frac{12250 - 11400}{7}$$

$\Rightarrow 17y = 850 \Rightarrow y = 50$

Putting value of y in (2), we get

$3x + 250 = 1750$

$\Rightarrow 3x = 1500 \Rightarrow x = 500$

Therefore, cost of each bat = Rs 500 and cost of each ball = Rs 50

(iv) Let fixed charge = Rs x and let charge for every km = Rs y

According to given conditions, we have

$x + 10y = 105$... (1)

$x + 15y = 155$... (2)

Using equation (1), we can say that

$x = 105 - 10y$

Putting this in equation (2), we get

$105 - 10y + 15y = 155$

$\Rightarrow 5y = 50 \Rightarrow y = 10$

Putting value of y in equation (1), we get

$x + 10\,(10) = 105$

$\Rightarrow x = 105 - 100 = 5$

Therefore, fixed charge = Rs 5 and charge per km = Rs 10

To travel distance of 25 Km, person will have to pay = Rs (x + 25y)

= Rs (5 + 25 × 10)

= Rs (5 + 250) = Rs 255

(v) Let numerator = x and let denominator = y

According to given conditions, we have

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

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

Using equation (1), we can say that

$11 (x + 2) = 9y + 18$

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

$\Rightarrow 11x = 9y - 4$

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

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

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

$$\Rightarrow \frac{54y}{11} - \frac{24}{11} + 18 = 5y + 15$$

$$\Rightarrow -\frac{24}{11} + \frac{3}{1} = \frac{5y}{1} - \frac{54y}{11}$$

$$\Rightarrow \frac{-24+33}{11} = \frac{55y-54y}{11}$$

$\Rightarrow y = 9$

Putting value of y in (1), we get

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

$\Rightarrow x + 2 = 9 \Rightarrow x = 7$

Therefore, fraction = $\frac{x}{y} = \frac{7}{9}$

(vi) Let present age of Jacob = x years

Let present age of Jacob's son = y years

According to given conditions, we have

$(x + 5) = 3 (y + 5)$ … (1)

And, $(x - 5) = 7 (y - 5)$ … (2)

From equation (1), we can say that

$x + 5 = 3y + 15$

$\Rightarrow x = 10 + 3y$

Putting value of x in equation (2) we get

$10 + 3y - 5 = 7y - 35$

$\Rightarrow -4y = -40$

$\Rightarrow y = 10$ years

Putting value of y in equation (1), we get

$x + 5 = 3 (10 + 5) = 3 \times 15 = 45$

$\Rightarrow x = 45 - 5 = 40$ years

Therefore, present age of Jacob = 40 years and, present age of Jacob's son = 10 years

CBSE Class–10 Mathematics

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Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.4

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

(i) x + y = 5, 2x – 3y = 4

(ii) 3x + 4y = 10, 2x – 2y = 2

(iii) 3*x* − 5*y* – 4 = 0, 9*x* = 2*y* + 7

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

Ans. (i) x + y = 5 … (1)

2x – 3y = 4 … (2)

Elimination method:

Multiplying equation (1) by 2, we get equation (3)

$2x + 2y = 10$ … (3)

$2x - 3y = 4$ … (2)

Subtracting equation (2) from (3), we get

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

Putting value of y in (1), we get

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

$\Rightarrow x = 5 - \frac{6}{5} = \frac{19}{5}$

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

Substitution method:

$x + y = 5$ … (1)

$2x - 3y = 4$ … (2)

From equation (1), we get,

$x = 5 - y$

Putting this in equation (2), we get

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

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

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

Putting value of y in (1), we get

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

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

(ii) $3x + 4y = 10$… (1)

$2x - 2y = 2$… (2)

Elimination method:

Multiplying equation (2) by 2, we get (3)

$4x - 4y = 4$ … (3)

$3x + 4y = 10$ … (1)

Adding (3) and (1), we get

$7x = 14 \Rightarrow x = 2$

Putting value of x in (1), we get

$3(2) + 4y = 10$

$\Rightarrow 4y = 10 - 6 = 4$

$\Rightarrow y = 1$

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

Substitution method:

$3x + 4y = 10$… (1)

$2x - 2y = 2$… (2)

From equation (2), we get

$2x = 2 + 2y$

$\Rightarrow x = 1 + y$ … (3)

Putting this in equation (1), we get

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

$\Rightarrow 3 + 3y + 4y = 10$

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

Putting value of y in (3), we get $x = 1 + 1 = 2$

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

(iii) $3x - 5y - 4 = 0$ ... (1)

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

Elimination method:

Multiplying (1) by 3, we get (3)

$9x - 15y - 12 = 0$... (3)

$9x - 2y - 7 = 0$... (2)

Subtracting (2) from (3), we get

$-13y - 5 = 0$

$\Rightarrow -13y = 5$

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

Putting value of y in (1), we get

$3x - 5\left(\frac{-5}{13}\right) - 4 = 0$

$\Rightarrow 3x = 4 - \frac{25}{13} = \frac{52-25}{13} = \frac{27}{13}$

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

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

Substitution Method:

$3x - 5y - 4 = 0$ ... (1)

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

From equation (1), we can say that

$3x = 4 + 5y \Rightarrow x = \frac{4+5y}{3}$

Putting this in equation (2), we get

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

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

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

Putting value of y in (1), we get

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

$\Rightarrow 3x = 4 - \frac{25}{13} = \frac{52-25}{13} = \frac{27}{13}$

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

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

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

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

Elimination method:

Multiplying equation (2) by 2, we get (3)

$2x-\frac{2}{3}y=6$ … (3)

$\frac{x}{2}+\frac{2y}{3}=-1$ … (1)

Adding (3) and (1), we get

$\frac{5}{2}x=5$ ⇒ x = 2

Putting value of x in (2), we get

2 − $\frac{y}{3}$ = 3

⇒ y = −3

Therefore, x = 2 and y = −3

Substitution method:

$\frac{x}{2}+\frac{2y}{3}=-1$ … (1)

$x-\frac{y}{3}=3$ … (2)

From equation (2), we can say that $x=3+\frac{y}{3}=\frac{9+y}{3}$

Putting this in equation (1), we get

$\frac{9+y}{6}+\frac{2}{3}y=-1$

⇒ $\frac{9+y+4y}{6}=-1$

⇒ 5y + 9 = −6

$\Rightarrow 5y = -15 \Rightarrow y = -3$

Putting value of y in (1), we get

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

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 ½ if we only add 1 to the denominator. What is the fraction?

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

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

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

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

Ans. (i) Let numerator $=x$ and let denominator $=y$

According to given condition, we have

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

$\Rightarrow x + 1 = y - 1$ and $2x = y + 1$

$\Rightarrow x - y = -2$ ... **(1)** and $2x - y = 1$... **(2)**

So, we have equations **(1)** and **(2)**, multiplying equation **(1)** by 2 we get **(3)**

$2x - 2y = -4$... **(3)**

$2x - y = 1$... **(2)**

Subtracting equation **(2)** from **(3)**, we get

$-y = -5 \Rightarrow y = 5$

Putting value of y in **(1)**, we get

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

Therefore, fraction = $\frac{x}{y} = \frac{3}{5}$

(ii) Let present age of Nuri = x years and let present age of Sonu = y years

5 years ago, age of Nuri = (x – 5) years

5 years ago, age of Sonu = (y – 5) years

According to given condition, we have

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

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

$\Rightarrow x - 3y = -10$... **(1)**

10 years later from present, age of Nuri = $(x + 10)$ years

10 years later from present, age of Sonu = $(y + 10)$ years

According to given condition, we have

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

$\Rightarrow x + 10 = 2y + 20$

$\Rightarrow x - 2y = 10$ … **(2)**

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

$y = 10 - (-10) = 20$ years

Putting value of **y** in **(1)**, we get

$x - 3\,(20) = -10$

$\Rightarrow x - 60 = -10$

$\Rightarrow x = 50$ years

Therefore, present age of Nuri = 50 years and present age of Sonu = 20 years

(iii) Let digit at ten's place = x and Let digit at one's place = y

According to given condition, we have

$x + y = 9$ … **(1)**

And $9\,(10x + y) = 2\,(10y + x)$

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

$\Rightarrow 88x = 11y$

$\Rightarrow 8x = y$

$\Rightarrow 8x - y = 0$ … **(2)**

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

$9x = 9 \Rightarrow x = 1$

Putting value of **x** in **(1)**, we get

$1 + y = 9$

$\Rightarrow y = 9 - 1 = 8$

Therefore, number = $10x + y = 10(1) + 8 = 10 + 8 = 18$

(iv) Let number of Rs 100 notes = x and let number of Rs 50 notes = y

According to given conditions, we have

$x + y = 25$ … **(1)**

and $100x + 50y = 2000$

$\Rightarrow 2x + y = 40$ … **(2)**

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

$-x = -15 \Rightarrow x = 15$

Putting value of **x** in **(1)**, we get

$15 + y = 25$

$\Rightarrow y = 25 - 15 = 10$

Therefore, number of Rs 100 notes = 15 and number of Rs 50 notes = 10

(v) Let fixed charge for 3 days = Rs x
Let additional charge for each day thereafter = Rs y
According to given condition, we have
$x + 4y = 27$ … **(1)**
$x + 2y = 21$ … **(2)**
Subtracting **(2)** from **(1)**, we get
$2y = 6 \Rightarrow y = 3$
Putting value of **y** in **(1)**, we get
$x + 4(3) = 27$
$\Rightarrow x = 27 - 12 = 15$
Therefore, fixed charge for 3 days = Rs 15 and additional charge for each day after 3 days = Rs 3

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Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.5

1. 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) $x - 3y - 7 = 0$

$3x - 3y - 15 = 0$

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

$3x - 9y - 2 = 0$

Comparing equation $x - 3y - 3 = 0$ with $a_1x + b_1y + c_1 = 0$ and $3x - 9y - 2 = 0$ with $a_2x + b_2y + c_2 = 0$,

We get $a_1 = 1, b_1 = -3, c_1 = -3, a_2 = 3, b_2 = -9, c_2 = -2$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ this means that the two lines are parallel.

Therefore, there is no solution for the given equations i.e. it is inconsistent.

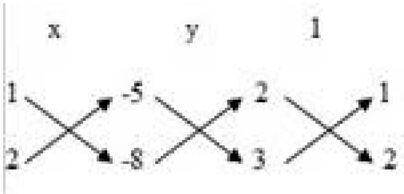
(ii) $2x + y = 5$

$3x + 2y = 8$

Comparing equation $2x + y = 5$ with $a_1x + b_1y + c_1 = 0$ and $3x + 2y = 8$ with $a_2x + b_2y + c_2 = 0$,

We get $a_1 = 2, b_1 = 1, c_1 = -5, a_2 = 3, b_2 = 2, c_2 = -8$

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ this means that there is unique solution for the given equations.



$$\frac{x}{(-8)(1)-(2)(-5)} = \frac{y}{(-5)(3)-(-8)(2)} = \frac{1}{(2)2-(3)1}$$

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

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

$\Rightarrow x = 2$ and $y = 1$

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

$6x - 10y = 40$

Comparing equation $3x - 5y = 20$ with $a_1x + b_1y + c_1 = 0$ and $6x - 10y = 40$ with $a_2x + b_2y + c_2 = 0$,

We get $a_1 = 3, b_1 = -5, c_1 = -20, a_2 = 6, b_2 = -10, c_2 = -40$

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

It means lines coincide with each other.

Hence, there are infinitely many solutions.

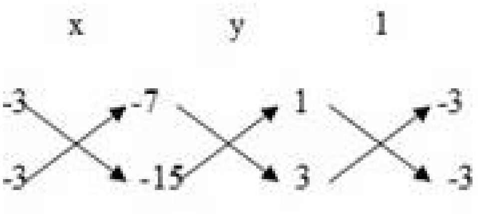
(iv) $x - 3y - 7 = 0$

$3x - 3y - 15 = 0$

Comparing equation $x - 3y - 7 = 0$ with $a_1x + b_1y + c_1 = 0$ and $3x - 3y - 15 = 0$ with $a_2x + b_2y + c_2 = 0$,

We get $a_1 = 1, b_1 = -3, c_1 = -7, a_2 = 3, b_2 = -3, c_2 = -15$

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ this means that we have unique solution for these equations.



$$\frac{x}{(-3)(-15)-(-3)(-7)} = \frac{y}{(-7)(3)-(-15)(1)} = \frac{1}{(-3)1-(-3)3}$$

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

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

$\Rightarrow x = 4$ and $y = -1$

---

2. (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 linear equations have no solution?

$3x + y = 1$

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

Ans. (i) Comparing equation $2x + 3y - 7 = 0$ with $a_1x + b_1y + c_1 = 0$ and $(a - b)\, x + (a + b)\, y - 3a - b + 2 = 0$ with $a_2x + b_2y + c_2 = 0$

We get $a_1 = 2, b_1 = 3$ and $c_1 = -7, a_2 = (a - b), b_2 = (a + b)$ and $c_2 = 2 - b - 3a$

Linear equations have infinite many solutions if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\Rightarrow \frac{2}{a-b} = \frac{3}{a+b} = \frac{-7}{2-b-3a}$

$\Rightarrow \frac{2}{a-b} = \frac{3}{a+b}\ and\ \frac{3}{a+b} = \frac{-7}{2-b-3a}$

$\Rightarrow 2a + 2b = 3a - 3b$ and $6 - 3b - 9a = -7a - 7b$

$\Rightarrow a = 5b$... (1) and $-2a = -4b - 6$... (2)

Putting (1) in (2), we get

$-2\,(5b) = -4b - 6$

$\Rightarrow -10b + 4b = -6$

$\Rightarrow -6b = -6 \Rightarrow b = 1$

Putting value of b in (1), we get

$a = 5b = 5\ (1) = 5$

Therefore, $a = 5$ and $b = 1$

(ii) Comparing $(3x + y - 1 = 0)$ with $a_1x + b_1y + c_1 = 0$ and $(2k - 1)x + (k - 1)y - 2k - 1 = 0)$ with $a_2x + b_2y + c_2 = 0$,

We get $a_1 = 3, b_1 = 1$ and $c_1 = -1, a_2 = (2k-1), b_2 = (k-1)$ and $c_2 = -2k - 1$

Linear equations have no solution if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\Rightarrow \frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{-1}{-2k-1}$

$\Rightarrow \frac{3}{2k-1} = \frac{1}{k-1}$

$\Rightarrow 3\ (k - 1) = 2k - 1$

$\Rightarrow 3k - 3 = 2k - 1$

$\Rightarrow k = 2$

---

3. Solve the following pair of linear equations by the substitution and cross-multiplication methods:

$8x + 5y = 9$

$3x + 2y = 4$

Ans. Substitution Method

$8x + 5y = 9$ … **(1)**

$3x + 2y = 4$ … **(2)**

From equation **(1)**,

$5y = 9 - 8x \Rightarrow y = \dfrac{9-8x}{5}$

Putting this in equation **(2)**, we get

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

$\Rightarrow 3x + \dfrac{18-16x}{5} = 4$

$\Rightarrow 3x - \dfrac{16}{5}x = \dfrac{4}{1} - \dfrac{18}{5}$

$\Rightarrow 15x - 16x = 20 - 18$

$\Rightarrow x = -2$

Putting value of **x** in **(1)**, we get

$8(-2) + 5y = 9$

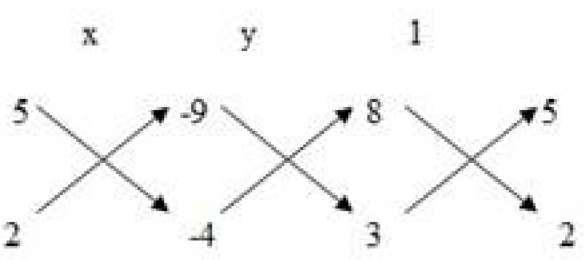
$\Rightarrow 5y = 9 + 16 = 25 \Rightarrow y = 5$

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

Cross multiplication method

$8x + 5y = 9$ ... **(1)**

$3x + 2y = 4$ ... **(2)**



$$\frac{x}{5(-4)-2(-9)} = \frac{y}{(-9)3-(-4)8} = \frac{1}{8\times 2-5\times 3}$$

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

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

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

---

4. Form the pair of linear equations in the following problems and find their solutions (if they exist) by any algebraic method:

(i) 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 Rs 1000 as hostel charges whereas a student B, who takes food for 26 days, pays Rs 1180 as hostel charges. Find the fixed charges and the cost of food per day.

(ii) 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.

(iii) 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?

(iv) 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?

(v) 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.

Ans.(i) Let fixed monthly charge = Rs x and let charge of food for one day = Rs y

According to given conditions,

$x + 20y = 1000$ … (1),

and $x + 26y = 1180$ … (2)

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

$6y = 180$

$\Rightarrow y = 30$

Putting value of y in (1), we get

$x + 20 (30) = 1000$

$\Rightarrow x = 1000 - 600 = 400$

Therefore, fixed monthly charges = Rs 400 and, charges of food for one day = Rs 30

(ii) Let numerator = x and let denominator = y

According to given conditions,

$$\frac{x-1}{y} = \frac{1}{3} \quad \ldots(1) \qquad \frac{x}{y+8} = \frac{1}{4} \quad \ldots(2)$$

$\Rightarrow 3x - 3 = y$ … (1) $4x = y + 8$ … (1)

$\Rightarrow 3x - y = 3$ … (1) $4x - y = 8$ … (2)

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

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

$\Rightarrow x = 5$

Putting value of x in (1), we get

$3(5) - y = 3$

$\Rightarrow 15 - y = 3$

$\Rightarrow y = 12$

Therefore, numerator = 5 and, denominator = 12

It means fraction = $\frac{x}{y} = \frac{5}{12}$

(iii) Let number of correct answers = x and let number of wrong answers = y

According to given conditions,

$3x - y = 40$ … (1)

And, $4x - 2y = 50$ … (2)

From equation (1), $y = 3x - 40$

Putting this in (2), we get

$4x - 2(3x - 40) = 50$

$\Rightarrow 4x - 6x + 80 = 50$

$\Rightarrow -2x = -30$

$\Rightarrow x = 15$

Putting value of x in (1), we get

$3(15) - y = 40$

$\Rightarrow 45 - y = 40$

$\Rightarrow y = 45 - 40 = 5$

Therefore, number of correct answers = x = 15and number of wrong answers = y = 5

Total questions = $x + y = 15 + 5 = 20$

(iv) Let speed of car which starts from part A = x km/hr

Let speed of car which starts from part B = y km/hr

According to given conditions,

$\frac{100}{x-y} = 5$ (Assuming x > y)

$\Rightarrow 5x - 5y = 100$

$\Rightarrow x - y = 20$ … (1)

And, $\frac{100}{x+y} = 1$

$\Rightarrow x + y = 100$ … (2)

Adding (1) and (2), we get

$2x = 120$

$\Rightarrow x = 60$ km/hr

Putting value of x in (1), we get

$60 - y = 20$

$\Rightarrow y = 60 - 20 = 40$ km/hr

Therefore, speed of car starting from point A = 60 km/hr

And, Speed of car starting from point B = 40 km/hr

(v) Let length of rectangle = x units and Let breadth of rectangle = y units

Area =xy square *units.* According to given conditions,

$xy - 9 = (x - 5)(y + 3)$

$\Rightarrow xy - 9 = xy + 3x - 5y - 15$

$\Rightarrow 3x - 5y = 6$ … (1)

And, $xy + 67 = (x + 3)(y + 2)$

$\Rightarrow xy + 67 = xy + 2x + 3y + 6$

$\Rightarrow 2x + 3y = 61$ … (2)

From equation (1),

$3x = 6 + 5y$

$\Rightarrow x = \dfrac{6+5y}{3}$

Putting this in (2), we get

$2\left(\dfrac{6+5y}{3}\right) + 3y = 61$

$\Rightarrow 12 + 10y + 9y = 183$

$\Rightarrow 19y = 171$

$\Rightarrow y = 9$ units

Putting value of y in (2), we get

$2x + 3(9) = 61$

$\Rightarrow 2x = 61 - 27 = 34$

$\Rightarrow x = 17$ units

Therefore, length = 17 units and, breadth = 9 units

CBSE Class–10 Mathematics

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Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.6

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

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

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

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

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

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

$\frac{3}{x}$ − 4y = 23

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

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

(v) $\frac{7x-2y}{xy}=5$

$\frac{8x+7y}{xy}=15$

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

$2x + 4y = 5xy$

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

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

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

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

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

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

Let $\frac{1}{x} = p$ and $\frac{1}{y} = q$

Putting this in equation (1) and (2), we get

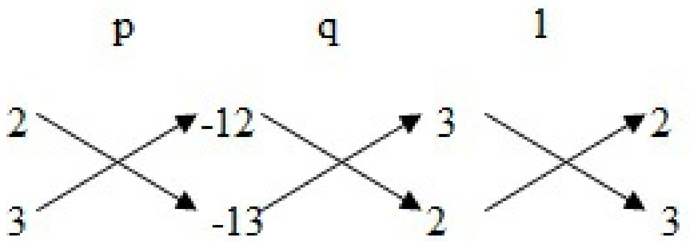
$\frac{p}{2} + \frac{q}{3} = 2 \text{ and } \frac{p}{3} + \frac{q}{2} = \frac{13}{6}$

Multiply both equation by 6, we get

$\Rightarrow 3p + 2q = 12$ and $2p + 3q = 13$

$\Rightarrow 3p + 2q - 12 = 0$ .... (3)

and $2p + 3q - 13 = 0$ .... (4)



$$\frac{p}{2(-13)-3(-12)}=\frac{q}{(-12)2-(-13)3}=\frac{1}{3\times 3-2\times 2}$$

$\Rightarrow \dfrac{p}{-26+36}=\dfrac{q}{-24+39}=\dfrac{1}{9-4}$

$\Rightarrow \dfrac{p}{10}=\dfrac{q}{15}=\dfrac{1}{5}$

$\Rightarrow \dfrac{p}{10}=\dfrac{1}{5}\ and\ \dfrac{q}{15}=\dfrac{1}{5}$

$\Rightarrow p = 2$ and $q = 3$

But $\dfrac{1}{x} = p$ and $\dfrac{1}{y} = q$

Putting value of p and q in this we get

$x = \dfrac{1}{2}$ and $y = \dfrac{1}{3}$

(ii) $\dfrac{2}{\sqrt{x}}+\dfrac{3}{\sqrt{y}}=2$ … (1)

$\dfrac{4}{\sqrt{x}}-\dfrac{9}{\sqrt{y}}=-1$ … (2)

Let $\dfrac{1}{\sqrt{x}} = p$ and $\dfrac{1}{\sqrt{y}} = q$

Putting this in (1) and (2), we get

$2p + 3q = 2$ … (3)

$4p - 9q = -1$ … (4)

Multiplying (3) by 2 and subtracting it from (4), we get

=> $4p - 9q - 2(2p + 3q) = -1 - 2(2)$

⇒ $4p - 9q - 4p - 6q = -1 - 4$

⇒ $-15q = -5$

⇒ $q = \frac{-5}{-15} = \frac{1}{3}$

Putting value of q in (3), we get

=> $2p + 1 = 2$

⇒ $2p = 1$

⇒ $p = \frac{1}{2}$

Putting values of p and q in ($\frac{1}{\sqrt{x}} = p$ and $\frac{1}{\sqrt{y}} = q$), we get

$\frac{1}{\sqrt{x}} = \frac{1}{2}$ and $\frac{1}{\sqrt{y}} = \frac{1}{3}$

⇒ $\frac{1}{x} = \frac{1}{4} \text{ and } \frac{1}{y} = \frac{1}{9}$

⇒ $x = 4$ and $y = 9$

(iii) $\frac{4}{x} + 3y = 14$ … (1)

$\frac{3}{x}$ − 4y = 23 … (2)

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

we get

4p + 3y = 14 … (3)

3p − 4y = 23 … (4)

Multiplying (3) by 3 and (4) by 4, we get

3 (4p + 3y - 14 =0) and, 4 (3p − 4y – 23 = 0)

⇒ 12p + 9y – 42 = 0 … (6) 12p − 16y – 92 = 0 … (7)

Subtracting (7) from (6), we get

9y − (−16y) – 42 − (−92) = 0

⇒ 25y + 50 = 0

⇒ y = $\frac{-50}{25}$ = −2

Putting value of y in (4), we get

4p + 3 (−2) = 14

⇒ 4p – 6 = 14

⇒ 4p = 20

⇒ p = 5

Putting value of p in (3), we get

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

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

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

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

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

Let $\frac{1}{x-1} = p \ \ and \ \frac{1}{y-2} = q$

Putting this in (1) and (2), we get

$5p + q = 2$

$\Rightarrow 5p + q - 2 = 0$ ... (3)

And, $6p - 3q = 1$

$\Rightarrow 6p - 3q - 1 = 0$ ... (4)

Multiplying (3) by 3 and adding it to (4), we get

$3\,(5p + q - 2) + 6p - 3q - 1 = 0$

$\Rightarrow 15p + 3q - 6 + 6p - 3q - 1 = 0$

$\Rightarrow 21p - 7 = 0$

$\Rightarrow p = \frac{1}{3}$

Putting this in (3), we get

$5\,(\frac{1}{3}) + q - 2 = 0$

$\Rightarrow 5 + 3q = 6$

$\Rightarrow 3q = 6 - 5 = 1$

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

Putting values of p and q in ($\frac{1}{x-1} = p \;\; and \;\; \frac{1}{y-2} = q$), we get

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

$\Rightarrow 3 = x - 1$ and $3 = y - 2$

$\Rightarrow x = 4$ and $y = 5$

(v) $7x - 2y = 5xy$ … (1)

$8x + 7y = 15xy$ … (2)

Dividing both the equations by xy, we get

$\frac{7}{y} - \frac{2}{x} = 5 \qquad ...(3)$

$\frac{8}{y} + \frac{7}{x} = 15 \qquad ...(4)$

Let $\frac{1}{x} = p$ and $\frac{1}{y} = q$

Putting these in (3) and (4), we get

$7q - 2p = 5$ … (5)

$8q + 7p = 15$ … (6)

From equation (5),

$2p = 7q - 5$

$\Rightarrow p = \dfrac{7q-5}{2}$

Putting value of p in (6), we get

$8q + 7\left(\dfrac{7q-5}{2}\right) = 15$

$\Rightarrow 16q + 49q - 35 = 30$

$\Rightarrow 65q = 30 + 35 = 65$

$\Rightarrow q = 1$

Putting value of q in (5), we get

$7(1) - 2p = 5$

$\Rightarrow 2p = 2$

$\Rightarrow p = 1$

Putting value of p and q in ($\dfrac{1}{x} = p$ and $\dfrac{1}{y} = q$), we get $x = 1$ and $y = 1$

(vi) $6x + 3y - 6xy = 0$ ... (1)

$2x + 4y - 5xy = 0$ ... (2)

Dividing both the equations by xy, we get

$$\frac{6}{y} + \frac{3}{x} - 6 = 0 \quad ...(3)$$

$$\frac{2}{y} + \frac{4}{x} - 5 = 0 \quad ...(4)$$

Let $\frac{1}{x} = p$ and $\frac{1}{y} = q$

Putting these in (3) and (4), we get

$6q + 3p - 6 = 0$ … (5)

$2q + 4p - 5 = 0$ … (6)

From (5),

$3p = 6 - 6q$

$\Rightarrow p = 2 - 2q$

Putting this in (6), we get

$2q + 4(2 - 2q) - 5 = 0$

$\Rightarrow 2q + 8 - 8q - 5 = 0$

$\Rightarrow -6q = -3 \Rightarrow q = ½$

Putting value of q in (p = 2 – 2q), we get

$p = 2 - 2(½) = 2 - 1 = 1$

Putting values of p and q in ($\frac{1}{x} = p$ and $\frac{1}{y} = q$), we get $x = 1$ and $y = 2$

(vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4$ … (1)

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

Let $\frac{1}{x+y} = p \ and \ \frac{1}{x-y} = q$

Putting this in (1) and (2), we get

$10p + 2q = 4$ … (3)

$15p - 5q = -2$ … (4)

From equation (3),

$2q = 4 - 10p$

$\Rightarrow q = 2 - 5p$ … (5)

Putting this in (4), we get

$15p - 5(2 - 5p) = -2$

$\Rightarrow 15p - 10 + 25p = -2$

$\Rightarrow 40p = 8 \Rightarrow p = \frac{1}{5}$

Putting value of p in (5), we get

$q = 2 - 5\left(\frac{1}{5}\right) = 2 - 1 = 1$

Putting values of p and q in ($\frac{1}{x+y} = p \text{ and } \frac{1}{x-y} = q$), we get

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

$\Rightarrow x + y = 5$ … (6) and $x - y = 1$ … (7)

Adding (6) and (7), we get

$2x = 6 \Rightarrow x = 3$

Putting $x = 3$ in (7), we get

$3 - y = 1$

$\Rightarrow y = 3 - 1 = 2$

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

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

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

Let $\frac{1}{3x+y} = p$ *and* $\frac{1}{3x-y} = q$

Putting this in (1) and (2), we get

$p + q = \frac{3}{4}$ and $\frac{p}{2} - \frac{q}{2} = -\frac{1}{8}$

$\Rightarrow 4p + 4q = 3$ … (3) and $4p - 4q = -1$ … (4)

Adding (3) and (4), we get

$8p = 2 \Rightarrow p = \frac{1}{4}$

Putting value of p in (3), we get

$4 (\frac{1}{4}) + 4q = 3$

$\Rightarrow 1 + 4q = 3$

$\Rightarrow 4q = 3 - 1 = 2$

$\Rightarrow q = \frac{1}{2}$

Putting value of p and q in $\frac{1}{3x+y} = p$ *and* $\frac{1}{3x-y} = q$, we get

$\frac{1}{3x+y} = \frac{1}{4}$ *and* $\frac{1}{3x-y} = \frac{1}{2}$

$\Rightarrow 3x + y = 4$ … (5) and $3x - y = 2$ … (6)

Adding (5) and (6), we get

$6x = 6 \Rightarrow x = 1$

Putting $x = 1$ in (5) , we get

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

$\Rightarrow y = 4 - 3 = 1$

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

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2. Formulate the following problems as a part 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 women 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.

(iii) 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.

Ans. (i) Let speed of rowing in still water = x km/h

Let speed of current = y km/h

So, speed of rowing downstream = $(x + y)$ km/h

And, speed of rowing upstream = $(x - y)$ km/h

According to given conditions,

$$\frac{20}{x+y}=2 \text{ and } \frac{4}{x-y}=2$$

⇒ $2x + 2y = 20$ and $2x - 2y = 4$

⇒ $x + y = 10$ … (1) and $x - y = 2$ … (2)

Adding (1) and (2), we get

$2x = 12$

⇒ $x = 6$

Putting $x = 6$ in (1), we get

$6 + y = 10$

⇒ $y = 10 - 6 = 4$

Therefore, speed of rowing in still water = 6 km/h

Speed of current = 4 km/h

(ii) Let time taken by 1 woman alone to finish the work = x days

Let time taken by 1 man alone to finish the work = y days

So, 1 woman's 1-day work = $\left(\frac{1}{x}\right)th$ part of the work

And, 1 man's 1-day work = $\left(\frac{1}{y}\right)th$ part of the work

So, 2 women's 1-day work = $\left(\frac{2}{x}\right)th$ part of the work

And, 5 men's 1-day work = $\left(\frac{5}{y}\right)th$ part of the work

Therefore, 2 women and 5 men's 1-day work = $\left(\frac{2}{x}+\frac{5}{y}\right)$*th* part of the work... (1)

It is given that 2 women and 5 men complete work in = 4 days

It means that in 1 day, they will be completing $\frac{1}{4}$ *th* part of the work ... (2)

Clearly, we can see that (1) = (2)

$\Rightarrow \frac{2}{x}+\frac{5}{y}=\frac{1}{4}$ ... (3)

Similarly, $\frac{3}{x}+\frac{6}{y}=\frac{1}{3}$ ... (4)

Let $\frac{1}{x}=p \text{ and } \frac{1}{y}=q$

Putting this in (3) and (4), we get

$2p + 5q = \frac{1}{4}$ and $3p + 6q = \frac{1}{3}$

$\Rightarrow 8p + 20q = 1$ ... (5) and $9p + 18q = 1$ ... (6)

Multiplying (5) by 9 and (6) by 8, we get

$72p + 180q = 9$ ... (7)

$72p + 144q = 8$ ... (8)

Subtracting (8) from (7), we get

$36q = 1$

$\Rightarrow q = \frac{1}{36}$

Putting this in (6), we get

$9p + 18\left(\frac{1}{36}\right) = 1$

$\Rightarrow 9p = ½$

$\Rightarrow p = \frac{1}{18}$

Putting values of p and q in $\frac{1}{x} = p \, and \, \frac{1}{y} = q$, we get $x = 18$ and $y = 36$

Therefore, 1 woman completes work in = 18 days

And, 1 man completes work in = 36 days

(iii) Let speed of train = x km/h and let speed of bus = y km/h

According to given conditions,

$$\frac{60}{x} + \frac{240}{y} = 4 \, and \, \frac{100}{x} + \frac{200}{y} = 4 + \frac{10}{60}$$

Let $\frac{1}{x} = p \, and \, \frac{1}{y} = q$

Putting this in the above equations, we get

$60p + 240q = 4$ … (1)

And $100p + 200q = \frac{25}{6}$ … (2)

Multiplying (1) by 5 and (2) by 3, we get

$300p + 1200q = 20$ … (3)

$300p + 600q = \frac{25}{2}$ … (4)

Subtracting (4) from (3), we get

$600q = 20 - \frac{25}{2} = 7.5$

$\Rightarrow q = \frac{7.5}{600}$

Putting value of q in (2), we get

$100p + 200\left(\frac{7.5}{600}\right) = \frac{25}{6}$

$\Rightarrow 100p + 2.5 = \frac{25}{6}$

$\Rightarrow 100p = \frac{25}{6} - 2.5$

$\Rightarrow p = \frac{10}{600}$

But $\frac{1}{x} = p \text{ and } \frac{1}{y} = q$

Therefore, $x = \frac{600}{10} = 60$ km/h and $y = \frac{600}{7.5} = 80$ km/h

Therefore, speed of train = 60 km/h

And, speed of bus = 80 km/h

CBSE Class–10 Mathematics

NCERT solution

Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.7

1. The age of two friends Ani and Biju differ by 3 years. Ani's father Dharam is twice as old as Ani and Biju is twice as old as his sister Cathy. The ages of Cathy and Dharam differ by 30 years. Find the ages of Ani and Biju.

Ans. Let the age of Ani and Biju be x years and y years respectively.

Age of Dharam = 2x years and Age of Cathy = $\frac{y}{2}$ years

According to question, x – y = 3... (1)

And $2x - \frac{y}{2} = 30$

$\Rightarrow$ 4x – y = 60... (2)

Subtracting (1) from (2), we obtain:

3x = 60 – 3 = 57

$\Rightarrow$ x = Age of Ani = 19 years

Age of Biju = 19 – 3 = 16 years

Again, According to question, y – x = 3... (3)

And $2x - \frac{y}{2} = 30$

$\Rightarrow$ 4x – y = 60... (4)

Adding (3) and (4), we obtain:

3x = 63

$\Rightarrow$ x = 21

Age of Ani = 21 years

Age of Biju = 21 + 3 = 24 years

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2. One says, "Give me a hundred, friend! I shall then become twice as rich as you." The other replies, "If you give me ten, I shall be six times as rich as you." Tell me what is the amount of their (respective) capital? [From the Bijaganita of Bhaskara II]

Ans. Let the money with the first person and second person be Rs x and Rs y respectively. According to the question,

$x + 100 = 2(y - 100)$

$\Rightarrow x + 100 = 2y - 200$

$\Rightarrow x - 2y = -300$... (1)

Again, $6(x - 10) = (y + 10)$

$\Rightarrow 6x - 60 = y + 10$

$\Rightarrow 6x - y = 70$... (2)

Multiplying equation (2) by 2, we obtain:

$12x - 2y = 140$... (3)

Subtracting equation (1) from equation (3), we obtain:

$11x = 140 + 300$

$\Rightarrow 11x = 440$

$\Rightarrow x = 40$

Putting the value of x in equation (1), we obtain:

$40 - 2y = -300$

$\Rightarrow 40 + 300 = 2y$

$\Rightarrow$ 2y = 340

$\Rightarrow$ y = 170

Thus, the two friends had Rs 40 and Rs 170 with them.

---

3. A train covered a certain distance at a uniform speed. If the train would have been 10 km/h faster, it would have taken 2 hours less than the scheduled time. And, if the train were slower by 10 km/h, it would have taken 3 hours more than the scheduled time. Find the distance covered by the train.

Ans. Let the speed of the train be x km/h and the time taken by train to travel the given distance be t hours and the distance to travel be d km.

Since Speed = $\dfrac{\text{Distance travelled}}{\text{Time taken to travel that distance}}$

$\Rightarrow x = \dfrac{d}{t}$

$\Rightarrow d = xt$ ... (1)

According to the question

$x + 10 = \dfrac{d}{t-2}$

$\Rightarrow (x+10)(t-2) = d$

$\Rightarrow xt + 10t - 2x - 20 = d$ [Since, $xt = d$]

$\Rightarrow -2x + 10t = 20$ ......(2)[Using eq. (1)]

Again, $x - 10 = \dfrac{d}{t+3}$

$\Rightarrow (x-10)(t+3) = d$

$\Rightarrow xt - 10t + 3x - 30 = d$

$\Rightarrow 3x - 10t = 30$ ......(3)[Using eq. (1)] [Since, $xt = d$]

Adding equations (2) and (3), we obtain:
x = 50
Substituting the value of x in equation (2), we obtain:
$(-2)\times(50) + 10t = 20$

$\Rightarrow$ –100 + 10t = 20

$\Rightarrow$ 10t = 120

$\Rightarrow$ t = 12

From equation (1), we obtain:

d = xt = 50×12 = 600

Thus, the distance covered by the train is 600 km.

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4. The students of a class are made to stand in rows. If 3 students are extra in a row, there would be 1 row less. If 3 students are less in a row, there would be 2 rows more. Find the number of students in the class.

Ans. Let the number of rows be x and number of students in a row be y.
Total number of students in the class = Number of rows x Number of students in a row = xy

According to the question,

Total number of students = (x – 1) (y + 3)

$\Rightarrow$ xy = (x – 1) (y + 3)

$\Rightarrow$ xy = xy – y + 3x – 3

$\Rightarrow$ 3x – y – 3 = 0

$\Rightarrow$ 3x – y = 3... (1)

Total number of students = (x + 2) (y – 3)

$\Rightarrow xy = xy + 2y - 3x - 6$

$\Rightarrow 3x - 2y = -6$... (2)

Subtracting equation (2) from (1), we obtain:

$y = 9$

Substituting the value of y in equation (1), we obtain:

$3x - 9 = 3$

$\Rightarrow 3x = 9 + 3 = 12$

$\Rightarrow x = 4$

Number of rows = x = 4

Number of students in a row = y = 9

Hence, Total number of students in a class = xy = $4 \times 9 = 36$

---

5. In a $\triangle ABC$, $\angle C = 3\angle B = 2(\angle A + \angle B)$. Find three angles.

Ans. $\angle C = 3\angle B = 2(\angle A + \angle B)$

Taking $3\angle B = 2(\angle A + \angle B)$

$\Rightarrow \angle B = 2\angle A$

$\Rightarrow 2\angle A - \angle B = 0$ ....(1)

We know that the sum of the measures of all angles of a triangle is 180°.

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow \angle A + \angle B + 3\angle B = 180°$

$\Rightarrow \angle A + 4\angle B = 180°$ ....(2)

Multiplying equation (1) by 4, we obtain:

$8\angle A - 4\angle B = 0$ ....(3)

Adding equations (2) and (3), we get

$9\angle A = 180^\circ$

$\Rightarrow \angle A = 20^\circ$

From eq. (2), we get,

$20^\circ + 4\angle B = 180^\circ$

$\Rightarrow \angle B = 40^\circ$

And $\angle C = 3 \times 40^\circ = 120^\circ$

Hence the measures of $\angle A$, $\angle B$ and $\angle C$ are $20^\circ, 40^\circ$ *and* 120° respectively.

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6. Draw the graphs of the equations $5x - y = 5$ and $3x - y = 3$. Determine the co-ordinate of the vertices of the triangle formed by these lines and the $y-$axis.

Ans. $5x - y = 5$

$\Rightarrow y = 5x - 5$

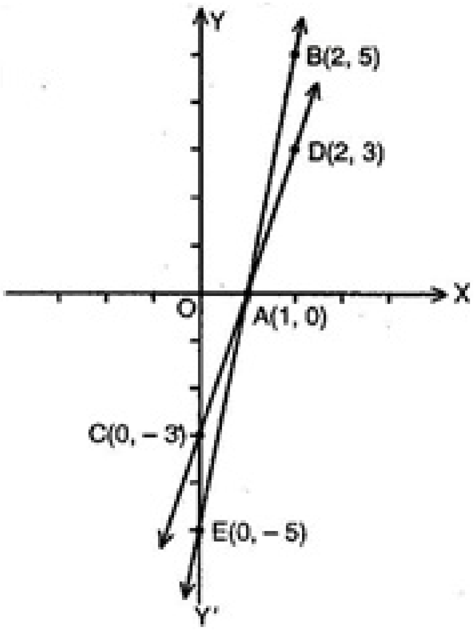
Three solutions of this equation can be written in a table as follows:

x	0	1	2
y	–5	0	5

$3x - y = 3$

$\Rightarrow y = 3x - 3$

x	0	1	2
y	–3	0	3



It can be observed that the required triangle is ΔABC.

The coordinates of its vertices are A (1, 0), B (0, –3), C (0, –5).

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7. Solve the following pair of linear equations:

(i) $px + py = p - q$

$qx - py = p + q$

(ii) $ax + by = c$

$bx + ay = 1 + c$

(iii) $\frac{x}{a} - \frac{y}{b} = 0$

$ax + by = a^2 + b^2$

(iv) $(a-b)x + (a+b)y = a^2 - 2ab - b^2$

$(a+b)(x+y) = a^2 + b^2$

(v) $152x - 378y = -74$

$-378x + 152y = -604$

Ans. (i) $px + qy = p - q$ ... (1)

$qx - py = p + q$ ... (2)

Multiplying equation (1) by p and equation (2) by q, we obtain:

$p^2x + pqy = p^2 - pq$ ... (3)

$q^2x - pqy = pq + q^2$ ... (4)

Adding equations (3) and (4), we obtain:

$p^2x + q^2x = p^2 + q^2$

$\Rightarrow (p^2 + q^2)x = p^2 + q^2$

$\Rightarrow x = \dfrac{p^2 + q^2}{p^2 + q^2} = 1$

Substituting the value of x in equation (1), we obtain:

$p(1) + qy = p - q$

$\Rightarrow qy = -q \Rightarrow y = -1$

Hence the required solution is x = 1 and y = –1.

(ii) $ax + by = c$ ... (1)

$bx + ay = 1 + c$ ... (2)

Multiplying equation (1) by a and equation (2) by b, we obtain:

$a^2x + aby = ac$ ... (3)

$b^2x + aby = b + bc$ ... (4)

Subtracting equation (4) from equation (3),

$(a^2 - b^2)x = ac - bc - b$

$\Rightarrow x = \dfrac{c(a-b) - b}{a^2 - b^2}$

Substituting the value of x in equation (1), we obtain:

$a\left\{\dfrac{c(a-b) - b}{a^2 - b^2}\right\} + by = c$

$$\Rightarrow \frac{ac(a-b)-ab}{a^2-b^2}+by=c$$

$$\Rightarrow by=c-\frac{ac(a-b)-ab}{a^2-b^2}$$

$$\Rightarrow by=\frac{a^2c-b^2c-a^2c+abc+ab}{a^2-b^2}$$

$$\Rightarrow by=\frac{abc-b^2c+ab}{a^2-b^2}$$

$$\Rightarrow y=\frac{c(a-b)+a}{a^2-b^2}$$

(iii) $\frac{x}{a}-\frac{y}{b}=0$

$\Rightarrow bx-ay=0$ ....(1)

$ax+by=a^2+b^2$ ....(2)

Multiplying equation (1) and (2) by b and a respectively, we obtain:

$b^2x-aby=0$ ....(3)

$a^2x+aby=a^3+ab^2$ ....(4)

Adding equations (3) and (4), we obtain:

$b^2x+a^2x=a^3+ab^2$

$\Rightarrow x(b^2+a^2)=a(a^2+b^2)$

$\Rightarrow x=a$

Substituting the value of x in equation (1), we obtain:

$b(a)-ay=0$

$\Rightarrow ab-ay=0$

$\Rightarrow y=b$

(iv) $(a-b)x+(a+b)y=a^2-2ab-b^2$ ... (1)

$(a+b)(x+y)=a^2+b^2$

$\Rightarrow (a+b)x+(a+b)y=a^2+b^2$ ....(2)

Subtracting equation (2) from (1), we obtain:

$(a-b)x-(a+b)x=(a^2-2ab-b^2)-(a^2+b^2)$

$\Rightarrow (a-b-a-b)x=-2ab-2b^2$

$\Rightarrow -2bx=-2b(a+b)$

$\Rightarrow x=a+b$

Substituting the value of x in equation (1), we obtain:

$(a-b)(a+b)+(a+b)y=a^2-2ab-b^2$

$\Rightarrow a^2-b^2+(a+b)y=a^2-2ab-b^2$

$\Rightarrow (a+b)y=-2ab$

$\Rightarrow y=\dfrac{-2ab}{a+b}$

(v)152x – 378y = –74... (1)

–378x + 152y = –604 ... (2)

Adding the equations (1) and (2), we obtain:

–226x – 226y = –678

$\Rightarrow$x + y = 3 ....(3)

Subtracting the equation (2) from equation (1), we obtain:

530x – 530y = 530

$\Rightarrow$x – y = 1 ....(4)

Adding equations (3) and (4), we obtain:

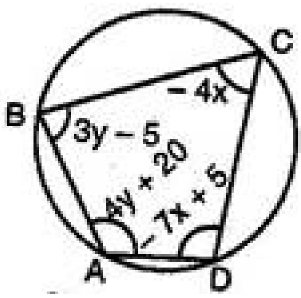
2x = 4

$\Rightarrow$x = 2

Substituting the value of x in equation (3), we obtain:

y = 1

8. ABCD is a cyclic quadrilateral (see figure). Find the angles of the cyclic quadrilateral.



Ans. We know that the sum of the measures of opposite angles in a cyclic quadrilateral is $180°$.

$\therefore \angle A + \angle C = 180°$

$\Rightarrow 4y + 20 - 4x = 180°$

$\Rightarrow -4x + 4y = 160°$

$\Rightarrow x - y = -40°$ ....(1)

Also $\angle B + \angle D = 180°$

$\Rightarrow 3y - 5 - 7x + 5 = 180°$

$\Rightarrow -7x + 3y = 180°$.........(2)

Multiplying equation (1) by 3, we obtain:

$3x - 3y = -120°$ ....(3)

Adding equations (2) and (3), we obtain:

$-4x = 60° \Rightarrow x = -15°$

Substituting the value of x in equation (1), we obtain:

$-15 - y = -40°$

$\Rightarrow y = -15 + 40 = 25$

$\therefore \angle A = 4y + 20 = 4 \times 25 + 20 = 120°$

$\angle B = 3y - 5 = 3 \times 25 - 5 = 70°$

$\angle C = -4x = -4 \times (-15) = 60°$

$\angle D = -7x + 5 = -7(-15) + 5 = 110°$