

CBSE Test Paper 05
Chapter 3 Pair of Linear Equation

1. The area of the triangle formed by $2x - y + 6 = 0$, $4x + 5y - 16 = 0$ and the x - axis is **(1)**
- 15 sq. units
 - 16 sq. units
 - 14 sq. units
 - 12 sq. units
2. The system of equations $2x + 3y - 7 = 0$ and $6x + 5y - 11 = 0$ has **(1)**
- unique solution
 - infinite many solutions
 - no solution
 - non zero solution
3. The pair of linear equations $5x - 3y = 11$ and $-10x + 6y = -22$ are **(1)**
- dependent(consistent)
 - None of these
 - consistent
 - inconsistent
4. The system of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has no solution if **(1)**
- $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
 - $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
 - $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
 - None of these
5. Ten students of class X took part in Mathematics quiz. The number of girls is 4 more than that of the boys. The algebraic representation of the above situation is **(1)**
- none of these

- b. $x - y = 10$ and $x + y = 4$
c. $x = y - 12$ and $y = 6 + x$
d. $y = x + 4$ and $x = 10 - y$
6. Given the linear equation $3x + 4y - 8 = 0$, write another linear equation in two variables such that the geometrical representation of the pair so formed is parallel lines. **(1)**
7. Write whether the following pair of linear equations is consistent or not. **(1)**
 $x + y = 14$
 $x - y = 4$
8. In a deer park, the number of heads and the number of legs of deer and human visitors were counted and it was found that there were 39 heads and 132 legs. Find the number of deer and human visitors in the park. **(1)**
9. Write the value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky - 3 = 0$ has no solution. **(1)**
10. Determine k for which the system of equations has infinite solutions: **(1)**
 $4x + y = 3$ and $8x + 2y = 5k$
11. Solve the following system of equations: **(2)**
 $2x - \frac{3}{y} = 9$
 $3x + \frac{7}{y} = 2, y \neq 0$
12. Determine the values of a and b for which the following system of linear equations has infinite solutions: **(2)**
 $2x - (a - 4)y = 2b + 1$
 $4x - (a - 1)y = 5b - 1$
13. Solve the following system of linear equation by substitution method: **(2)**
 $2x - y = 2 \dots(i)$
 $x + 3y = 15 \dots(ii)$
14. Solve for x and y : $\frac{3}{x+y} + \frac{2}{x-y} = 2$; $\frac{9}{x+y} - \frac{4}{x-y} = 1$. **(3)**

15. Draw the graphs of the equations $4x - y - 8 = 0$ and $2x - 3y + 6 = 0$. Also, determine the vertices of the triangle formed by the lines and x-axis. **(3)**

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

(3)

$$\frac{1}{(3x+y)} + \frac{1}{(3x-y)} = \frac{3}{4} \text{ and } \frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{-1}{8}$$

17. 2 men and 5 boys can finish a piece of work in 4 days, while 3 men and 6 boys can finish it in 3 days. Find the time taken by one man alone to finish the work and that taken by one boy alone to finish the work. **(3)**

18. A motor boat takes 6 hours to cover 100 km downstream and 30 km upstream. If the boat goes 75 km downstream and returns back to the starting point in 8 hours. Find the speed of the boat in still water and the speed of the stream. **(4)**

19. Solve the following system of linear equation graphically

$$4x - 5y - 20 = 0 \text{ and } 3x + 5y - 15 = 0.$$

Also, find the coordinates of the vertices of the Triangle formed by these two lines and the Y-axis. **(4)**

20. Solve the following system of linear equations graphically and shade the region between the two lines and x-axis: **(4)**

$$3x + 2y - 4 = 0,$$

$$2x - 3y - 7 = 0$$

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Solution

1. c. 14 sq. units

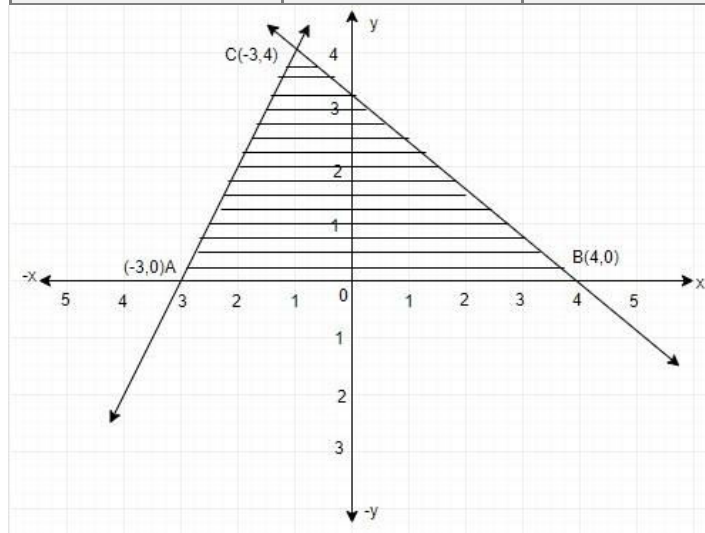
Explanation: Here are the two solutions of each of the given equations.

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

x	0	-1	-2
y	6	1	2

$$4x + 5y - 16 = 0$$

x	4	1.5	-1
y	0	2	4



The triangle ABC formed by given two linear equations is shaded in the graph.

$$\therefore \text{Area of triangle ABC} = \frac{1}{2} \times \text{Base} \times \text{Height} = \frac{1}{2} \times 7 \times 4 = 14 \text{ sq. units}$$

2. a. unique solution

Explanation: $2x + 3y - 7 = 0$

$$6x + 5y - 11 = 0$$

By Comparing with $a_1x + b_1y + c = 0$ and $a_2x + b_2y + c = 0$,

Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -7$, and $a_2 = 6$, $b_2 = 5$, $c_2 = -11$

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

$$\frac{b_1}{b_2} = \frac{3}{5}$$

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

Therefore, system of equations has unique solution.

3. a. dependent(consistent)

Explanation: Given: $a_1 = 5, a_2 = -10, b_1 = -3, b_2 = 6, c_1 = 11$ and $c_2 = -22$

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

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

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

Therefore, the pair of given linear equations is consistent.

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

Explanation: The system of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has no solution because both the equation satisfy the condition i.e

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

5. d. $y = x + 4$ and $x = 10 - y$

Explanation: Let the number of boys = x

Number of girls = y

Given, that total number of student is 10. So that

$$x + y = 10$$

Subtracting y on both sides, we get

$$x = 10 - y$$

Given, that If the number of girls is 4 more than the number of boys

$$\text{So that, } y = x + 4$$

6. Given equation $3x + 4y - 8 = 0$

$$\text{Lines are parallel when } \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

\therefore One of the linear equation in two variables can be $6x + 8y + k = 0$ where k is constant not equal to -16 .

7. Given, $x + y = 14$ and $x - y = 4$ such that $a_1=1, b_1=1, c_1=-14$ and $a_2=1, b_2=-1, c_2=-4$

$$\text{Now, } \frac{a_1}{a_2} = 1 \text{ and } \frac{b_1}{b_2} = -1$$

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

\Rightarrow The equations have unique solution.

Therefore pair of linear equations is consistent.

8. Let a number of humans be x and deer be y .

then, $x + y = 39$ (i)

and $2x + 4y = 132$

$x + 2y = 66$ (ii)

On solving (i) and (ii), we get

$-y = -27$

$\Rightarrow y = 27, x = 12$

9. Given system of equations $x + y - 4 = 0$ and $2x + ky - 3 = 0$. With $a_1=1, b_1=1, c_1=-4$ and $a_2=2, b_2=k, c_2=-3$

For no solution $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
then, $\frac{1}{2} = \frac{1}{k} = \frac{-4}{-3}$ (1)

then $\frac{1}{2} = \frac{1}{k}$

$\Rightarrow k=2$

Substitute $k=2$ in (1) we get $\frac{1}{k} = \frac{1}{2} \neq \frac{4}{3}$

Hence, $k \neq \frac{3}{4}$ for no solution

10. For infinite many solutions

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
 $\frac{4}{8} = \frac{1}{2} = \frac{-3}{-5k} \Rightarrow \frac{1}{2} = \frac{3}{5k}$
 $5k = 6 \Rightarrow k = \frac{6}{5}$

11. The given system of equations is

$2x - \frac{3}{y} = 9$ (i)

$3x + \frac{7}{y} = 2, y \neq 0$ (ii)

Taking $\frac{1}{y} = u$, the given equations become,

$2x - 3u = 9$ (iii)

$3x + 7u = 2$ (iv)

From (iii), we get $2x = 9 + 3u$

$$\Rightarrow x = \frac{9+3u}{2}$$

Substituting $x = \frac{9+3u}{2}$ in (iv), we get

$$3\left(\frac{9+3u}{2}\right) + 7u = 2$$

$$\Rightarrow \frac{27+9u+14u}{2} = 2$$

$$\Rightarrow 27 + 23u = 2 \times 2$$

$$\Rightarrow 23u = 4 - 27$$

$$\Rightarrow u = \frac{-23}{23} = -1$$

$$\text{Hence, } y = \frac{1}{u} = \frac{1}{-1} = -1$$

Putting $u = -1$ in $x = \frac{9+3u}{2}$, we get

$$x = \frac{9+3(-1)}{2} = \frac{9-3}{2} = \frac{6}{2} = 3$$

$$\Rightarrow x = 3$$

Hence, Solution of the given system of equation is $x = 3, y = -1$.

12. $2x - (a - 4)y = 2b + 1$ (i)

$$4x - (a - 1)y = 5b - 1$$
 (ii)

Compare the equations with form of equations

$$a_1x + b_1y = c_1$$

$$a_2x + b_2y = c_2$$

We get, $a_1 = 2, b_1 = -(a - 4)$ and $c_1 = (2b + 1)$

$a_2 = 4, b_2 = -(a - 1)$ and $c_2 = (5b - 1)$

Equations has infinite number of solutions, if

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

Therefore, the given system of equations will have infinite number of solutions, if

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

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

$$\Rightarrow \frac{1}{2} = \frac{a-4}{a-1} \text{ and } \frac{1}{2} = \frac{2b+1}{5b-1}$$

$$\Rightarrow a - 1 = 2a - 8 \text{ and } 5b - 1 = 4b + 2$$

$$\Rightarrow a = 7 \text{ and } b = 3$$

13. Given, $2x - y = 2$..(i)

$$x + 3y = 15$$
 ..(ii)

From eqn. (i), we get $y = 2x - 2$ (iii)

Substituting the value of y in eqn. (ii),

$$x + 3y = 15$$

$$x + 3(2x - 2) = 15$$

$$x + 6x - 6 = 15$$

$$7x = 15 + 6$$

$$\text{or, } 7x = 21$$

$$\therefore x = 3$$

Substituting this value of x in (iii), we get

$$y = 2x - 2$$

$$y = 2 \times 3 - 2$$

$$y = 6 - 2$$

$$y = 4$$

Hence the value of x and y of given equations are 3 and 4 respectively.

14. According to the question,

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

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

$$\text{Putting } \frac{1}{x+y} = u \text{ and } \frac{1}{x-y} = v,$$

$$3u + 2v = 2 \dots\dots\dots (i)$$

$$9u - 4v = 1 \dots\dots\dots (ii)$$

Multiplying (i) by 2 and (ii) by 1,

$$\Rightarrow 6u + 4v = 4 \dots\dots\dots (iii)$$

$$9u - 4v = 1 \dots\dots\dots (iv)$$

Adding (iii) and (iv),

$$\Rightarrow 15u = 5, u = \frac{5}{15} = \frac{1}{3}$$

$$\text{Putting } u = \frac{1}{3} \text{ in (i),}$$

$$\Rightarrow 3 \times \frac{1}{3} + 2v = 2 \Rightarrow 1 + 2v = 2 \Rightarrow 2v = 1$$

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

$$\text{Now, } u = \frac{1}{3} \Rightarrow \frac{1}{x+y} = \frac{1}{3} \Rightarrow x + y = 3 \dots\dots\dots (v)$$

$$\text{and } v = \frac{1}{2} \Rightarrow \frac{1}{x-y} = \frac{1}{2} \Rightarrow x - y = 2 \dots\dots\dots (vi)$$

Adding (v) and (vi),

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

Putting $x = \frac{5}{2}$ in (v),

$$\Rightarrow \frac{5}{2} + y = 3 \Rightarrow y = 3 - \frac{5}{2} = \frac{6-5}{2} = \frac{1}{2}.$$

The solution is $x = \frac{5}{2}, y = \frac{1}{2}$

15. $4x - y - 8 = 0$ or $-y = -4x + 8$,

$$\Rightarrow y = 4x - 8,$$

Solution table for $4x - y - 8 = 0$ is

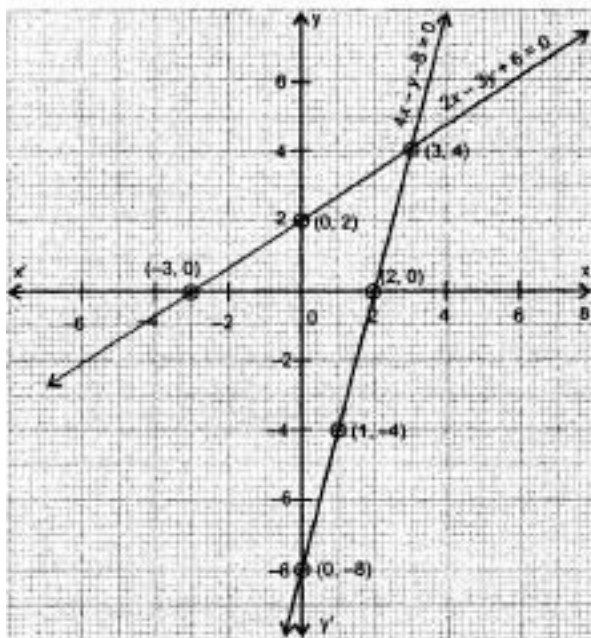
x	0	1	2
y	-8	-4	0

$$2x - 3y + 6 = 0; -3y = -2x - 6$$

$$3y = 2x + 6$$

Solution table for $2x - 3y + 6 = 0$ is

x	0	3	-3
y	2	4	0



Vertices of the triangle formed by lines and x-axis are $(2, 0)$, $(3, 4)$ and $(-3, 0)$.

16. The given pair of the equation is:

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

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

Put, $\frac{1}{3x+y} = u$ (3)

and $\frac{1}{3x-y} = v$ (4)

Then, the equation (1) and (2) can be rewritten as :

$$u + v = \frac{3}{4} \text{(5)}$$

$$\frac{1}{2}u - \frac{1}{2}v = -\frac{1}{8} \text{(6)}$$

Equation(6) gives

$$u - v = -\frac{1}{4} \text{(7) Multiplying both sides by 2}$$

Adding equation(5) to equation (7), we get

$$2u = \frac{3}{4} - \frac{1}{4} = \frac{1}{2} \Rightarrow u = \frac{1}{4} \text{ (8)}$$

Subtracting equation(7) from equation (5), we get $2v = \frac{3}{4} + \frac{1}{4} = 1$

$$\Rightarrow v = \frac{1}{2} \text{ (9)}$$

From equation(3) and equation(8), we get $\frac{1}{3x+y} = \frac{1}{4}$

$$\Rightarrow 3x + y = 4 \text{ (10)}$$

From equation (4) and equation (9), we get

$$\frac{1}{3x-y} = \frac{1}{2} \Rightarrow 3x - y = 2 \text{(11)}$$

Adding equation (10) and equation(11), we get $6x = 6$

$$\Rightarrow x = \frac{6}{6} = 1$$

Substitute this value of x in equation (1), we get $3(1) + y = 4$

$$\Rightarrow 3 + y = 4$$

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

Hence, the solution of the given pair of equation is $x = 1, y = 1$

Verification, Substituting $x = 1, y = 1$.

We find that both the equations (1) and (2) are satisfied as shown below:

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

$$\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{1}{2(3.1+1)} - \frac{1}{2(3.1-1)}$$

$$= \frac{1}{8} - \frac{1}{4} = -\frac{1}{8}.$$

This verifies the solution.

17. Suppose man's 1 day's work be $\frac{1}{x}$ and boy's 1 day's work be $\frac{1}{y}$

Suppose, $\frac{1}{x} = u$ and $\frac{1}{y} = v$

By first condition,

$$\frac{2}{x} + \frac{5}{y} = \frac{1}{4} \Rightarrow 2u + 5v = \frac{1}{4} \dots\dots (i)$$

By second condition,

$$\frac{3}{x} + \frac{6}{y} = \frac{1}{3} \Rightarrow 3u + 6v = \frac{1}{3} \dots\dots (ii)$$

Multiplying (i) by 6 and (ii) by 5,

$$\Rightarrow 12u + 30v = \frac{6}{4} \dots\dots\dots (iii)$$

$$15u + 30v = \frac{5}{3} \dots\dots\dots (iv)$$

Subtracting (iii) and (iv),

$$\Rightarrow 3u = \frac{5}{3} - \frac{6}{4}$$

$$\Rightarrow 3u = \frac{20-18}{12}$$

$$\Rightarrow 3u = \frac{2}{12}$$

$$\Rightarrow 3u = \frac{1}{6}$$

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

Putting $u = \frac{1}{18}$ in (i),

$$\Rightarrow 2 \times \frac{1}{18} + 5v = \frac{1}{4} \Rightarrow \frac{1}{9} + 5v = \frac{1}{4} \Rightarrow 5v = \frac{1}{4} - \frac{1}{9}$$

$$\Rightarrow 5v = \frac{5}{36} \Rightarrow v = \frac{1}{36}$$

$$\text{Now, } u = \frac{1}{18} \Rightarrow x = \frac{1}{\frac{1}{18}} = 18$$

$$\text{and } v = \frac{1}{36} \Rightarrow y = \frac{1}{\frac{1}{36}} = 36$$

$$\therefore x = 18, y = 36$$

The man will complete the given work in 18 days and the boy will complete the given work in 36 days when they work alone.

18. Let the speed of the motor boat in still water be x km / hour and the speed of the stream by y km/hour. Then,

The speed of the motor boat downstream = $(x + y)$ km / hour

And, the speed of the motor boat upstream = $(x - y)$ km / hour

Also, $\text{time} = \frac{\text{distance}}{\text{Speed}}$

In the first case, the motor boat takes 6 hour to cover 100 km downstream and 30 km upstream.

$$\therefore \frac{100}{x+y} + \frac{30}{x-y} = 6 \dots(1)$$

In the second case, the motor boat goes 75 km downstream and returns back to the starting point in 8 hours.

$$\therefore \frac{75}{x+y} + \frac{75}{x-y} = 8 \dots(2)$$

$$\text{Put } \frac{1}{x+y} = u \dots(3)$$

And $\frac{1}{x-y} = v \dots(4)$

Then equation (1) and (2) can be rewritten as

$$100u + 30v = 6 \dots(5)$$

$$75u + 75u = 8 \dots(6)$$

From equation (5)

$$50u + 15v = 3 \dots(7) \dots \text{Dividing by 2}$$

Multiplying equation (7) by 5, we get

$$250u + 75v = 15 \dots(8)$$

Subtracting equation (6) from equation (8), we get $175u = 7$

$$\Rightarrow u = \frac{7}{175} = \frac{1}{25} \dots(9)$$

Substituting this values of u in equation (7), we get $50 \left(\frac{1}{25} \right) + 15v = 3$

$$\Rightarrow 2 + 15v = 3 \Rightarrow 15v = 1$$

$$\Rightarrow v = \frac{1}{15} \dots(10)$$

from equation (3) and equation (9), we get $\frac{1}{x+y} = \frac{1}{25}$

$$\Rightarrow x + y = 25 \dots(11)$$

From equation (4) and equation (10), we get $\frac{1}{x-y} = \frac{1}{15}$

$$\Rightarrow x - y = 15 \dots(12)$$

Adding equation (11) and equation (12), we get $2x = 40$

$$\Rightarrow x = \frac{40}{2} = 20$$

substituting this value of x in equation (11), we get $20 + y = 25$

$$\Rightarrow y = 5$$

Hence, the speed of the boat in still water is 20 km/hour and the speed of the stream is 5 km/hour.

Verification : Substituting $x = 20$ and $y = 5$, We find that both the equations (1) and (2) are satisfied as shown below:

$$\frac{100}{x+y} + \frac{30}{x-y} = \frac{100}{20+5} + \frac{30}{20-5} = 4 + 2 = 6$$

$$\frac{75}{x+y} + \frac{75}{x-y} = \frac{75}{20+5} + \frac{75}{20-5} = 3 + 5 = 8$$

19. Given equations, $4x-5y-20=0$ and $3x+5y-15=0$.

Now, $4x-5y-20=0$

When $y=0$, then $x=5$

When $y=-4$, then $x=0$

Thus, we have the following table:

x	5	0
y	0	-4

Now, $3x+5y-15=0$

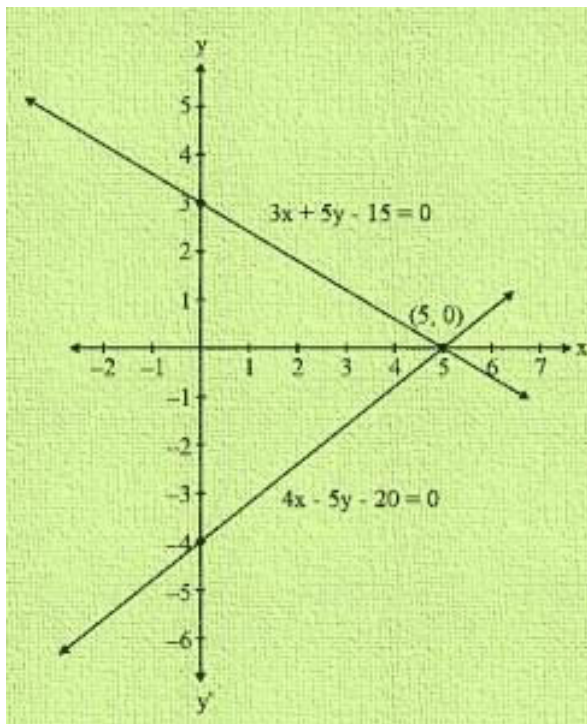
When $y=0$, then $x=5$

When $y=3$, then $x=0$

Thus, we have the following table:

x	5	0
y	0	3

Graph of the given system of equations:



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Clearly, the two lines intersect at $A(5,0)$.

Hence $x=5$, $y=0$ is the solution of the given system of equations.

The lines meet y-axis at $B(0,-4)$ and $C(0,3)$ respectively.

Therefore, The vertices of the triangle are $(5,0)$, $(0,-4)$ and $(0,3)$

20. Given system of linear equations is

$$3x + 2y - 4 = 0 \dots (1)$$

$$2x - 3y - 7 = 0 \dots (2)$$

Now for equation $3x + 2y - 4 = 0$

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

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

When $y = 8$, then $x = -4$

Thus, we have the following table:

x	-2	-4
y	5	8

We have,

$$2x - 3y - 7 = 0$$

$$x = \frac{3y+7}{2}$$

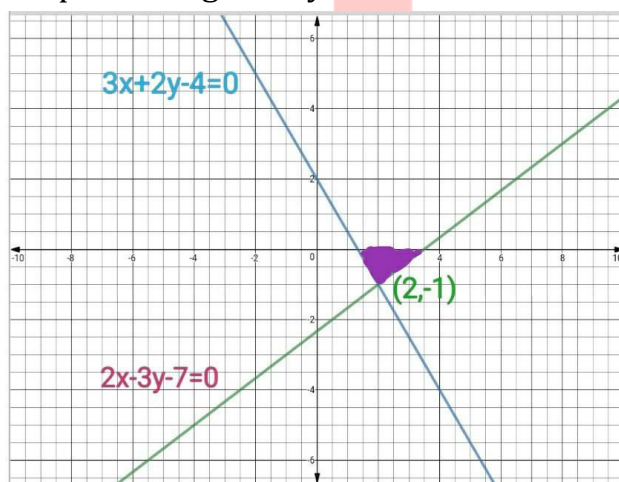
When $y = 1$, then $x = 5$

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

Thus, we have the following table:

x	2	5
y	-1	1

Graph of the given system is:



Clearly, the two lines intersect at $(2, -1)$. Also, area between the given system of linear equations and x-axis is shaded.

Hence $x = 2$ and $y = -1$ is the solution of the given system of equations.