

5. Linear Simultaneous Equations

Let us Work Out 5.1

1. Question

Let us form the simultaneous equations in each of the following cases and see whether the solution of them is possible or not.

The sum of my elder sister's present age and my father's present age is 55 years. By calculating, I observed that after 16 years, my father's age will be two times of my sister's age.

(a) Let me draw the graph after framing simultaneous equations.

(b) With the help of graph, let me find out whether the general solution of two equations can be determined.

(c) Let me write the present age of my elder sister and father from the graph.

Answer

Let take my sister's present age to be = X

My father's present age as = Y

Given that

The sum of my elder sister's present age and my father's present age is 55 years.

So we can write it as

Sister's age + father's age = 55

$X + Y = 55$ (1)

Also given that after 16 years, my father's age will be two times of my sister's age.

So father's age after 16 years will be $(Y + 16)$

And sister's age after 16 years will be $(X + 16)$

So our new equation become

Father's age = $2 \times$ (sister's age)

$Y + 16 = 2 \times (X + 16)$

$Y = 2X + 16$ (2)

Equation (1)

$$X + Y = 55$$

X	0	55
Y=55-X	55	0

Equation (2)

$$Y = 2X + 16$$

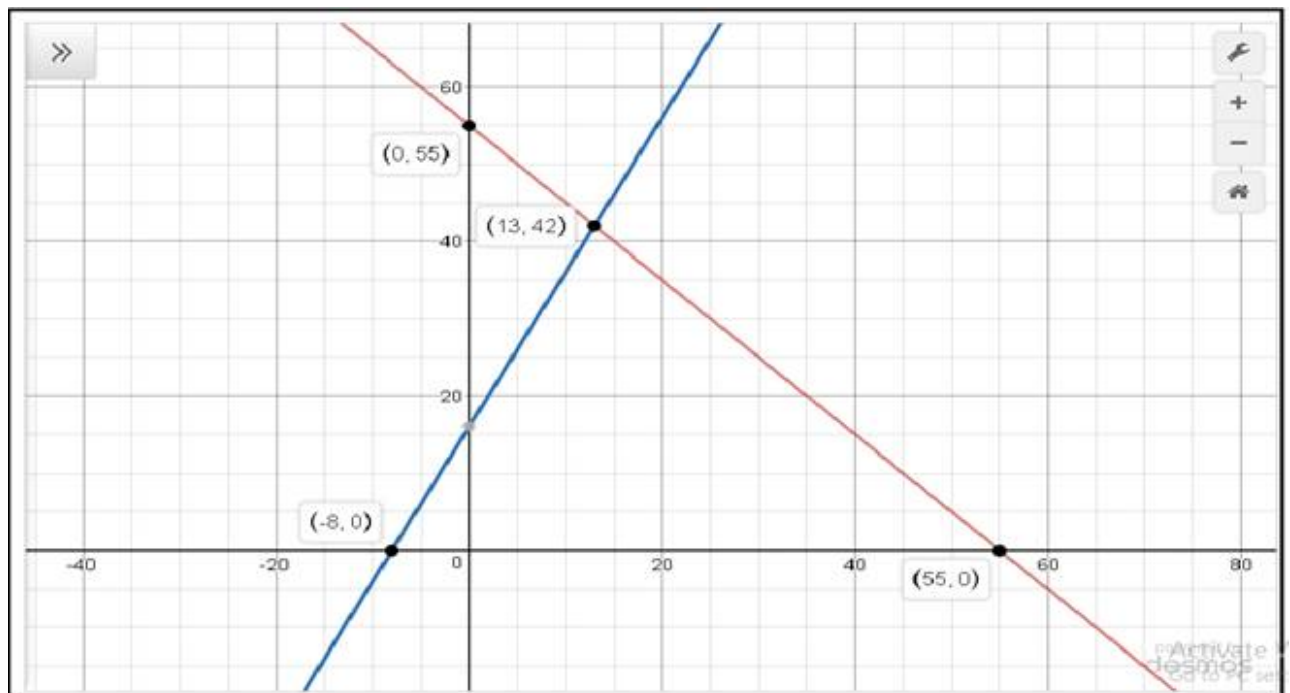
X	0	-8
Y=2X+16	16	0

After plotting the lines, we can determine the intersection point of lines.

You can clearly see in the figure given below.

Red line for equation (1)

Blue line for equation (2)



We can satisfy the point (13, 42)

Equation (1)

$$X + Y = 55$$

$$13 + 42 = 55$$

AND EQUATION (2)

$$Y = 2X + 16$$

$$42 = 2 \times 13 + 16$$

HENCE, sister's age is =13 years

Father's age is =24 years

2. Question

Let us form the simultaneous equations in each of the following cases and see whether the solution of them is possible or not.

Mita has bought 3 pens and 4 pencils at Rs. 42 from the shop of Jadabkaku. I bought 9 pens and 1 dozen pencils at the same rate to give gifts to my friends at the Rs. 126.

- (a) Let me draw the graph after forming the simultaneous equations.
- (b) With the help of graph, let me find whether the general solution of two equations can be determined.
- (c) Let me write the price of 1 pen and 1 pencil separately from the graph.

Answer

Let's take the value of pen = Rs X

Value of pencil = Rs Y

Given that

Mita has bought 3 pens and 4 pencils for Rs.42

So we can write the equation as

$$3(\text{PEN}) + 4(\text{PENCIL}) = 42$$

$$3X + 4Y = 42 \dots\dots\dots (1)$$

Also given that

I bought 9 pens and 1 dozen pencils at the same rate to give gifts to my friends at the Rs. 126.

Equation become

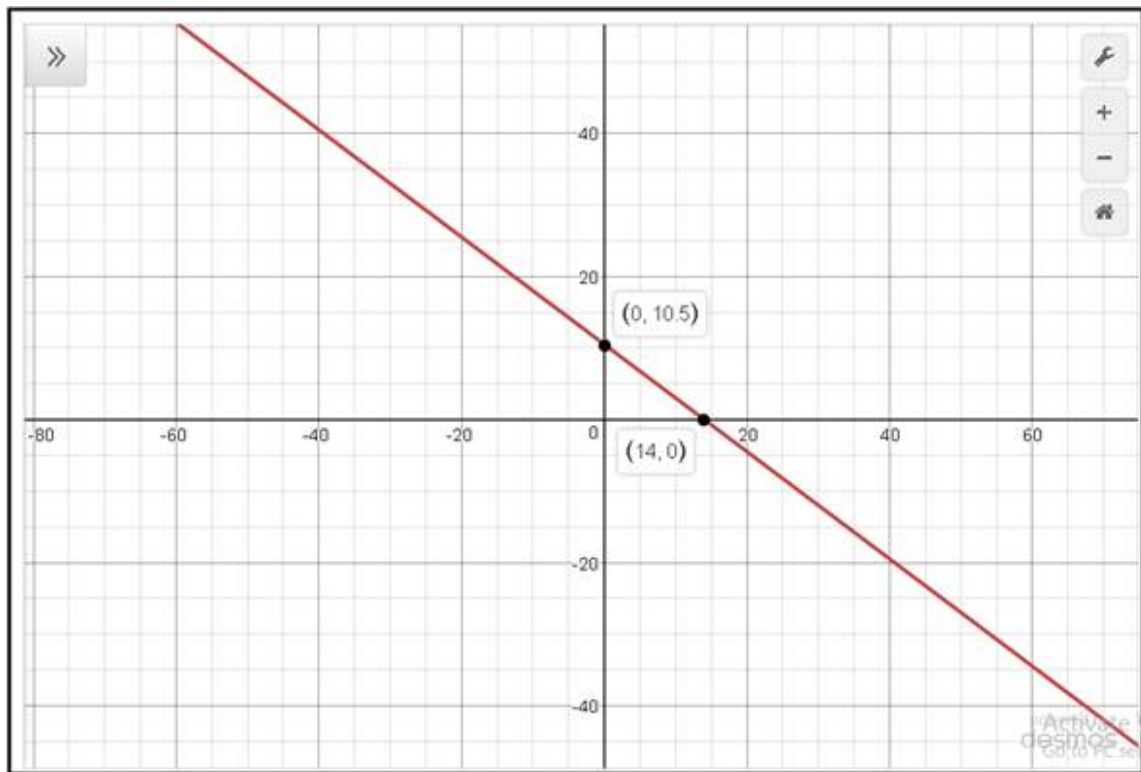
$$9X + 12Y = 126 \dots\dots\dots (2)$$

If we divide both sides by 3 we get

$$3X + 4Y = 42$$

Both equation (1) and (2) are the same, so there exist an infinite number of solutions.

We can plot this equation, see the figure given below -



Every point laying on this line on 1st quadrant can be our answer ...

So there is an infinite number of solution to this question.

3. Question

Let us form the simultaneous equations in each of the following cases and see whether the solution of them is possible or not.

Today we shall draw the pictures as we like in our school. For this, I have bought 2 art papers and 5 sketch pens at Rs.16. But Dola has bought 4 art papers and 10 sketch pens of the same rate and from the same shop.

- Let me form simultaneous equations and draw the graph.
- Let me see whether the general solution of the equations can be found out from the graph.
- Let me write whether I can get the price of 1 art paper and 1 sketch pen.

Answer

Let's take the price of one art papers to be = Rs X

And the price of one sketch pen be = Rs Y

Given that

I have bought 2 art papers and 5 sketch pens at Rs. 16

So the equations will become

$$2X + 5Y = 16 \dots\dots\dots (1)$$

Also given that

Dola has bought 4 art papers and 10 sketch pens of the same rate.

So the equation become

$$4(\text{art papers}) + 10(\text{pens}) = 16$$

$$4X + 10Y = 16 \dots\dots\dots (2)$$

We can plot this line on graphs

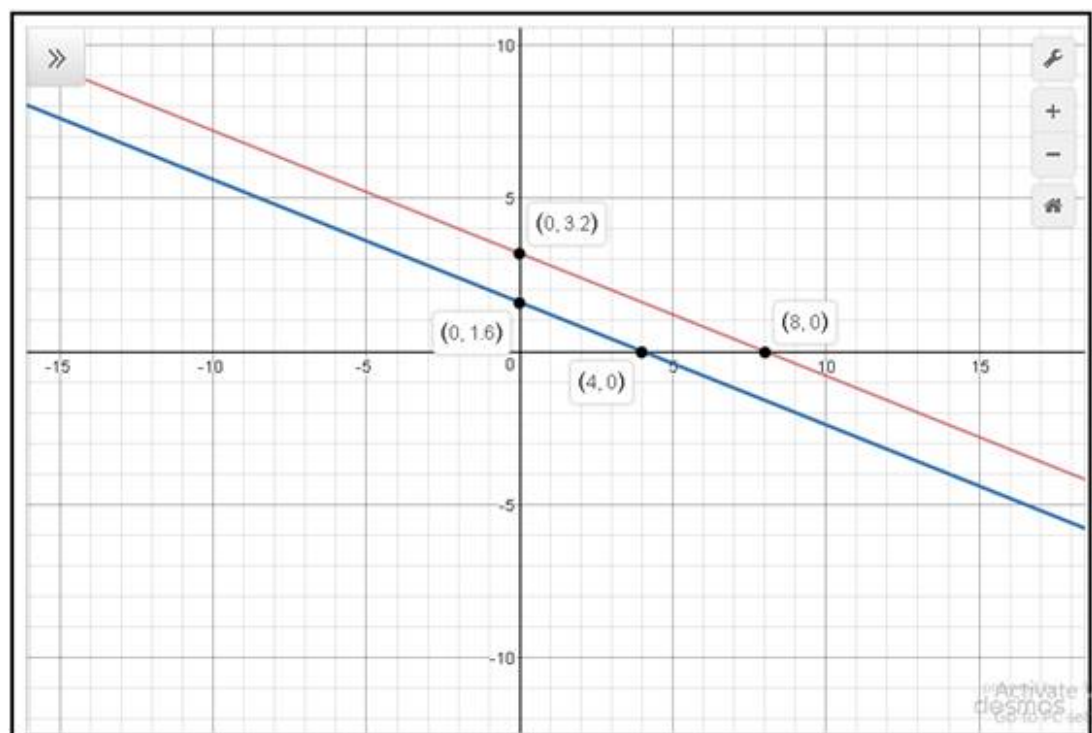
Equation (1)

X	0	8
$Y = \frac{16-2X}{5}$	3.2	0

Equation (2)

X	0	4
$Y = \frac{16-10X}{10}$	1.6	0

We can see the plots given below –



As we can see that both lines are parallel to each other

So there is no solution to this equations

We cannot find any value of the price of pens and art papers.

Let us Work Out 5.2

1 A. Question

Let us draw the graph of the following simultaneous equations and write whether they are solvable or not and if they are solvable, let us write that

particular solution or 3 solutions if they have infinite number of solutions:

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

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

Answer

$$2x + 3y - 7 = 0 \Rightarrow y = \frac{7-2x}{3} \dots \text{equation (i)}$$

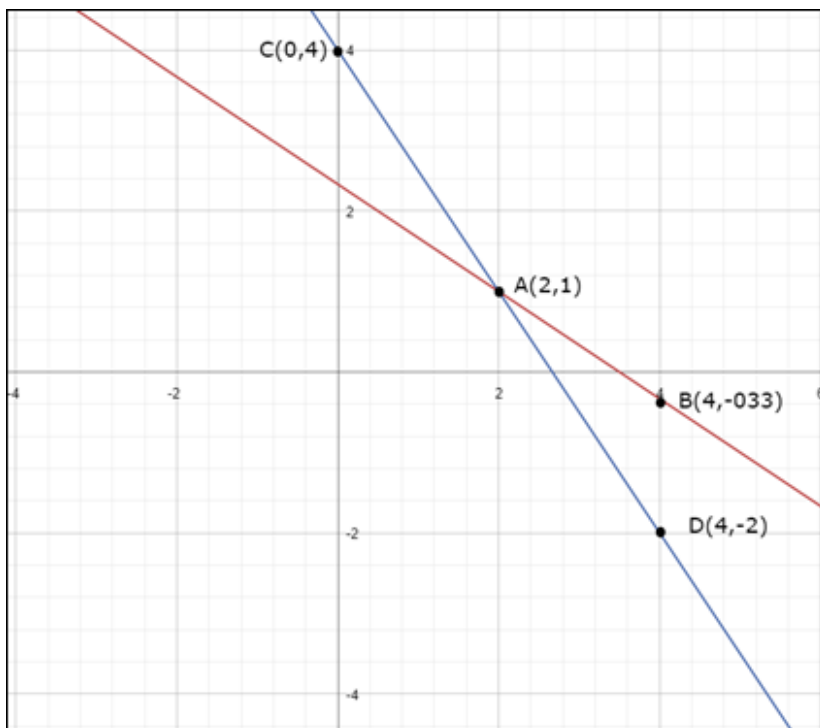
x	2	4
$y = \frac{7-2x}{3}$	1	-0.33

Equation (i) will be plotted as line AB.

$$3x + 2y - 8 = 0 \Rightarrow y = \frac{8-3x}{2} \dots \text{equation (ii)}$$

x	0	4
$y = \frac{8-3x}{2}$	4	-2

Equation (ii) will be plotted as line CD.



Here, we can see in the graph that lines AB and CD are intersecting at point A(2,1). Hence it is solvable.

Solution of equations is $x=2$ and $y=1$.

1 B. Question

Let us draw the graph of the following simultaneous equations and write whether they are solvable or not and if they are solvable, let us write that particular solution or 3 solutions if they have infinite number of solutions:

$$4x - y = 0$$

$$-8x + 2y = -22$$

Answer

$$4x - y = 0 \Rightarrow y = 4x \dots \text{equation (i)}$$

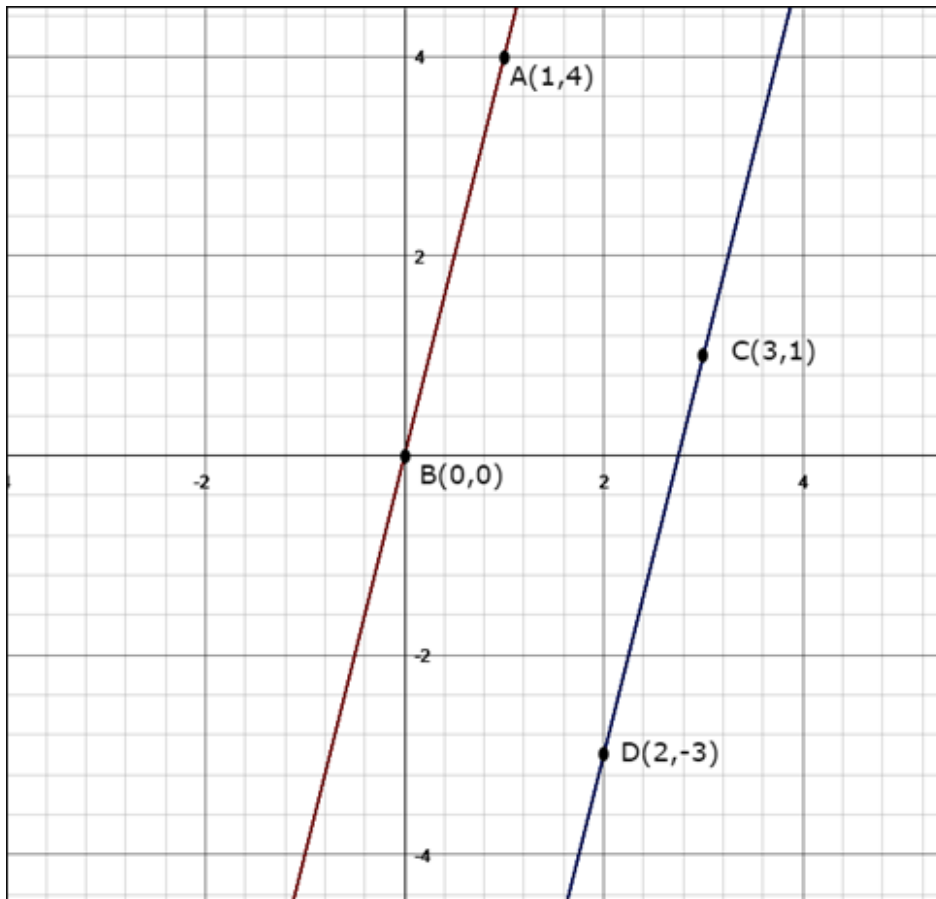
x	0	1
y = 4x	0	4

Equation (i) will be plotted as line AB.

$$-8x + 2y = -22 \Rightarrow y = \frac{-22+8x}{2} \dots \text{equation (ii)}$$

x	3	2
y = $\frac{-22+8x}{2}$	1	-3

Equation (ii) will be plotted as line CD.



Here, we can see from graph that lines AB and CD are not intersecting each other i.e, they are parallel. Hence it is not solvable.

1 C. Question

Let us draw the graph of the following simultaneous equations and write whether they are solvable or not and if they are solvable, let us write that particular solution or 3 solutions if they have infinite number of solutions:

$$7x + 3y = 42$$

$$21x + 9y = 42$$

Answer

$$7x + 3y = 42 \Rightarrow y = \frac{42-7x}{3} \dots \text{equation (i)}$$

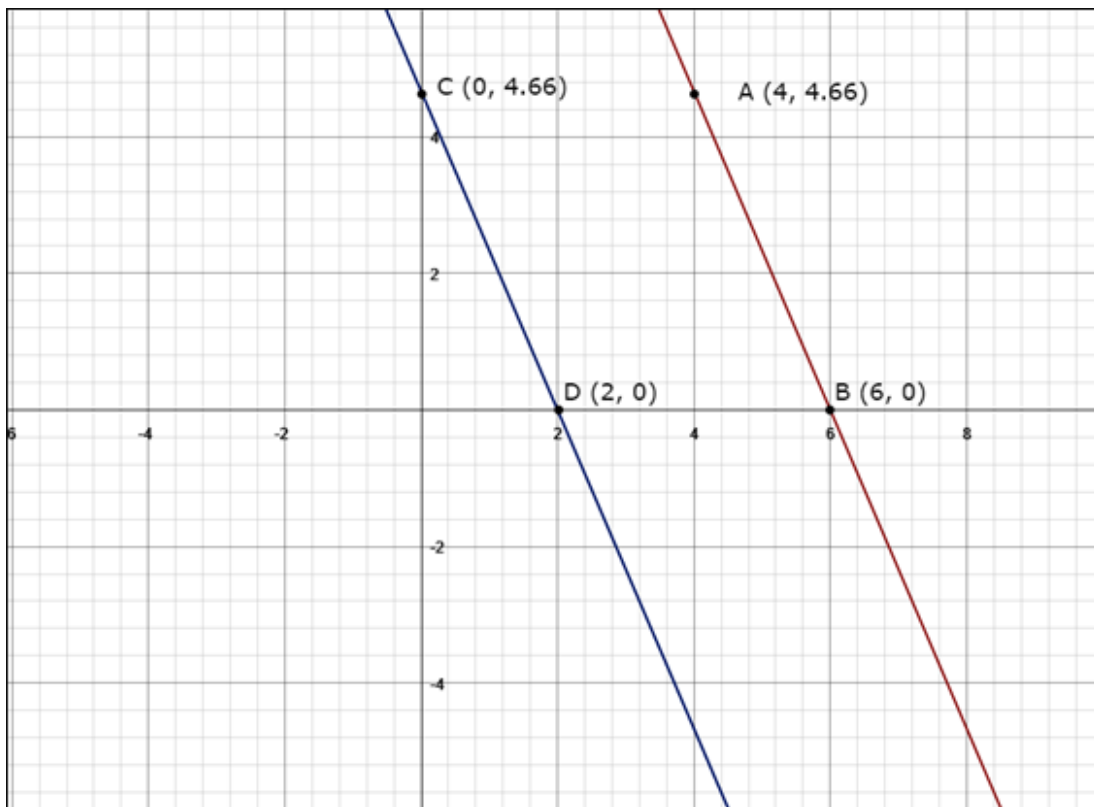
x	6	4
$y = \frac{42-7x}{3}$	0	4.66

Equation (i) will be plotted as line AB.

$$21x + 9y = 42 \Rightarrow y = \frac{42-21x}{9} \dots \text{equation (ii)}$$

x	2	0
$y = \frac{42-21x}{9}$	0	4.66

Equation (ii) will be plotted as line CD.



Here, we can see from graph that lines AB and CD are not intersecting each other i.e, they are parallel. Hence it is not solvable.

1 D. Question

Let us draw the graph of the following simultaneous equations and write whether they are solvable or not and if they are solvable, let us write that particular solution or 3 solutions if they have infinite number of solutions:

$$5x + y = 13$$

$$5x + 5y = 12$$

Answer

$$5x + y = 13 \quad y = 13 - 5x \dots \text{equation (i)}$$

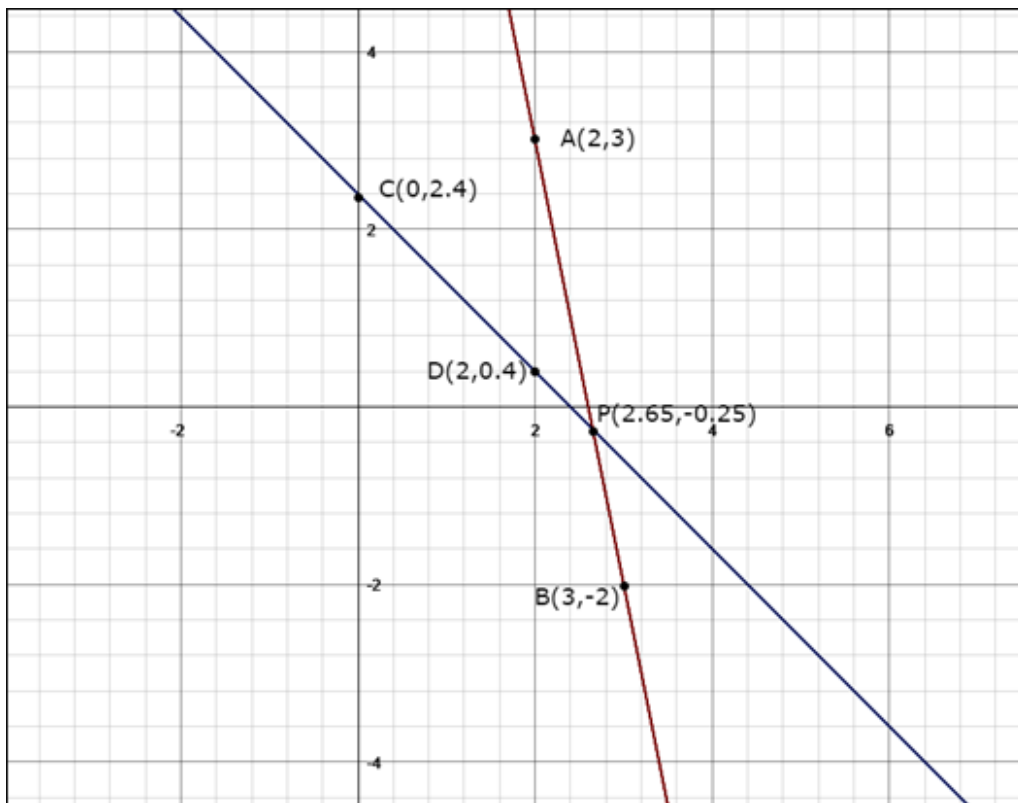
x	2	3
$y = 13 - 5x$	3	-2

Equation (i) will be plotted as line AB.

$$5x + 5y = 12 \quad y = \frac{12-5x}{5} \dots \text{equation (ii)}$$

x	0	2
$y = \frac{12-5x}{5}$	2.4	0.4

Equation (ii) will be plotted as line CD.



Here, we can see in the graph that lines AB and CD are intersecting at point P(2.65, -0.25). Hence it is solvable.

Solution of equations is $x=2.65$ and $y=-0.25$.

2 A. Question

By comparing the co-efficient of the same variables and constants of the following pairs of equations, let us write whether the pair of equations is solvable or not and check them by drawing the graphs of the equations.

$$x + 5y = 7$$

$$x + 5y = 20$$

Answer

$$x + 5y = 7 \dots(1)$$

$$x + 5y = 20 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$x + 5y = 7 \quad x + 5y = 20$$

$$\therefore x + 5y + (-7) = 0 \quad \therefore x + 5y + (-20) = 0$$

$$\text{Or } 1 \times x + 5 \times y + (-7) = 0 \text{ or, } 1 \times x + 5 \times y + (-20) = 0$$

$$\text{Here } a_1 = 1, b_1 = 5, c_1 = -7 \text{ and } a_2 = 1, b_2 = 5, c_2 = -20$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{1}{1}, \frac{b_1}{b_2} = \frac{5}{5} = 1 \text{ and } \frac{c_1}{c_2} = \frac{-7}{-20}$$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$. Therefore, it is not solvable. Lines will be parallel.

Now, plot the lines on graph,

$$x + 5y = 7 \quad y = \frac{7-x}{5} \dots \text{equation (i)}$$

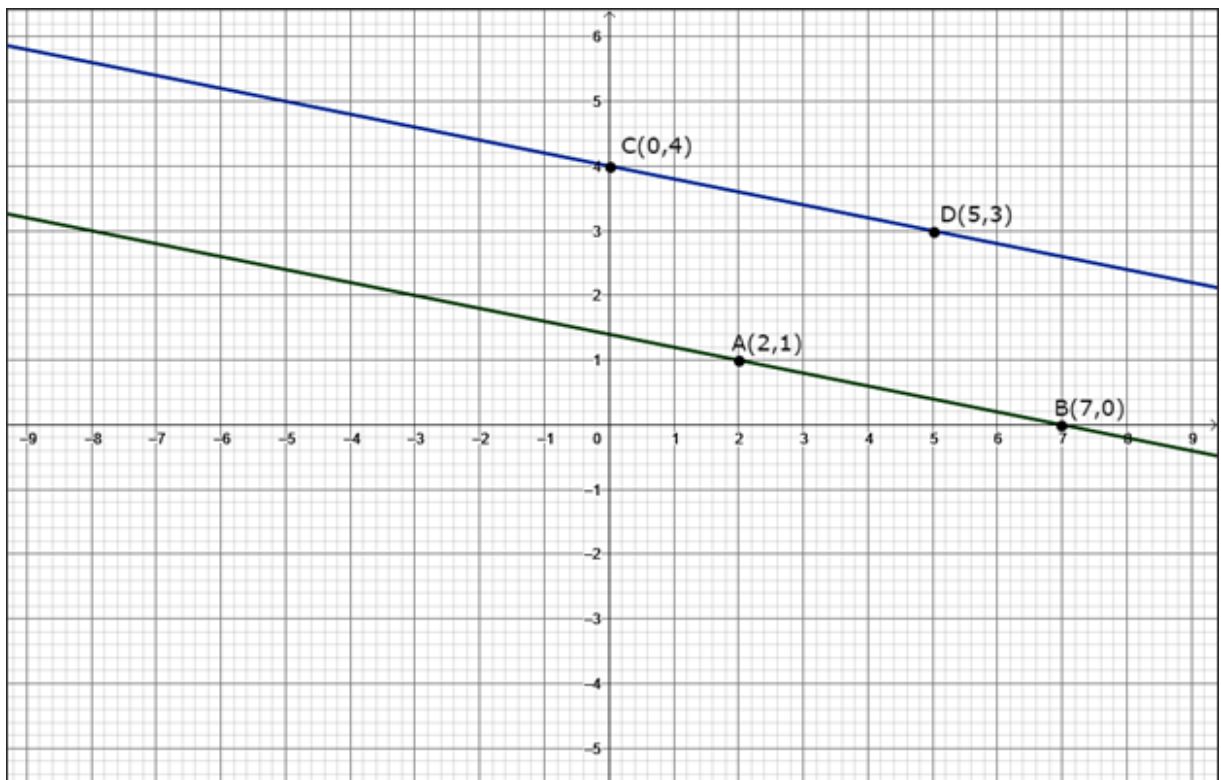
x	2	7
$y = \frac{7-x}{5}$	1	0

Equation (i) will be plotted as line AB.

$$x + 5y = 20 \quad y = \frac{20-x}{5} \dots \text{equation (ii)}$$

x	0	5
$y = \frac{20-x}{5}$	4	3

Equation (ii) will be plotted as line CD.



We can also see clearly in the graph that two lines are not intersecting each other at any point.

2 B. Question

By comparing the co-efficient of the same variables and constants of the following pairs of equations, let us write whether the pair of equations is solvable or not and check them by drawing the graphs of the equations.

$$2x + y = 8$$

$$2y - 3x = -5$$

Answer

$$2x + y = 8 \dots(1)$$

$$2y - 3x = -5 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$2x + y = 8 \quad 2y - 3x = -5$$

$$\therefore 2x + y + (-8) = 0 \quad \therefore 2y + (-3x) + 5 = 0$$

$$\text{Or } 2 \times x + 1 \times y + (-8) = 0 \text{ or, } -3 \times x + 2 \times y + 5 = 0$$

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

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

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

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$. Therefore, it is solvable and has one common solution. Lines will intersect at a point.

Now, plot the lines on graph,

$$2x + y = 8 \quad y = 8 - 2x \dots \text{equation (i)}$$

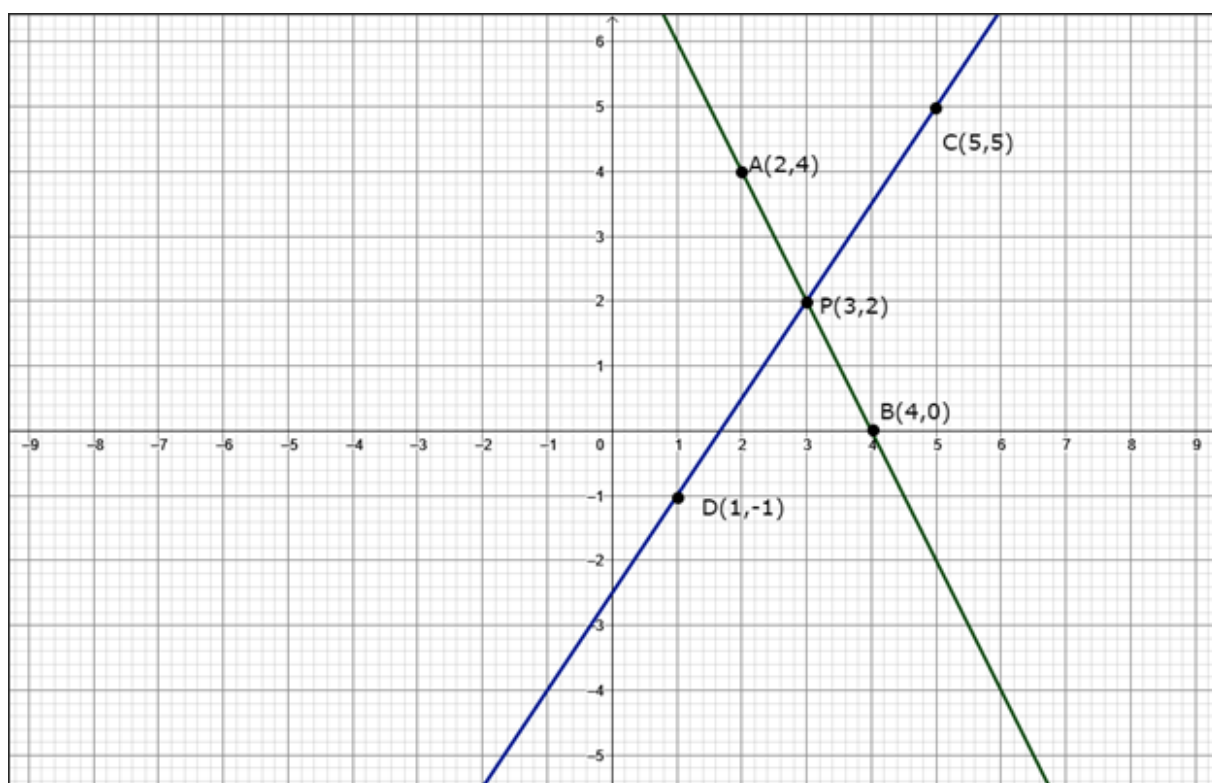
x	4	2
y = 8 - 2x	0	4

Equation (i) will be plotted as line AB.

$$2y - 3x = -5 \quad y = \frac{-5+3x}{2} \dots \text{equation (ii)}$$

x	1	5
y = $\frac{-5+3x}{2}$	-1	5

Equation (ii) will be plotted as line CD.



Here in the graph also, we can see that two lines are intersecting each other at point P(3,2). So it has a common solution which is $x = 3$ and $y = 2$.

2 C. Question

By comparing the co-efficient of the same variables and constants of the following pairs of equations, let us write whether the pair of equations is solvable or not and check them by drawing the graphs of the equations.

$$5x + 8y = 14$$

$$15x + 24y = 42$$

Answer

$$5x + 8y = 14 \dots(1)$$

$$15x + 24y = 42 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$5x + 8y = 14 \quad 15x + 24y = 42$$

$$\therefore 5x + 8y - 14 = 0 \quad \therefore 15x + 24y - 42 = 0$$

$$\text{Or } 5 \times x + 8 \times y + (-14) = 0 \text{ or, } 15 \times x + 24 \times y + (-42) = 0$$

$$\text{Here } a_1 = 5, b_1 = 8, c_1 = -14 \text{ and } a_2 = 15, b_2 = 24, c_2 = -42$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{5}{15} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{8}{24} = \frac{1}{3} \text{ and } \frac{c_1}{c_2} = \frac{-14}{-42} = \frac{1}{3}$$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. Therefore, it is solvable and has infinite common solutions.

Lines will overlap.

Now, plot the lines on graph,

$$5x + 8y = 14 \quad y = \frac{14-5x}{8} \dots \text{equation (i)}$$

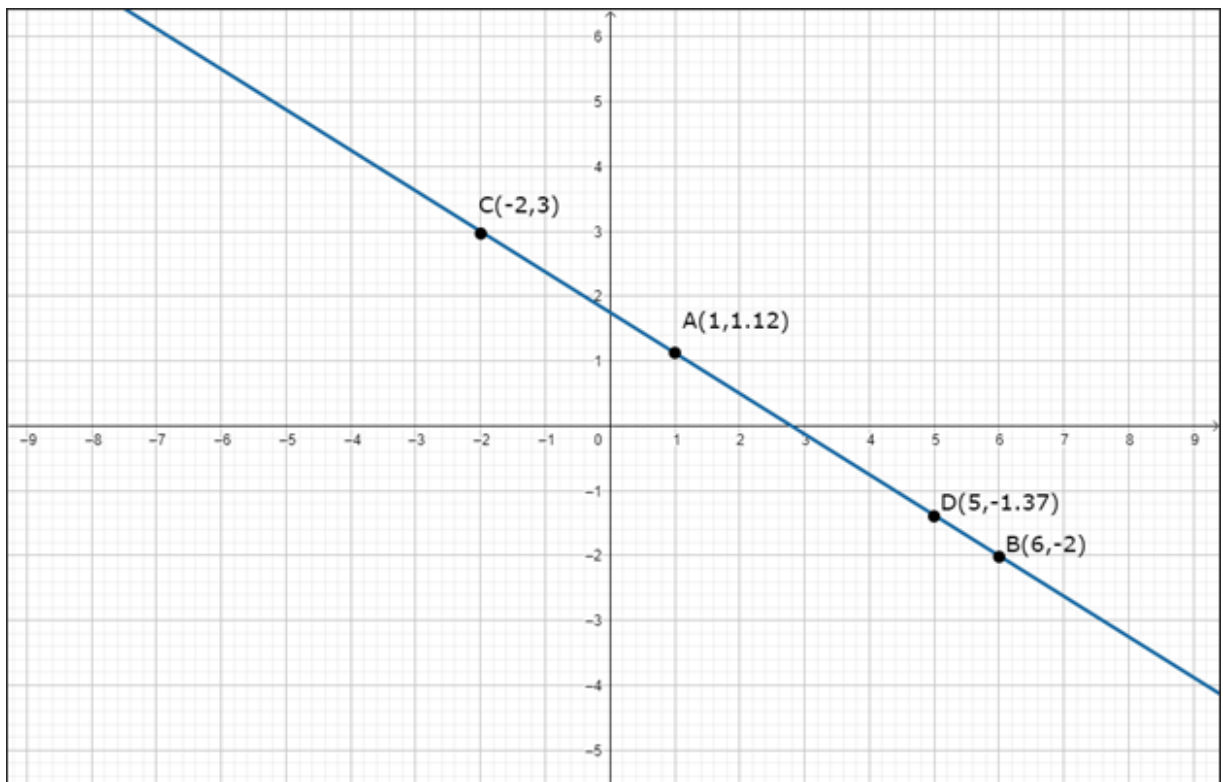
x	1	6
$y = \frac{14-5x}{8}$	1.12	-2

Equation (i) will be plotted as line AB.

$$15x + 24y = 42 \quad y = \frac{42-15x}{24} \dots \text{equation (ii)}$$

x	-2	5
$y = \frac{42-15x}{24}$	3	-1.37

Equation (ii) will be plotted as line CD.



Here in the graph also, we can see that both lines are overlapped on each other. Therefore it has infinite common solutions.

2 D. Question

By comparing the co-efficient of the same variables and constants of the following pairs of equations, let us write whether the pair of equations is solvable or not and check them by drawing the graphs of the equations.

$$3x + 2y = 6$$

$$12x + 8y = 24$$

Answer

$$3x + 2y = 6 \dots(1)$$

$$12x + 8y = 24 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$3x + 2y = 6 \quad 12x + 8y = 24$$

$$\therefore 3x + 2y + (-6) = 0 \quad \therefore 12x + 8y + (-24) = 0$$

$$\text{Or } 3 \times x + 2 \times y + (-6) = 0 \text{ or, } 12 \times x + 8 \times y + (-24) = 0$$

$$\text{Here } a_1 = 3, b_1 = 2, c_1 = -6 \text{ and } a_2 = 12, b_2 = 8, c_2 = -24$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{3}{12} = \frac{1}{4}, \frac{b_1}{b_2} = \frac{2}{8} = \frac{1}{4} \text{ and } \frac{c_1}{c_2} = \frac{-6}{-24} = \frac{1}{4}$$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. Therefore, it is solvable and has infinite common solutions.
Lines will overlap.

Now, plot the lines on graph,

$$3x + 2y = 6 \Rightarrow y = \frac{6-3x}{2} \dots \text{equation (i)}$$

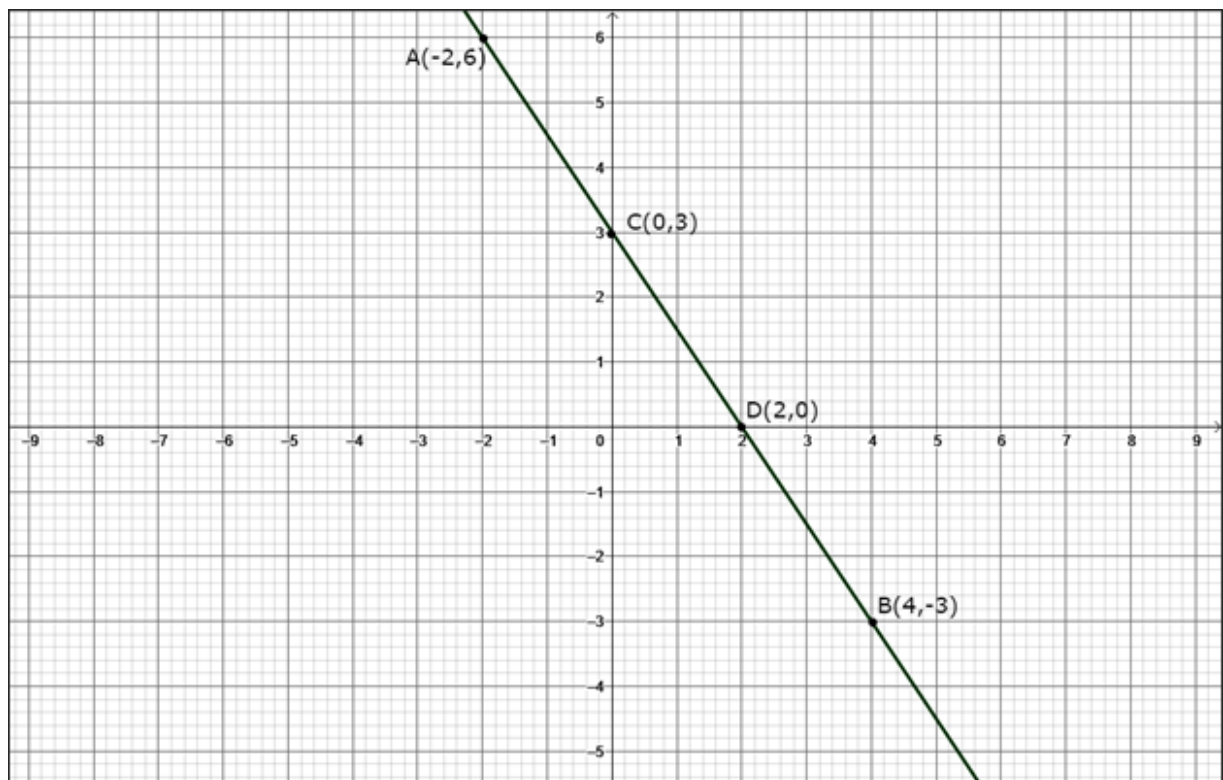
x	-2	4
$y = \frac{6-3x}{2}$	6	-3

Equation (i) will be plotted as line AB.

$$12x + 8y = 24 \Rightarrow y = \frac{24-12x}{8} \dots \text{equation (ii)}$$

x	0	2
$y = \frac{24-12x}{8}$	3	0

Equation (ii) will be plotted as line CD.



Here in the graph also, we can see that both lines are overlapping on each other. Therefore it has infinite common solutions.

3 A. Question

Let us determine the relations of ratios of the same variable and constants of the following pairs of equations and write whether the graphs of the equations will be parallel or intersecting or overlapping.

$$5x + 3y = 11$$

$$2x - 7y = -12$$

Answer

$$5x + 3y = 11 \dots(1)$$

$$2x - 7y = -12 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$5x + 3y = 11 \quad 2x - 7y = -12$$

$$\therefore 5x + 3y + (-11) = 0 \quad \therefore 2x - 7y + 12 = 0$$

$$\text{Or } 5 \times x + 3 \times y + (-11) = 0 \text{ or, } 2 \times x + (-7) \times y + 12 = 0$$

$$\text{Here } a_1 = 5, b_1 = 3, c_1 = -11 \text{ and } a_2 = 2, b_2 = -7, c_2 = 12$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{5}{2}, \frac{b_1}{b_2} = \frac{3}{-7} \text{ and } \frac{c_1}{c_2} = \frac{-11}{12}$$

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$. Therefore, it has one common solution. Graph of equations will intersect at a point.

3 B. Question

Let us determine the relations of ratios of the same variable and constants of the following pairs of equations and write whether the graphs of the equations will be parallel or intersecting or overlapping.

$$6x - 8y = 2$$

$$3x - 4y = 1$$

Answer

$$6x - 8y = 2 \dots(1)$$

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

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$6x - 8y = 2 \quad 3x - 4y = 1$$

$$\therefore 6x + (-8y) + (-2) = 0 \therefore 3x + (-4y) + (-1) = 0$$

$$\text{Or } 6 \times x + (-8) \times y + (-2) = 0 \text{ or, } 3 \times x + (-4) \times y + (-1) = 0$$

$$\text{Here } a_1 = 6, b_1 = -8, c_1 = -2 \text{ and } a_2 = 3, b_2 = -4, c_2 = -1$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{6}{3} = 2, \frac{b_1}{b_2} = \frac{-8}{-4} = 2 \text{ and } \frac{c_1}{c_2} = \frac{-2}{-1} = 2$$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. Therefore, it has infinite common solutions. Graph of equations will overlap.

3 C. Question

Let us determine the relations of ratios of the same variable and constants of the following pairs of equations and write whether the graphs of the equations will be parallel or intersecting or overlapping.

$$8x - 7y = 0$$

$$8x - 7y = 56$$

Answer

$$8x - 7y = 0 \dots(1)$$

$$x + 5y = 20 \dots(2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$8x - 7y = 0 \quad 8x - 7y = 56$$

$$\therefore 8x + (-7y) + 0 = 0 \therefore 8x + (-7y) + (-56) = 0$$

$$\text{Or } 8 \times x + (-7) \times y + 0 = 0 \text{ or, } 8 \times x + (-7) \times y + (-56) = 0$$

$$\text{Here } a_1 = 8, b_1 = -7, c_1 = 0 \text{ and } a_2 = 8, b_2 = -7, c_2 = -56$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{8}{8} = 1, \frac{b_1}{b_2} = \frac{-7}{-7} = 1 \text{ and } \frac{c_1}{c_2} = \frac{0}{-56} = 0$$

Here $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$. Therefore, graph of equations will be parallel.

3 D. Question

Let us determine the relations of ratios of the same variable and constants of the following pairs of equations and write whether the graphs of the equations will be parallel or intersecting or overlapping.

$$4x - 3y = 6$$

$$4y - 5x = -7$$

Answer

$$4x - 3y = 6 \dots (1)$$

$$4y - 5x = -7 \dots (2)$$

Let us express the equations (1) and (2) in the form of

$ax + by + c = 0$ where a and b can't be 0 at the same time.

[In the first equation, we use a_1, b_1, c_1 and in second equation, we use a_2, b_2, c_2]

$$4x - 3y = 6 \quad 4y - 5x = -7$$

$$\therefore 4x + (-3y) + (-6) = 0 \quad \therefore -5x + 4y + 7 = 0$$

$$\text{Or } 4 \times x + (-3) \times y + (-6) = 0 \text{ or, } -5 \times x + 4 \times y + 7 = 0$$

$$\text{Here } a_1 = 4, b_1 = -3, c_1 = -6 \text{ and } a_2 = -5, b_2 = 4, c_2 = 7$$

Comparing the ratio of $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$, we get

$$\frac{a_1}{a_2} = \frac{4}{-5}, \frac{b_1}{b_2} = \frac{-3}{4} \text{ and } \frac{c_1}{c_2} = \frac{-6}{7}$$

Here $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$. Therefore, it has one common solution. Graph of equations will intersect at a point.

4 A. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$4x + 3y = 20$$

$$8x + 6y = 40$$

Answer

$$4x + 3y = 20 \quad y = \frac{20-4x}{3} \dots \text{equation (i)}$$

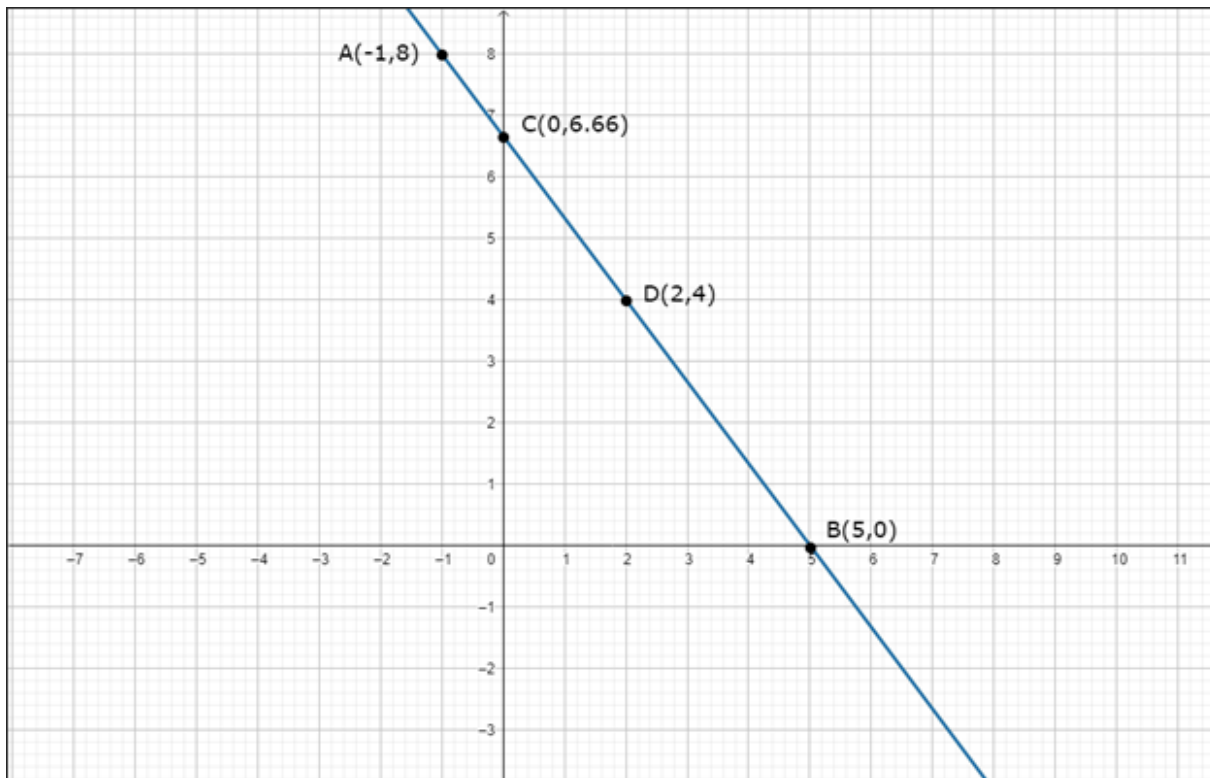
x	5	-1
$y = \frac{20-4x}{3}$	0	8

Equation (i) will be plotted as line AB.

$$8x + 6y = 40 \quad y = \frac{40-8x}{6} \dots \text{equation (ii)}$$

x	2	0
$y = \frac{40-8x}{6}$	4	6.66

Equation (ii) will be plotted as line CD.



Here we can see in the graph that, lines AB and CD overlaps on each other. Therefore, it has infinite number of solutions.

Among them 3 solutions are: $x = 2$ & $y = 4$

$x = 5$ & $y = 0$

$x = -1$ & $y = 8$

4 B. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$4x + 3y = 20$$

$$12x + 9y = 20$$

Answer

$$4x + 3y = 20 \quad y = \frac{20-4x}{3} \dots \text{equation (i)}$$

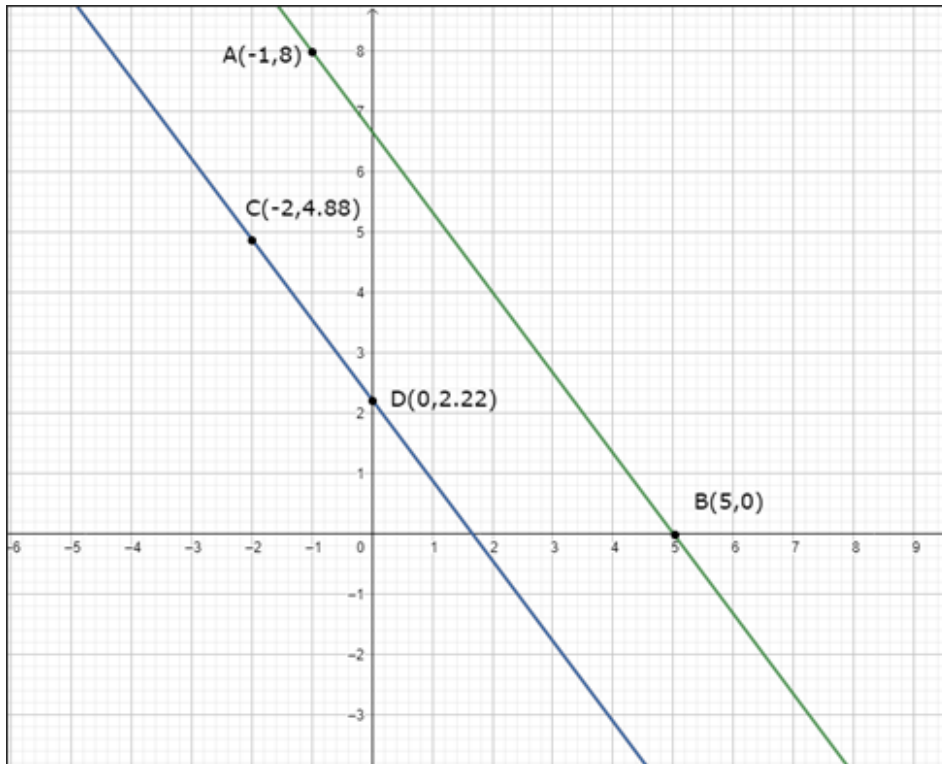
x	5	-1
$y = \frac{20-4x}{3}$	0	8

Equation (i) will be plotted as line AB.

$$12x + 9y = 20 \quad y = \frac{20-12x}{9} \dots \text{equation (ii)}$$

x	-2	0
$y = \frac{20-12x}{9}$	4.88	2.22

Equation (ii) will be plotted as line CD.



Here in the graph, we can see that these two lines are parallel to each other. Hence it is not solvable.

4 C. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$4x + 3y = 20$$

$$\frac{3x}{4} - \frac{y}{8} = 1$$

Answer

$$4x + 3y = 20 \quad y = \frac{20-4x}{3} \dots \text{equation (i)}$$

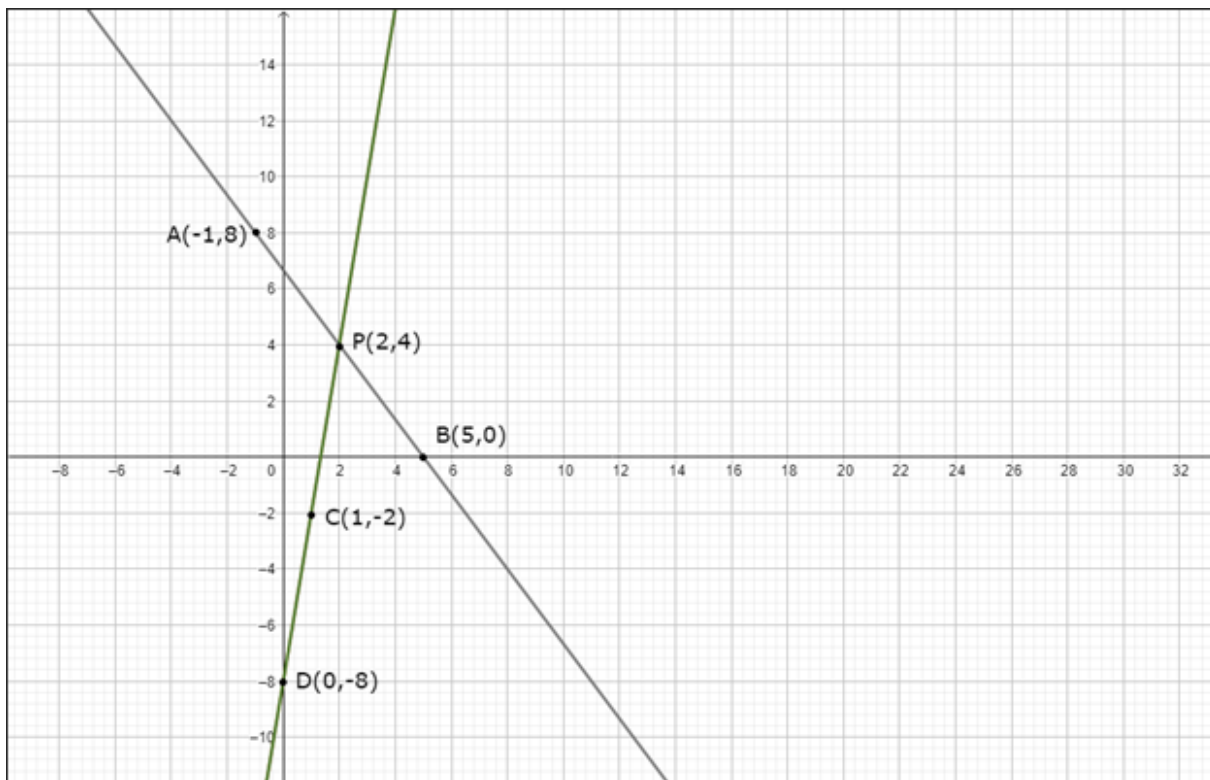
x	5	-1
$y = \frac{20-4x}{3}$	0	8

Equation (i) will be plotted as line AB.

$$\frac{3x}{4} - \frac{y}{8} = 1 \quad 6x - y = 8 \quad y = 6x - 8 \dots \text{equation (ii)}$$

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

Equation (ii) will be plotted as line CD.



Here in the graph, we can see that these two lines are intersecting each other at point P(2,4). Hence it is solvable and its solution is $x = 2$ and $y = 4$

4 D. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$p - q = 3$$

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

Answer

$$p - q = 3 \quad q = p - 3 \dots \text{equation (i)}$$

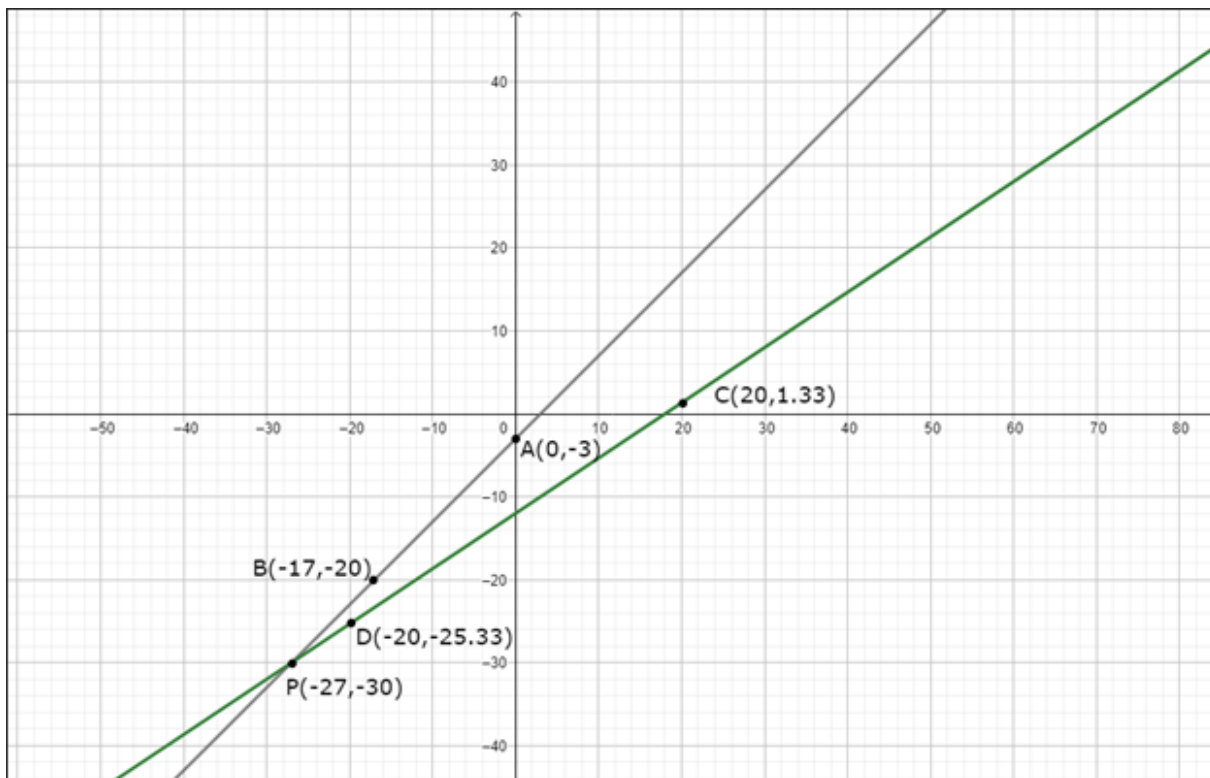
p	0	-17
q = p - 3	-3	-20

Equation (i) will be plotted as line AB.

$$\frac{p}{3} - \frac{q}{2} = 6 \quad 2p - 3q = 36 \quad q = \frac{2p-36}{3} \dots \text{equation (ii)}$$

p	20	-20
$q = \frac{2p-36}{3}$	1.33	25.33

Equation (ii) will be plotted as line CD.



Here in the graph, we can see that two lines are intersecting each other at point P(-27, -30). Hence it is solvable and its solution is $x = -27$ and $y = -30$

4 E. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$p - q = 3$$

$$\frac{p}{5} - \frac{q}{5} = 3$$

Answer

$$p - q = 3 \quad q = p - 3 \quad \dots \text{equation (i)}$$

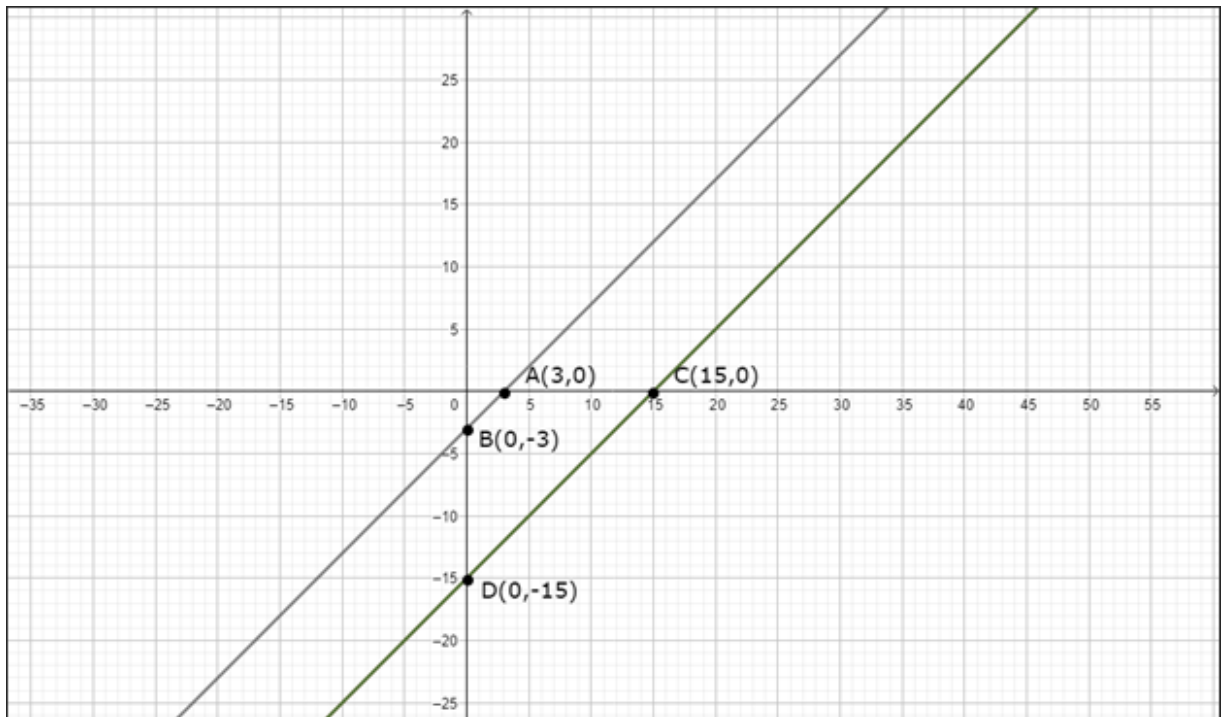
p	0	3
$q = p - 3$	-3	0

Equation (i) will be plotted as line AB.

$$\frac{p}{5} - \frac{q}{5} = 3 \quad p - q = 15 \quad q = p - 15 \quad \dots \text{equation (ii)}$$

p	0	15
$q = p - 15$	-15	0

Equation (ii) will be plotted as line CD.



Here in the graph, we can see that these two lines are parallel to each other. Hence it is not solvable.

4 F. Question

Let us solve the following pairs of equations by drawing graphs which are solvable and write 3 solutions which have infinite number of solutions.

$$p - q = 3$$

$$8p - 8q = 5$$

Answer

$$p - q = 3 \quad q = p - 3 \dots \text{equation (i)}$$

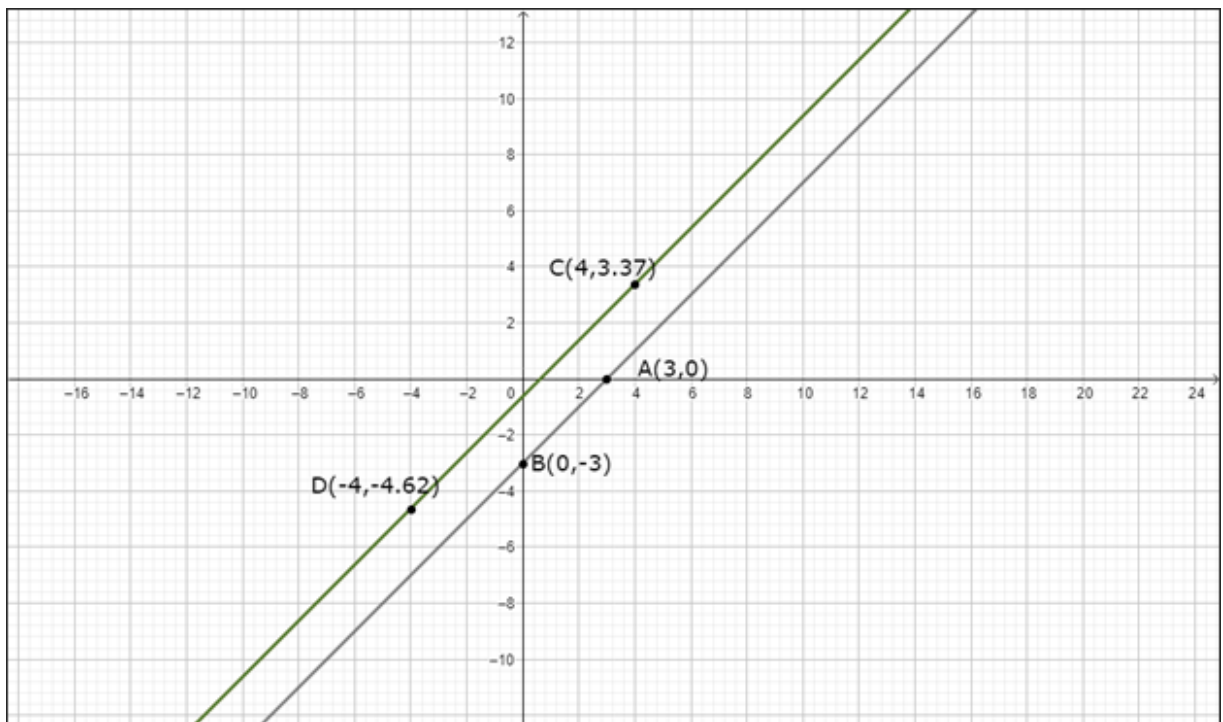
p	3	0
$q = p - 3$	0	-3

Equation (i) will be plotted as line AB.

$$8p - 8q = 5 \quad q = \frac{8p-5}{8} \dots \text{equation (ii)}$$

p	4	-4
$q = \frac{8p-5}{8}$	3.37	-4.62

Equation (ii) will be plotted as line CD.



Here in the graph, we can see that these two lines are parallel to each other.
Hence it is not solvable.

5 A. Question

Tathagata has written a linear equation in two variables $x + y = 5$. I write another linear equation in two variables, so that, the graphs of two equations will be

parallel to each other

Answer

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

Let us express the equations (1) in the form of

$a_1x + b_1y + c_1 = 0$ where a and b can't be 0 at the same time.

Let the required equation be $a_2x + b_2y + c_2 = 0$

$$x + y = 5$$

$$\therefore x + y + (-5) = 0$$

$$\text{Or } 1 \times x + 1 \times y + (-5) = 0$$

$$\text{Here } a_1 = 1, b_1 = 1, c_1 = -5$$

For lines of equation to be parallel in the graph, we need

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

Let $\frac{a_1}{a_2} = \frac{b_1}{b_2} = k_1$ and $\frac{c_1}{c_2} = k_2$ where k_1 and k_2 are any real number and $k_1 \neq k_2$
also both are non zero.

For simplicity, take $k_1 = 0.5$ and $k_2 = 0.2$

$$\text{So, } \frac{a_1}{a_2} = 0.5 \Rightarrow \frac{1}{a_2} = 0.5 \Rightarrow a_2 = 2,$$

$$\frac{b_1}{b_2} = 0.5 \Rightarrow \frac{1}{b_2} = 0.5 \Rightarrow b_2 = 2 \text{ and}$$

$$\frac{c_1}{c_2} = 0.2 \Rightarrow \frac{-5}{c_2} = 0.2 \Rightarrow c_2 = -25$$

Therefore, required equation is $2x + 2y - 25 = 0$ which will be parallel in the graph with equation $x + y = 5$

5 B. Question

Tathagata has written a linear equation in two variables $x + y = 5$. I write another linear equation in two variables, so that, the graphs of two equations will be

intersecting

Answer

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

Let us express the equations (1) in the form of

$$a_1x + b_1y + c_1 = 0 \text{ where } a \text{ and } b \text{ can't be } 0 \text{ at the same time.}$$

$$\text{Let the required equation be } a_2x + b_2y + c_2 = 0$$

$$x + y = 5$$

$$\therefore x + y + (-5) = 0$$

$$\text{Or } 1 \times x + 1 \times y + (-5) = 0$$

$$\text{Here } a_1 = 1, b_1 = 1, c_1 = -5$$

For lines of equation to be intersecting in the graph, we need

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

$$\text{Let } \frac{a_1}{a_2} = k_1, \frac{b_1}{b_2} = k_2 \text{ and } c_1 = c_2 \text{ where } k_1 \text{ and } k_2 \text{ are any real number}$$

and $k_1 \neq k_2$ also both are non zero.

For simplicity, take $k_1 = 0.5$ and $k_2 = 0.2$

$$\text{So, } \frac{a_1}{a_2} = 0.5 \Rightarrow \frac{1}{a_2} = 0.5 \Rightarrow a_2 = 2, \text{ and}$$

$$\frac{b_1}{b_2} = 0.2 \Rightarrow \frac{1}{b_2} = 0.2 \Rightarrow b_2 = 5$$

Therefore, required equation is $2x + 5y - 5 = 0$ which will be intersecting in the graph with equation $x + y = 5$

5 C. Question

Tathagata has written a linear equation in two variables $x + y = 5$. I write another linear equation in two variables, so that, the graphs of two equations will be

overlapping

Answer

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

Let us express the equations (1) in the form of

$$a_1x + b_1y + c_1 = 0 \text{ where } a \text{ and } b \text{ can't be } 0 \text{ at the same time.}$$

$$\text{Let the required equation be } a_2x + b_2y + c_2 = 0$$

$$x + y = 5$$

$$\therefore x + y + (-5) = 0$$

$$\text{Or } 1 \times x + 1 \times y + (-5) = 0$$

$$\text{Here } a_1 = 1, b_1 = 1, c_1 = -5$$

For lines of equation to be parallel in the graph, we need

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

$$\text{Let } \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = k \text{ where } k \text{ is any real number and } k \neq 0.$$

For simplicity, take $k = 0.5$

$$\text{So, } \frac{a_1}{a_2} = 0.5 \Rightarrow \frac{1}{a_2} = 0.5 \Rightarrow a_2 = 2,$$

$$\frac{b_1}{b_2} = 0.5 \Rightarrow \frac{1}{b_2} = 0.5 \Rightarrow b_2 = 2 \text{ and}$$

$$\frac{c_1}{c_2} = 0.5 \Rightarrow \frac{-5}{c_2} = 0.5 \Rightarrow c_2 = -10$$

Therefore, required equation is $2x + 2y - 10 = 0$ which will be overlapping in the graph with equation $x + y = 5$

Let us Work Out 5.3

1 A. Question

Let us solve the following simultaneous linear equations in two variables by the method of elimination and check them graphically:

$$8x + 5y - 11 = 0$$

$$3x - 4y - 10 = 0$$

Answer

Rewriting the above equations in the standard form of $ax + by = c$

$$8x + 5y = 11 \text{ (i)}$$

$$3x - 4y = 10 \text{ (ii)}$$

In this problem, we will eliminate 'y' from both the equations (i) & (ii),

Note: - We can eliminate any one of the variable, to eliminate y, we have to make the coefficient of y in both the equations equal.

We have to multiply the coefficient of y with such a number that makes them equal to the common factor of both of them.

Multiply equations (i) with 4 and (ii) with 5 .

$$\begin{array}{rcl} 32x + 20y & = & 44 \\ 15x - 20y & = & 50 \\ \hline 47x & & = 94 \end{array}$$

$\Rightarrow x = 2$, putting the value of $x = 2$ in equation (i), we get $y = -1$

Hence the solution of the two linear equation is $x = 2$ and $y = -1$

Let us take the equation (i) as Straight Line A and (ii) as B . To draw the lines we need at least 2 points to draw.

Generally, we substitute $x = 0$ or $y = 0$ in the given linear equations to get y and x. So we get two points on the straight line. To find more points on the line, take different values of x related to it, we get different values for y from the equation.

We get the following tables for the given linear equations.

For $8x + 5y = 11$

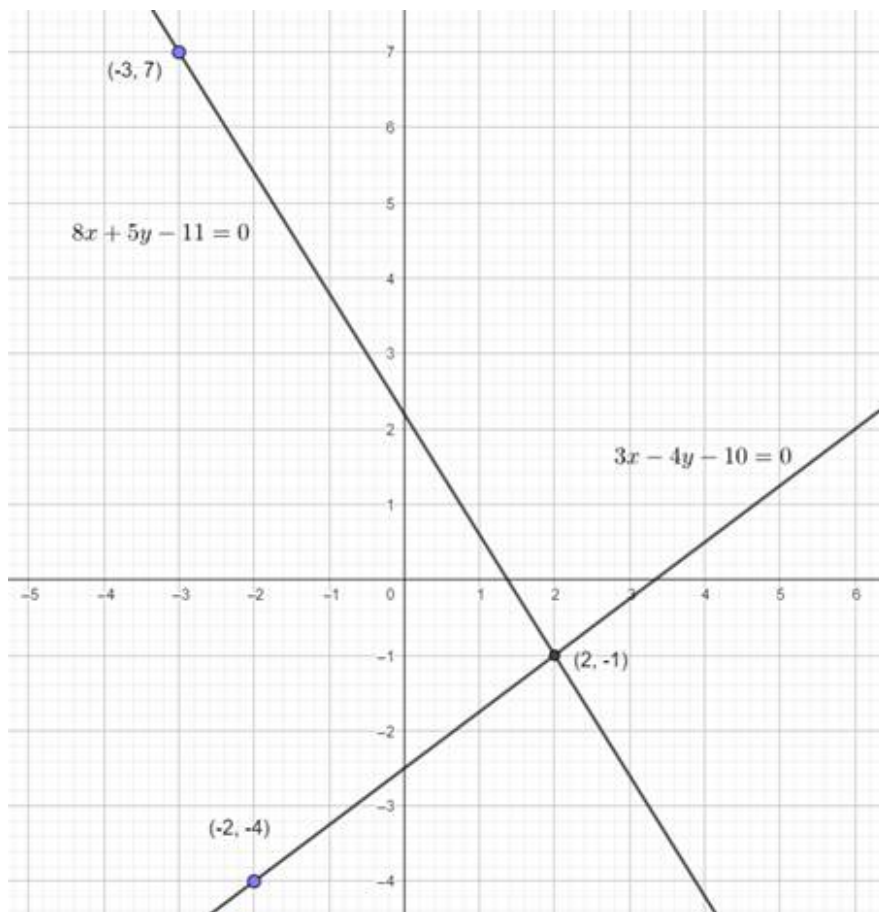
$$y = \frac{1}{5}(11 - 8x)$$

x	2	-3
y	-1	7

For $3x - 4y = 10$

$$y = -\frac{1}{4}(10 - 3x)$$

x	2	-2
y	-1	-4



Hence also by graphical method the solution comes out to be (2, - 1)

1 B. Question

Let us solve the following simultaneous linear equations in two variables by the method of elimination and check them graphically:

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

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

Answer

Rewriting the above equations in the standard form of $ax + by = c$

$$2x + 3y = 7 \text{ (i)}$$

$$3x + 2y = 8 \text{ (ii)}$$

In this problem, we will eliminate 'x' from both the equations (i) & (ii)

Multiply equations (i) with 3 and (ii) with 2 to make the coefficient of x equal.

$$\begin{array}{rclcl}
 6x & + & 9y & = & 21 \\
 [-] & 6x & + & 4y & = & 16 \\
 \hline
 & & 5y & = & 5
 \end{array}$$

$\Rightarrow y = 1$, Putting the value of y in equation (i) gives $x = 2$

Hence the solution of this linear equation is $x = 2$ and $y = 1$.

Let us take the equation (i) as Straight Line A and (ii) as B . To draw the lines we need at least 2 points to draw

Generally, we substitute $x = 0$ or $y = 0$ in the given linear equations to get y and x . So we get two points on the straight\ line. To find more points on the line, take different values of x related to it, we get different values for y from the equation.

We get the following tables for the given linear equations.

For $2x + 3y = 7$

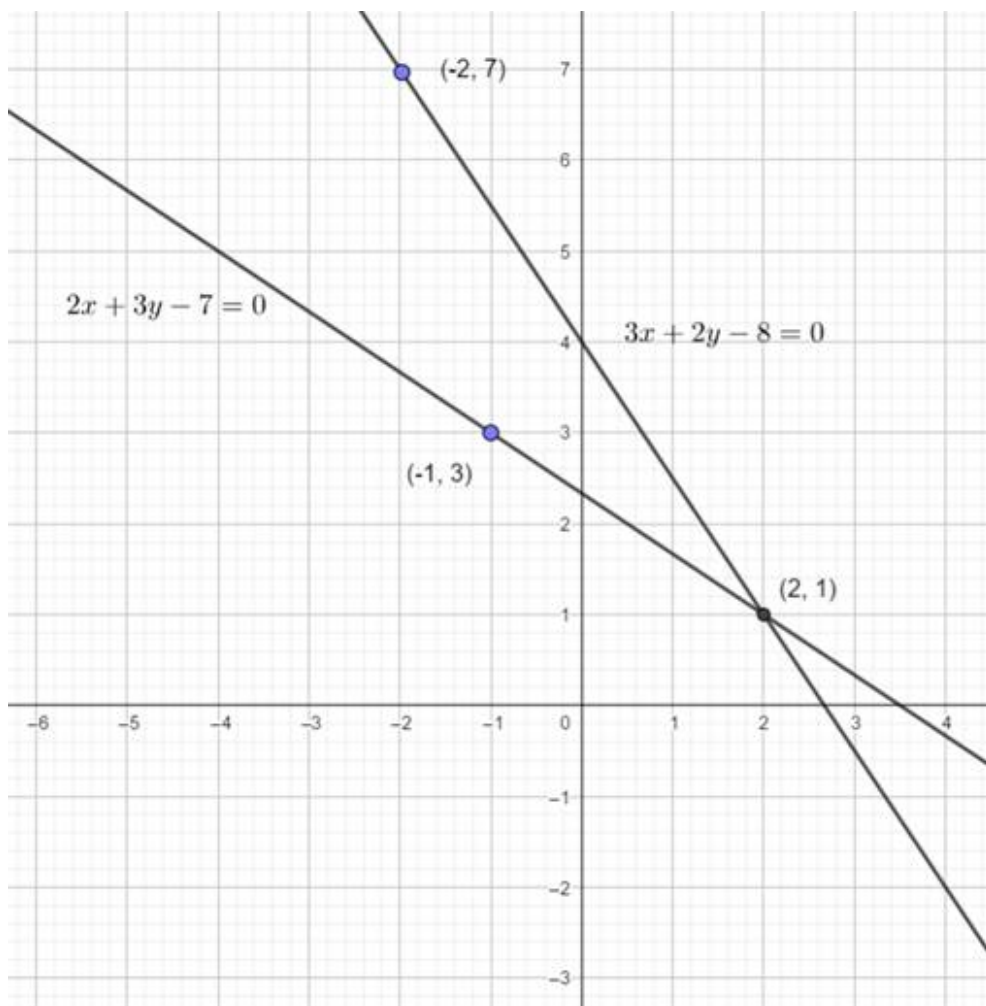
$$y = \frac{1}{3}(7 - 2x)$$

x	- 1	2
y	3	1

For $3x + 2y = 8$

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

x	2	- 2
y	1	7



Hence, Also by graphical method the solution comes out to be (2, 1).

2. Question

To eliminate y, what number is multiplied with the equation $7x - 5y + 2 = 0$ and then add to the equation $2x + 15y + 3 = 0$.

Answer

To eliminate y, we have to make the coefficient of y in both the equations equal, so we have to multiply the coefficient of y with such a number that makes them equal to the common multiple of both of them.

In this case, equation $7x - 5y + 2 = 0$ should be multiplied by 3 such that the coefficient of y will be equal to 15 in both the cases.

3. Question

Let us write the least natural number by which we can multiply both the equations and get the equal co - efficient of x, where the equations are $4x - 3y = 16$ and $6x + 5y = 62$.

Answer

In this case, the coefficient of x are 4 and 6, thinking of the common multiple of the 4 and 6 comes out to be 12, hence multiplying $4x - 3y = 16$ by 3 and $6x + 5y = 62$ by 2 makes the coefficient of x as 12 and then subtracting both the equations to eliminate x.

4 A. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$3x + 2y = 6$$

$$2x - 3y = 17$$

Answer

In this problem, we will eliminate 'y' from both the equations

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

$$2x - 3y = 17 \text{ (ii)}$$

Multiplying equation (i) with 3 and (ii) with 2, We have

$$\begin{array}{rclcl} 9x & + & 6y & = & 18 \\ 4x & - & 6y & = & 34 \\ \hline 13x & & & = & 52 \end{array}$$

$$\Rightarrow x = 4$$

Putting the value of x in equation (i)

$$\text{We have } y = \frac{1}{2} (6 - 3x)$$

$$y = -3.$$

Hence the solution of the linear equation is $x = 4$ and $y = -3$.

4 B. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$2x + 3y = 32$$

$$11y - 9x = 3$$

Answer

Rewriting the above equations in standard form,

$$2x + 3y = 32 \text{ (i)}$$

$$-9x + 11y = 3 \text{ (ii)}$$

In this problem, we will eliminate 'x' from both the equations.

Hence multiplying equation (i) with 9 and (ii) with 2, We have

$$\begin{array}{rclcl} 18x & + & 27y & = & 288 \\ -18x & + & 22y & = & 6 \\ \hline & & 49y & = & 294 \end{array}$$

$$\Rightarrow y = 6$$

Putting the value of y in equation (i)

$$\text{we have, } x = \frac{1}{2} (32 - 3y)$$

$$\Rightarrow x = 7$$

Hence the solution of the linear equation is $x = 7$ and $y = 6$.

4 C. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$x + y = 48$$

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

Answer

Rewriting the above equations in the standard form of $ax + by = c$.

$$x + y = 48 \text{ (i)}$$

$$x - 2.5y = 6 \text{ (ii)}$$

In this problem, we will eliminate 'x' from both the equations, simply subtracting

$$\begin{array}{rclcl} x & + & y & = & 48 \\ [-] & x & - & 2.5y & = & 6 \\ \hline & & 3.5y & = & 42 \end{array}$$

$$\Rightarrow y = 12$$

Putting the value of y in equation(i)

$$\text{we have, } x = (48 - y) \text{ or } x = 36.$$

Hence the solution of the linear equation is $x = 36$ and $y = 12$.

4 D. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{x}{2} + \frac{y}{3} = 8$$

$$\frac{5x}{4} - 3y = -3$$

Answer

Rewriting the above equation as.

$$3x + 2y = 48 \text{ (i)}$$

$$5x - 12y = -12 \text{ (ii)}$$

In this problem, we will eliminate 'y' from both the equations!

Multiplying equation (i) with 6, we have

$$\begin{array}{rclcl} 8x & + & 12y & = & 288 \\ 5x & - & 12y & = & -12 \\ \hline 23x & & & = & 276 \end{array}$$

$$\Rightarrow x = 12$$

Putting the value of y in equation(i)

$$\text{We have } y = 1/2(48 - 3x) \text{ or } y = 6.$$

Hence the solution of the linear equation is $x = 12$ and $y = 6$.

4 E. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

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

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

Answer

Let $\frac{1}{y}$ as Y, Rewriting the above equation as.

$$3x - 2Y = 5 \text{ (i)}$$

$$x + 4Y = 4 \text{ (ii)}$$

In this problem, we will eliminate 'y' from both the equations. Multiplying equation (i) with 2, we have

$$\begin{array}{rclcl} 6x & - & 4y & = & 10 \\ x & + & 4y & = & 4 \\ \hline 7x & & & = & 14 \end{array}$$

$$\Rightarrow x = 2$$

Putting the value of y in equation(i)

$$\text{We have } Y = -\frac{1}{2} (5 - 3x) \text{ or } Y = \frac{1}{2}$$

Since, $Y = \frac{1}{y}$, therefore $y = 2$.

Hence the solution of the linear equation is $x = 2$ and $y = 2$

4 F. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

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

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

Answer

Rewriting the above equation as.

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

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

In this problem, we will eliminate 'y' from both the equations,

Multiplying equation (i) with 3 and (ii) with 2, we have

$$\begin{array}{rclcl} 9x & + & 6y & = & 18 \\ [-] & 4x & + & 6y & = & 12 \\ \hline 5x & & & = & 6 \end{array}$$

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

Putting the value of x in equation(i)

$$\text{We have } y = 1/2(6 - 3x) \text{ or } y = \frac{6}{5}$$

Hence the solution of the linear equation is $x = \frac{6}{5}$ and $y = \frac{6}{5}$

4 G. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{x+y}{2} + \frac{3x-5y}{4} = 2$$

$$\frac{x}{14} + \frac{y}{18} = 1$$

Answer

Rewriting the above equation as.

$$5x - 3y = 8 \text{ (i)}$$

$$9x + 7y = 126 \text{ (ii)}$$

In this problem, we will eliminate 'y' from both the equations. Multiplying equation (i) with 7 and (ii) with 3, we have

$$\begin{array}{rclcl} 35x & - & 21y & = & 56 \\ 27x & + & 21y & = & 378 \\ \hline 62x & & & = & 434 \end{array}$$

$\Rightarrow x = 7$, putting the value of x in equation(i),

$$\text{we have } y = -\frac{1}{3}(8 - 5x) \text{ or } y = 9.$$

Hence the solution of the linear equation is $x = 7$ and $y = 9$.

4 H. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{xy}{x+y} = \frac{1}{5}$$

$$\frac{xy}{x-y} = \frac{1}{9}$$

Answer

Rewriting the above equation as.

$$x + y = 5xy \text{ (i)}$$

$$x - y = 9xy \text{ (ii)}$$

In this problem, we will eliminate 'y' from both the equations.

Adding both the equations

$$2x = 14xy \text{ (cancelling x from both the sides)}$$

$$\Rightarrow y = \frac{1}{7}$$

Putting the value of y in equation(i)

$$x = 5xy - y \text{ or } x = -1/2$$

Hence the solution of the linear equation is $x = \frac{1}{7}$ and $y = -1/2$

Note: - Since we have cancelled x as it is common from both the sides, we have neglected a solution that is $x = 0$, similarly other solution as $y = 0$.

4 I. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

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

$$\frac{2}{x-1} + \frac{3}{y-2} = 5$$

Answer

Let us take as

$$\frac{1}{x-1} = a \text{ and } \frac{1}{(y-2)} = b$$

Then the above equations will be

$$1a + 1.b = 3 \text{ (i)}$$

$$2a + 3b = 5 \text{ (ii)}$$

In this problem, we will eliminate 'a' from both the equations, Multiplying equation (i) with 2, we have

$$\begin{array}{rclcl} 2a & + & 2b & = & 6 \\ [-] & 2a & + & 3b & = & 5 \\ \hline & & & -b & = & 1 \end{array}$$

$\Rightarrow b = -1$, putting the value of b in equation(i) $a = 3 - b$ or $a = 4$.

Since $\frac{1}{x-1} = a \Rightarrow x = \frac{5}{4}$ and

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

Hence the solution of the linear equation is $x = \frac{5}{4}$ and $y = 1$.

4 J. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{14}{x+y} + \frac{3}{x-y} = 5$$

$$\frac{21}{x+y} - \frac{1}{x-y} = 2$$

Answer

Let us take as $\frac{1}{x+y} = a$ and $\frac{1}{x-y} = b$

Then above equations can be written as

$$14a + 3b = 5 \text{ (i)}$$

$$21a - b = 2 \text{ (ii)}$$

In this problem, we will eliminate 'b' from both the equations.

Multiplying equation (ii) with 3, we have

$$\begin{array}{rcl}
 14a & + & 3b = 5 \\
 63a & - & 3b = 6 \\
 \hline
 77a & & = 11 \\
 \hline
 \end{array}$$

$$\Rightarrow a = \frac{1}{7}$$

Putting the value of a in equation(i) gives $b = 1$

Now Since $\frac{1}{x+y} = a$ and $\frac{1}{x-y} = b$ It will form again a system of linear equations in x and y.

$$\frac{1}{x+y} = \frac{1}{7}$$

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

Rearranging the above equation

$$x + y = 7 \text{ (iii)}$$

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

$$\begin{array}{rcl}
 x & + & y = 7 \\
 x & - & y = 1 \\
 \hline
 2x & & = 8 \\
 \hline
 \end{array}$$

$\Rightarrow x = 4$, putting the value of x in equation(iii) gives $y = 3$.

Hence the solution of the linear equation is $x = 4$ and $y = 3$.

4 K. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{x+y}{5} - \frac{x-y}{4} = \frac{7}{20}$$

$$\frac{x+y}{3} - \frac{x-y}{2} + \frac{5}{6} = 0$$

Answer

Rewriting the above equation as.

$$9y - x = 7 \text{ (i)}$$

$$5y - x = -5 \text{ (ii)}$$

In this problem, we will eliminate 'x' from both the equations by subtracting the equation.

$$\begin{array}{rcl}
 9y & - & x & = & 7 \\
 [-] & 5y & - & x & = & -5 \\
 \hline
 4y & & & = & 12
 \end{array}$$

$y = 3$, putting the value of y in equation(i), we have $x = 20$

Hence the solution of the linear equation is $y = 3$ and $x = 20$

4 L. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$x + y = a + b$$

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

Answer

In this problem, we will eliminate 'y' from both the equations by subtracting the equation 2nd from 1st.

$$x + y = a + b \text{ (i)}$$

$$ax + by = a^2 - b^2 \text{ (ii)}$$

Multiplying equation 1st by 'b' to make the coefficient of y equal in both equation. So we get,

$$\begin{array}{rcl}
 bx & + & by & = & ba + b^2 \\
 [-] & ax & + & by & = & a^2 - b^2 \\
 \hline
 x(b - a) & & & = & ba - a^2 + 2b^2
 \end{array}$$

$$\Rightarrow x = \frac{ba - a^2 + 2b^2}{b - a}$$

Putting the value of x in equation (i) we get, value of y as

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

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

$$\Rightarrow y = \frac{ba - a^2 + 2b^2 - b^2 + a^2}{b - a}$$

$$\Rightarrow y = \frac{ba + b^2}{b - a}$$

Hence the solution of the linear equation is $x = \frac{ba - a^2 + 2b^2}{b - a}$ and $y = \frac{ba + b^2}{b - a}$.

4 M. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$\frac{x+a}{a} = \frac{y+b}{b}$$

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

Answer

Rewriting the above equation as

$$bx - ay = 0 \dots(i)$$

$$ax - by = a^2 - b^2 \dots(ii)$$

Multiplying equation (i) by 'b' and equation (ii) by 'a' to eliminate y, we get

$$\begin{array}{rcl} b^2x & - & aby = 0 \\ [-] & & \\ a^2x & - & aby = a^2 - b^2 \\ \hline x(b^2 - a^2) & = & b^2 - a^2 \\ \hline \end{array}$$

$$\Rightarrow x = 1$$

Putting the value of x in (i) we get $y = \frac{b}{a}$

Hence the solution of the linear equation is $x = 1$ and $y = \frac{b}{a}$

4 N. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$ax + by = c$$

$$a^2x + b^2y = c^2$$

Answer

In this case, we will eliminate y from both the equations

$$ax + by = c \text{ (i)}$$

$$a^2x + b^2y = c^2 \text{ (ii)}$$

Multiplying equation (i) by 'b' we get,

$$\begin{array}{rcl}
 abx & + & b^2y = cb \\
 [-] & a^2x & + b^2y = c^2 \\
 \hline
 x(ab - a^2) & & = cb - c^2 \\
 \hline
 \end{array}$$

$$\Rightarrow x = \frac{cb - c^2}{ab - a^2}$$

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

$$y = \frac{c^2 - ac}{b - a}$$

Hence the solution of the linear equation is $x = \frac{cb - c^2}{ab - a^2}$ and $y = \frac{c^2 - ac}{b - a}$

4 0. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$ax + by = 1$$

$$bx + ay = \frac{(a+b)^2}{a^2 + b^2} - 1$$

Answer

In this case, we will eliminate y from both the equations

$$ax + by = 1 \text{ (i)}$$

$$bx + ay = \frac{(a+b)^2}{a^2 + b^2} - 1 \text{ (ii)}$$

Multiplying equation (i) by 'a' and (ii) by 'b' to eliminate y we get,

$$a^2x + aby = a \text{ (iii)}$$

$$b^2x + aby = \frac{b(a+b)^2}{a^2 + b^2} - b$$

$$\Rightarrow b^2x + aby = b \left(\frac{a^2 + b^2 + 2ab - a^2 - b^2}{a^2 + b^2} \right)$$

$$\Rightarrow b^2x + aby = \frac{2ab^2}{(a^2 + b^2)} \text{ (iv)}$$

Subtracting (iii) from (iv), we get

$$\begin{array}{rcl}
 -a^2x & + & aby = a \\
 [-] & -b^2x & + aby = \frac{2ab^2}{a^2 + b^2} \\
 \hline
 x(a^2 - b^2) & = & a - \frac{2ab^2}{a^2 + b^2} \\
 \hline
 \end{array}$$

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

$$\Rightarrow x = \frac{a^3 - ab^2}{(a^2 + b^2)(a^2 - b^2)} = \frac{a(a^2 - b^2)}{(a^2 + b^2)(a^2 - b^2)} = \frac{a}{a^2 + b^2}$$

Putting the value of x in (i) we get $y = \frac{b}{a^2 + b^2}$

Hence the solution of the linear equation is $x = \frac{a}{a^2 + b^2}$ and $y = \frac{b}{a^2 + b^2}$

4 P. Question

Let us solve the following linear simultaneous equations in two variables by the method of elimination:

$$(7x - y - 6)^2 + (14x + 2y - 16)^2 = 0$$

Answer

This equation is of the form $a^2 + b^2 = 0$

This is possible if both 'a' = 0 and b = 0

So, for above equation equals to zero

$$7x - y - 6 = 0 \text{ (i) and}$$

$$14x + 2y - 16 = 0 \text{ (ii)}$$

Now multiplying equation (i) by 2 and adding both equation we get,

$$\begin{array}{rcl}
 14x & - & 2y = 12 \\
 14x & + & 2y = 16 \\
 \hline
 28x & & = 28 \\
 \hline
 \end{array}$$

$$\Rightarrow x = 1$$

Putting the value of x in (i) we get $y = 1$

So for the value of x = 1 and y = 1 the given equation equals to zero

Let us Work Out 5.4

1. Question

Let us express the variable x of the equation $\frac{x}{3} + \frac{y}{2} = 8$ in term of the variable y.

Answer

$$\frac{x}{3} + \frac{y}{2} = 8$$

Taking L.C.M

$$\Rightarrow \frac{2x + 3y}{6} = 8$$

$$\Rightarrow 2x + 3y = 48$$

$$\Rightarrow x = \frac{48 - 3y}{2}$$

2. Question

Let us express the variable y of the equation $\frac{2}{x} + \frac{7}{y} = 1$ in term of the variable x.

Answer

$$\frac{2}{x} + \frac{7}{y} = 1$$

Taking L.C.M

$$\Rightarrow 2y + 7x = xy$$

$$\Rightarrow 7x = xy - 2y$$

$$\Rightarrow 7x = y(x - 2)$$

$$y = \frac{7x}{x - 2}$$

3 A. Question

Let us solve the following simultaneous equations by the method of comparison and check whether the solutions satisfy the equations.

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

$$5x + 8y = 14$$

Answer

Let's express the variable in terms of another variable.

$$\Rightarrow 2(x - y) = 3 \dots\dots\dots[1]$$

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

$$\Rightarrow 2x = 3 + 2y$$

$$\Rightarrow x = \frac{3+2y}{2} \dots\dots\dots[3]$$

and,

$$5x + 8y = 14 \dots\dots\dots[2]$$

$$\Rightarrow 5x = 14 - 8y$$

$$\Rightarrow x = \frac{14-8y}{5} \dots\dots\dots[4]$$

on comparing eq. [3] and eq. [4]

we get,

$$\frac{3 + 2y}{2} = \frac{14 - 8y}{5}$$

$$\Rightarrow 15 + 10y = 28 - 16y$$

$$\Rightarrow 26y = 13$$

$$\Rightarrow y = \frac{1}{2} \dots\dots\dots[5]$$

from eq. [3]

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

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

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

$$\Rightarrow x = 2 \dots\dots\dots[6]$$

by eq. [5] and [6]

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

by using the result in eq. [1] and eq. [2]

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

L.H.S

$$\Rightarrow 2\left(2 - \frac{1}{2}\right)$$

$$= 2\left(\frac{3}{2}\right)$$

$$= 3 = \text{R.H.S}$$

similarly,

by eq. [2]

$$5x + 8y = 14$$

L.H.S

$$= 5(2) + 8\left(\frac{1}{2}\right)$$

$$= 10 + 4$$

$$= 14 = \text{R.H.S}$$

3 B. Question

Let us solve the following simultaneous equations by the method of comparison and check whether the solutions satisfy the equations.

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

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

Answer

expressing the equations in terms of one variable.

$$2x + \frac{3}{y} = 5 \dots\dots\dots[1]$$

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

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

$$\Rightarrow \frac{2xy + 3}{y} = 5$$

$$\Rightarrow 2xy + 3 = 5y$$

$$\Rightarrow 2xy = 5y - 3$$

$$\Rightarrow x = \frac{5y-3}{2y} \dots\dots\dots[3]$$

by eq. 2

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

$$\Rightarrow 5xy - 2 = 3y$$

$$\Rightarrow 5xy = 3y + 2$$

$$\Rightarrow x = \frac{3y+2}{5y} \dots\dots\dots[4]$$

on comparing eq. [3] and eq. [4]

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

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

$$\Rightarrow 25y^2 - 15y = 6y^2 + 4y$$

cancelling one power of y from both sides

$$\Rightarrow 25y - 15 = 6y + 4$$

$$\Rightarrow 19y = 19$$

$$\Rightarrow y = 1$$

by eq. [3]

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

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

$$\Rightarrow x = 1$$

$\therefore$ solution of this pair is $x = 1, y = 1$

verifying by eq. [1]

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

L.H.S

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

$$= 5 = \text{R.H.S}$$

by eq. [2]

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

L.H.S

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

$$= 3 = \text{R.H.S}$$

3 C. Question

Let us solve the following simultaneous equations by the method of comparison and check whether the solutions satisfy the equations.

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

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

Answer

$$\frac{x}{2} + \frac{y}{3} = 1 \dots\dots\dots[1]$$

$$\frac{x}{3} + \frac{y}{2} = 1 \dots\dots\dots[2]$$

by eq. [1]

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

taking L.C.M

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

$$\Rightarrow x = \frac{(6-2y)}{3} \dots\dots\dots[3]$$

by eq. [2]

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

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

$$\Rightarrow x = \frac{6-3y}{2} \dots\dots\dots[4]$$

on comparing eq. [3] and eq. [4]

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

$$\Rightarrow 12 - 4y = 18 - 9y$$

$$\Rightarrow 5y = 6$$

$$\Rightarrow y = \frac{6}{5} \dots\dots\dots [5]$$

by using eq. [5] in eq. [3]

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

$$\Rightarrow x = \frac{6 - 2\left(\frac{6}{5}\right)}{3}$$

$$\Rightarrow x = \frac{6}{5} \dots\dots\dots [6]$$

by eq. [5] and [6]

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

verifying the result by eq. [1]

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

L.H.S

$$\Rightarrow \left(\frac{\frac{6}{5}}{2} + \frac{\frac{6}{5}}{3} \right)$$

$$= \frac{6}{10} + \frac{6}{15}$$

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

$$= 1$$

verifying the result by eq. [2]

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

L.H.S

$$\Rightarrow \frac{\frac{6}{5}}{3} + \frac{\frac{6}{5}}{2}$$

$$\Rightarrow \frac{2}{5} + \frac{3}{5}$$

$$= 1 = \text{R. H. S}$$

3 D. Question

Let us solve the following simultaneous equations by the method of comparison and check whether the solutions satisfy the equations.

$$4x - 3y = 18$$

$$4y - 5x = -7$$

Answer

$$4x - 3y = 18 \dots\dots\dots[1]$$

$$4y - 5x = -7 \dots\dots\dots[2]$$

by eq. [1]

$$4x - 3y = 18$$

$$\Rightarrow 4x = 18 + 3y$$

$$\Rightarrow x = \frac{18 + 3y}{4} \dots\dots\dots[3]$$

by eq. [2]

$$4y - 5x = -7$$

$$\Rightarrow 5x = 4y + 7$$

$$\Rightarrow x = \frac{7 + 4y}{5} \dots\dots\dots[4]$$

on comparing eq. [3] and eq. [4]

$$\Rightarrow \frac{18 + 3y}{4} = \frac{7 + 4y}{5}$$

$$\Rightarrow 90 + 15y = 28 + 16y$$

$$\Rightarrow y = 62 \dots\dots\dots[5]$$

by using eq. [5] in eq. [3]

$$\Rightarrow x = \frac{18 + 3y}{4}$$

$$\Rightarrow x = \frac{6 - 2\left(\frac{6}{5}\right)}{3}$$

$$\Rightarrow x = \frac{6}{5} \dots\dots\dots[6]$$

by eq. [5] and [6]

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

verifying the result by eq. [1]

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

L.H.S

$$\Rightarrow \left(\frac{6}{5} + \frac{6}{3} \right)$$

$$= \frac{6}{10} + \frac{6}{15}$$

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

$$= 1$$

verifying the result by eq. [2]

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

L.H.S

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

$$\Rightarrow \frac{2}{5} + \frac{3}{5}$$

$$= 1 = \text{R. H. S}$$

4. Question

Let us solve the simultaneous equations $2x + y = 8$ and $2y - 3x = -5$ by the method of comparison and justify them by solving graphically.

Answer

expressing the equations in terms of one variable.

$$2x + y = 8$$

$$\Rightarrow x = \frac{8-y}{2} \dots\dots\dots[1]$$

$$2y - 3x = -5$$

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

$$\Rightarrow x = \frac{2y+5}{3} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{8-y}{2} = \frac{2y+5}{3}$$

$$\Rightarrow 24 - 3y = 4y + 10$$

$$\Rightarrow 7y = 14$$

$$\Rightarrow y = 2 \dots\dots\dots [3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{8-y}{2}$$

$$\Rightarrow x = \frac{8-2}{2}$$

$$\Rightarrow x = 3$$

Let's make the graphs of given linear equations,

We get the following tables for the given linear equations.

For $2x + y = 8$

$$y = 8 - 2x$$

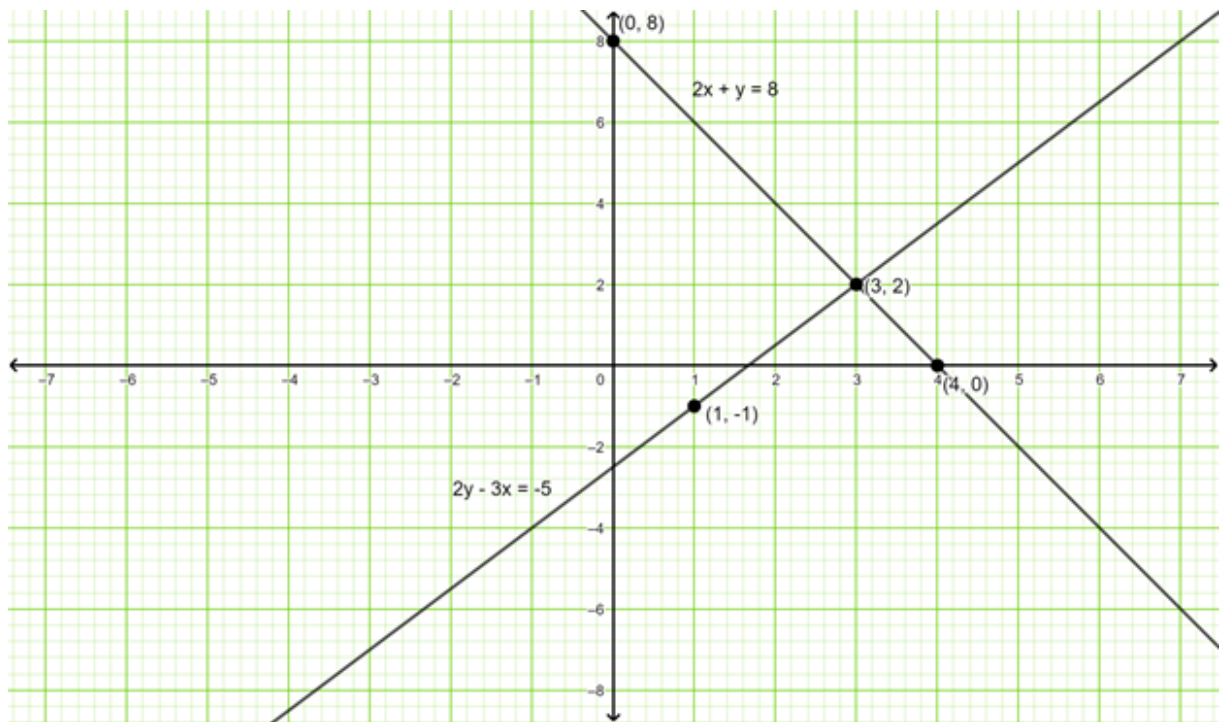
x	0	4
y	8	0

For $2y - 3x = -5$

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

x	3	1
y	2	-1

Plotting these points on a graph and joining them, we get two straight lines.



From the graph, we can see that both lines intersect at $(3, 2)$, hence the solution to this pair is $(3, 2)$.

5 A. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$3x - 2y = 2$$

$$7x + 3y = 43$$

Answer

expressing the equations in terms of one variable

$$3x - 2y = 2$$

$$\Rightarrow x = \frac{2 + 2y}{3} \dots\dots\dots[1]$$

$$7x + 3y = 43$$

$$\Rightarrow x = \frac{43 - 3y}{7} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{2 + 2y}{3} = \frac{43 - 3y}{7}$$

$$\Rightarrow 14y + 14 = 129 - 9y$$

$$\Rightarrow 23y = 115$$

$$\Rightarrow y = 5 \dots\dots\dots[3]$$

by using [3] in [1]

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

$$\Rightarrow x = \frac{2 + 2 \times 5}{3}$$

$$\Rightarrow x = 4$$

5 B. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$2x - 3y = 8$$

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

Answer

expressing the equations in terms of one variable

$$2x - 3y = 8$$

$$\Rightarrow x = \frac{8 + 3y}{2} \dots\dots\dots[1]$$

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

$$\Rightarrow 3x + 3y = 7x - 7y$$

$$\Rightarrow 4x = 10y$$

$$\Rightarrow x = \frac{5y}{2} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{8 + 3y}{2} = \frac{5y}{2}$$

$$\Rightarrow 8 + 3y = 5y$$

$$\Rightarrow 2y = 8$$

$$\Rightarrow y = 4 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{8 + 3y}{2}$$

$$\Rightarrow x = \frac{8 + 3 \times 4}{2}$$

$$\Rightarrow x = 10$$

5 C. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

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

$$\frac{1}{7}(4x - 5y) = x - 7$$

Answer

expressing the equations in terms of one variable

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

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

$$\Rightarrow 4x = 7y - 3$$

$$\Rightarrow x = \frac{7y-3}{4} \dots\dots\dots[1]$$

$$\frac{1}{7}(4x - 5y) = x - 7$$

$$\Rightarrow 4x - 5y = 7x - 49$$

$$\Rightarrow 3x = 49 - 5y$$

$$\Rightarrow x = \frac{49-5y}{3} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{7y - 3}{4} = \frac{49 - 5y}{3}$$

$$\Rightarrow 21y - 9 = 196 - 20y$$

$$\Rightarrow 41y = 205$$

$$\Rightarrow y = 5 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{7y - 3}{4}$$

$$\Rightarrow x = \frac{7 \times 5 - 3}{4}$$

$$\Rightarrow x = 8$$

5 D. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

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

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

Answer

expressing the equations in terms of one variable

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

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

$$\Rightarrow x = \frac{4y-1}{5} \dots\dots\dots[1]$$

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

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

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

$$\Rightarrow x = \frac{5+y}{2} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

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

$$\Rightarrow 8y - 2 = 25 + 5y$$

$$\Rightarrow 3y = 27$$

$$\Rightarrow y = 9 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{4y-1}{5}$$

$$\Rightarrow x = \frac{4(9) - 1}{5}$$

$$\Rightarrow x = 7$$

5 E. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$x + y = 11$$

$$y + 2 = \frac{1}{8}(10y + x)$$

Answer

expressing the equations in terms of one variable

$$x + y = 11$$

$$\Rightarrow x = 11 - y \text{[1]}$$

$$y + 2 = \frac{1}{8}(10y + x)$$

$$\Rightarrow 8y + 16 = 10y + x$$

$$\Rightarrow x = 16 - 2y \text{[2]}$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow 16 - 2y = 11 - y$$

$$\Rightarrow y = 5 \text{[3]}$$

by using [3] in [1]

$$\Rightarrow x = 11 - y$$

$$\Rightarrow x = 11 - 5$$

$$\Rightarrow x = 6$$

5 F. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

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

$$2x + 4y = 11$$

Answer

expressing the equations in terms of one variable

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

$$\Rightarrow 4x + 3y = 12$$

$$\Rightarrow x = \frac{12-3y}{4} \dots\dots\dots[1]$$

$$2x + 4y = 11$$

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

$$\Rightarrow x = \frac{11-4y}{2} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{12-3y}{4} = \frac{11-4y}{2}$$

$$\Rightarrow 24 - 6y = 44 - 16y$$

$$\Rightarrow 10y = 20$$

$$\Rightarrow y = 2 \dots\dots\dots[3]$$

by using [3] in [1]

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

$$\Rightarrow x = \frac{12-3(2)}{4}$$

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

5 G. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

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

$$2x - \frac{6}{y} = 9$$

Answer

expressing the equations in terms of one variable

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

$$\Rightarrow xy + 2 = 7y$$

$$\Rightarrow x = \frac{7y-2}{y} \dots\dots\dots[1]$$

$$2x - \frac{6}{y} = 9$$

$$\Rightarrow 2xy - 6 = 9y$$

$$\Rightarrow x = \frac{9y+6}{2y} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{7y-2}{y} = \frac{9y+6}{2y}$$

$$\Rightarrow \frac{7y-2}{1} = \frac{9y+6}{2}$$

$$\Rightarrow 14y - 4 = 9y + 6$$

$$\Rightarrow 5y = 10$$

$$\Rightarrow y = 2 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{7y-2}{y}$$

$$\Rightarrow x = \frac{7(2)-2}{2}$$

$$\Rightarrow x = 6$$

5 H. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$\frac{1}{x} + \frac{1}{y} = \frac{5}{6}$$

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

Answer

expressing the equations in terms of one variable

$$\frac{1}{x} + \frac{1}{y} = \frac{5}{6}$$

$$\Rightarrow 6y + 6x = 5xy$$

$$\Rightarrow x(5y - 6) = 6y$$

$$\Rightarrow x = \frac{6y}{5y-6} \dots\dots\dots[1]$$

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

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

$$\Rightarrow x(y + 6) = 6y$$

$$\Rightarrow x = \frac{6y}{y+6} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

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

$$\Rightarrow y + 6 = 5y - 6$$

$$\Rightarrow 4y = 12$$

$$\Rightarrow y = 3 \dots\dots\dots[3]$$

by using [3] in [1]

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

$$\Rightarrow x = \frac{6 \times 3}{5 \times 3 - 6}$$

$$\Rightarrow x = \frac{18}{9}$$

$$\Rightarrow x = 2$$

5 I. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

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

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

Answer

expressing the equations in terms of one variable

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

$$\Rightarrow x + y = 2xy$$

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

$$\Rightarrow x = \frac{y}{2y-1} \dots\dots\dots [1]$$

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

$$\Rightarrow x - y = xy$$

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

$$\Rightarrow x = \frac{y}{1-y} \dots\dots\dots [2]$$

by comparing eq. [1] and eq. [2]

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

$$\Rightarrow 2y - 1 = 1 - y$$

$$\Rightarrow 3y = 2$$

$$\Rightarrow y = \frac{2}{3} \dots\dots\dots [3]$$

by using [3] in [1]

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

$$\Rightarrow x = \frac{\frac{2}{3}}{2 \times \frac{2}{3} - 1}$$

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

5 J. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$\frac{x+y}{5} + \frac{x-y}{4} = 5$$

$$\frac{x+y}{4} + \frac{x-y}{5} = 5\frac{4}{5}$$

Answer

expressing the equations in terms of one variable

$$\frac{x+y}{5} + \frac{x-y}{4} = 5$$

$$\Rightarrow 4x + 4y + 5x - 5y = 20 \times 5$$

$$\Rightarrow 9x - y = 100$$

$$\Rightarrow x = \frac{100+y}{9} \dots\dots\dots[1]$$

$$\frac{x+y}{4} + \frac{x-y}{5} = 5\frac{4}{5}$$

$$\frac{x+y}{4} + \frac{x-y}{5} = \frac{29}{5}$$

$$\Rightarrow 5x + 5y + 4x - 4y = 116$$

$$\Rightarrow 9x = 116 - y$$

$$\Rightarrow x = \frac{116-y}{9} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{100+y}{9} = \frac{116-y}{9}$$

$$\Rightarrow 2y = 16$$

$$\Rightarrow y = 8 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{100+y}{9}$$

$$\Rightarrow x = \frac{100+8}{9}$$

$$\Rightarrow x = \frac{108}{9}$$

$$\Rightarrow x = 12$$

5 K. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$\frac{4}{x} - \frac{y}{2} = -1$$

$$\frac{8}{x} + 2y = 10$$

Answer

expressing the equations in terms of one variable

$$\frac{4}{x} - \frac{y}{2} = -1$$

$$\Rightarrow 8 - xy = -2x$$

$$\Rightarrow x(y - 2) = 8$$

$$\Rightarrow x = \frac{8}{y-2} \dots\dots\dots[1]$$

$$\frac{8}{x} + 2y = 10$$

$$\Rightarrow 8 + 2xy = 10x$$

$$\Rightarrow x(10 - 2y) = 8$$

$$\Rightarrow x = \frac{8}{10-2y} \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{8}{y-2} = \frac{8}{10-2y}$$

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

$$\Rightarrow 3y = 12$$

$$\Rightarrow y = 4 \dots\dots\dots[3]$$

by using [3] in [1]

$$\Rightarrow x = \frac{8}{y-2}$$

$$\Rightarrow x = \frac{8}{4-2}$$

$$\Rightarrow x = \frac{8}{2}$$

$$\Rightarrow x = 4$$

5 L. Question

Let us solve the following simultaneous equations in two variables by the method of comparison:

$$2 - 2(3x - y) = 10$$

$$10(4 - y) - 5x = 4(y - x)$$

Answer

expressing the equations in terms of one variable

$$2 - 2(3x - y) = 10$$

$$\Rightarrow 2 - 6x + 2y = 10$$

$$\Rightarrow 6x = 2y - 8$$

dividing by 3 on both sides.

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

$$\Rightarrow x = \frac{y-4}{3} \dots\dots\dots[1]$$

$$10(4 - y) - 5x = 4(y - x)$$

$$\Rightarrow 40 - 10y - 5x = 4y - 4x$$

$$\Rightarrow x + 14y = 40$$

$$\Rightarrow x = 40 - 14y \dots\dots\dots[2]$$

by comparing eq. [1] and eq. [2]

$$\Rightarrow \frac{y-4}{3} = 40 - 14y$$

$$\Rightarrow y - 4 = 120 - 42y$$

$$\Rightarrow y = \frac{124}{43} \dots\dots\dots[3]$$

by using [3] in [1]

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

$$\Rightarrow x = \frac{124}{43}$$

Let us Work Out 5.5

1. Question

Let us express x of the equation $\frac{2}{x} + \frac{3}{y} = 1$ in terms of the variable y.

Answer

We have to express x of the equation $\frac{2}{x} + \frac{3}{y} = 1$ in terms of y.

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

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

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

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

$$\Rightarrow x = 2\left(\frac{y}{y-3}\right)$$

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

$\therefore$ x of the given equation in terms of variable y is $x = \frac{2y}{y-3}$.

2. Question

Let us write the value of x by putting $\frac{7-4x}{-5}$ instead of y in the equation $2x + 3y = 9$.

Answer

Given let $\frac{7-4x}{-5}$ be put instead of y in the equation $2x + 3y = 9$.

We have to find the value of x.

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

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

$$\Rightarrow \frac{5(2x) - 3(7 - 4x)}{5} = 9$$

$$\Rightarrow \frac{10x - 21 + 12x}{5} = 9$$

$$\Rightarrow \frac{22x - 21}{5} = 9$$

$$\Rightarrow 22x - 21 = 9 \text{ (5)}$$

$$\Rightarrow 22x - 21 = 45$$

$$\Rightarrow 22x = 45 + 21$$

$$\Rightarrow 22x = 66$$

$$\Rightarrow x = 3$$

$\therefore$ Value of x is 3.

3 A. Question

Let us solve the following equations in two variables by the method of substitution and check them graphically.

$$3x - y = 7$$

$$2x + 4y = 0$$

Answer

$$\text{Given } 3x - y = 7 \dots (1)$$

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

Expressing y of equation (1) in terms of x,

$$\Rightarrow 3x - y = 7$$

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

Substituting (3) in (2),

$$\Rightarrow 2x + 4y = 0$$

$$\Rightarrow 2x + 4(3x - 7) = 0$$

$$\Rightarrow 2x + 12x - 28 = 0$$

$$\Rightarrow 14x - 28 = 0$$

$$\Rightarrow 14x = 28$$

$$\therefore x = 2$$

Substituting x value in (3),

$$\Rightarrow 3x - 7 = y$$

$$\Rightarrow 3(2) - 7 = y$$

$$\therefore y = -1$$

$\therefore$ By solving, we get $x = 2$ and $y = -1$.

Justification:

Generally, we substitute $x = 0$ or $y = 0$ in the given linear equations to get y and x . So we get two points on the straight line. To find more points on the line, take different values of x related to it, we get different values for y from the equation.

We get the following tables for the given linear equations.

For $3x - y = 7$

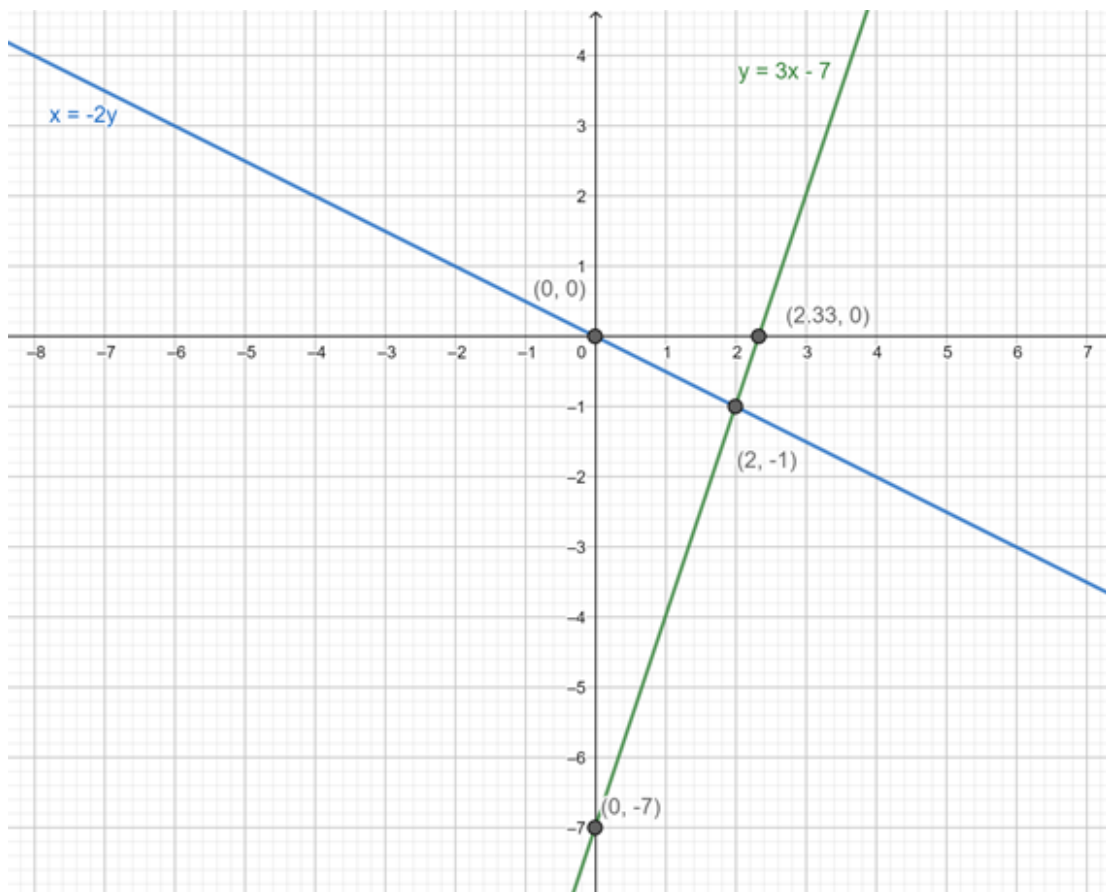
$$\Rightarrow y = 3x - 7$$

X	0	$7/3=2.33$
Y	-7	0

For $2x + 4y = 0$

$$\Rightarrow x = -2y$$

X	0	2
Y	0	-1



Plotting these points on a graph and joining them, we get two straight lines.

From the graph, we can see that both lines intersect at $(2, -1)$, hence the solution to this pair is $(2, -1)$.

Hence x and y values satisfy equations (1) and (2).

3 B. Question

Let us solve the following equations in two variables by the method of substitution and check them graphically.

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

Answer

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

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

Expressing x of equation (1) in terms of y ,

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

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

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

$$\therefore x = \frac{12-2y}{3} \dots (3)$$

Substituting (3) in (2),

$$\Rightarrow \frac{x}{4} + \frac{y}{2} = 2$$

$$\Rightarrow \frac{\frac{12-2y}{3}}{4} + \frac{y}{2} = 2$$

$$\Rightarrow \frac{12-2y}{12} + \frac{y}{2} = 2$$

$$\Rightarrow \frac{12-2y+6y}{12} = 2$$

$$\Rightarrow \frac{12+4y}{12} = 2$$

$$\Rightarrow 12 + 4y = 2(12)$$

$$\Rightarrow 12 + 4y = 24$$

$$\Rightarrow 4y = 24 - 12$$

$$\therefore y = 3$$

Substituting y value in (3),

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

$$\Rightarrow x = \frac{12-2(3)}{3}$$

$$\Rightarrow x = \frac{6}{3}$$

$$\therefore x = 2$$

$\therefore$ By solving, we get $x = 2$ and $y = 3$.

Justification:

Generally, we substitute $x = 0$ or $y = 0$ in the given linear equations to get y and x . So we get two points on the straight line. To find more points on the line, take different values of x related to it, we get different values for y from the equation.

We get the following tables for the given linear equations.

$$\text{For } \frac{x}{2} + \frac{y}{3} = 2$$

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

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

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

X	0	4
Y	6	0

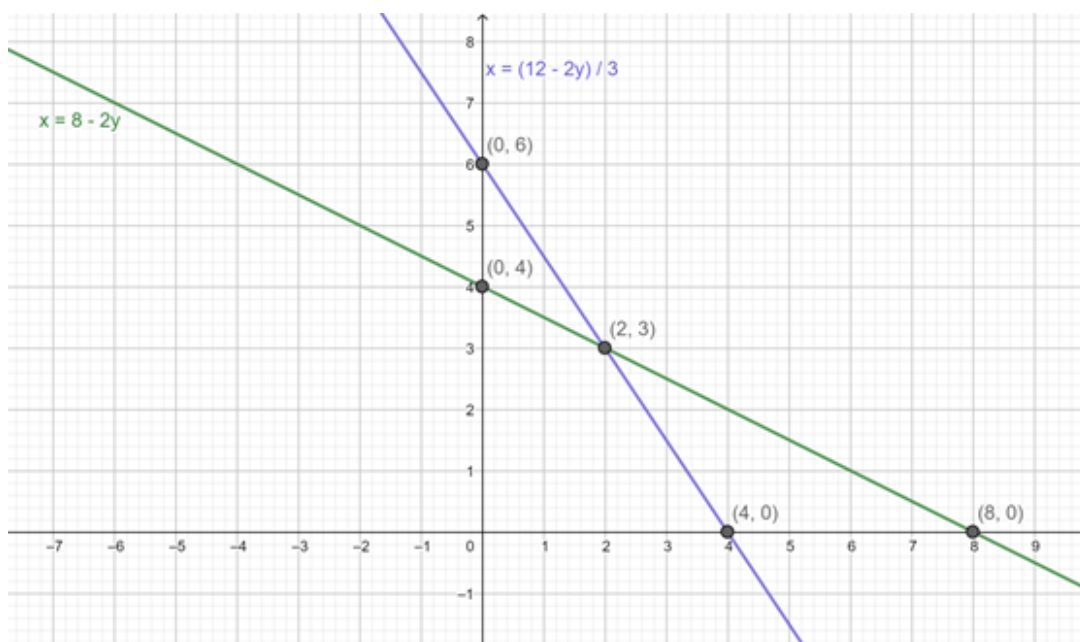
For $\frac{x}{4} + \frac{y}{2} = 2$

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

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

$$\therefore x = 8 - 2y$$

X	0	2	8
Y	4	3	0



Plotting these points on a graph and joining them, we get two straight lines.

From the graph, we can see that both lines intersect at (2, 3), hence the solution to this pair is (2, 3).

Hence we can say that x and y values satisfy equations (1) and (2).

4 A. Question

Let us solve the following simultaneous equations in two variables by the method of substitution and check whether the solutions satisfy the equations.

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

$$5x - \frac{2}{y} = \frac{11}{12}$$

Answer

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

$$\text{And } 5x - \frac{2}{y} = \frac{11}{12} \dots (2)$$

Expressing x of equation (1) in terms of y,

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

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

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

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

Substituting (3) in (2),

$$\Rightarrow 5x - \frac{2}{y} = \frac{11}{12}$$

$$\Rightarrow 5\left(\frac{y-3}{2y}\right) - \frac{2}{y} = \frac{11}{12}$$

$$\Rightarrow \frac{5y-15}{2y} - \frac{2}{y} = \frac{11}{12}$$

$$\Rightarrow \frac{5y-15-4}{2y} = \frac{11}{12}$$

$$\Rightarrow \frac{5y-19}{2y} = \frac{11}{12}$$

$$\Rightarrow 12(5y-19) = 11(2y)$$

$$\Rightarrow 60y - 228 = 22y$$

$$\Rightarrow 60y - 22y = 228$$

$$\Rightarrow 38y = 228$$

$$\Rightarrow y = 228 / 38$$

$$\therefore y = 6$$

Substituting y value in (3),

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

$$\Rightarrow x = \frac{6 - 3}{2(6)}$$

$$\Rightarrow x = \frac{3}{12}$$

$$\therefore x = 1/4$$

$\therefore$ By solving, we get $x = 1/4$ and $y = 6$.

Justification:

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

$$\Rightarrow 2\left(\frac{1}{4}\right) + \frac{3}{6} = 1$$

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

$$\Rightarrow 1 = 1$$

$$\text{And (2) - } 5x - \frac{2}{y} = \frac{11}{12}$$

$$\Rightarrow 5\left(\frac{1}{4}\right) - \frac{2}{6} = \frac{11}{12}$$

$$\Rightarrow \frac{15}{12} - \frac{4}{12} = \frac{11}{12}$$

$$\Rightarrow \frac{11}{12} = \frac{11}{12}$$

$\therefore$ We can see $x = 1/4$ and $y = 6$ satisfy equations (1) and (2).

4 B. Question

Let us solve the following simultaneous equations in two variables by the method of substitution and check whether the solutions satisfy the equations.

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

$$\frac{5}{x} + \frac{10}{y} = 5\frac{5}{6}$$

Answer

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

$$\text{And } \frac{5}{x} + \frac{10}{y} = 5\frac{5}{6}$$

$$\Rightarrow \frac{5}{x} + \frac{10}{y} = \frac{35}{6} \dots (2)$$

Expressing x of equation (1) in terms of y,

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

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

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

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

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

Substituting (3) in (2),

$$\Rightarrow \frac{5}{x} + \frac{10}{y} = \frac{35}{6}$$

$$\Rightarrow \frac{5}{\frac{2y}{2y - 3}} + \frac{10}{y} = \frac{35}{6}$$

$$\Rightarrow \frac{10y - 15}{2y} + \frac{10}{y} = \frac{35}{6}$$

$$\Rightarrow \frac{10y - 15 + 20}{2y} = \frac{35}{6}$$

$$\Rightarrow \frac{10y + 5}{2y} = \frac{35}{6}$$

$$\Rightarrow 6(10y + 5) = 35(2y)$$

$$\Rightarrow 60y + 30 = 70y$$

$$\Rightarrow 30 = 70y - 60y$$

$$\Rightarrow 30 = 10y$$

$$\Rightarrow y = 30/10$$

$$\therefore y = 3$$

Substituting y value in (3),

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

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

$$\Rightarrow x = \frac{6}{3}$$

$$\therefore x = 2$$

$\therefore$ By solving, we get $x = 2$ and $y = 3$.

Justification:

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

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

$$\Rightarrow 1 + 1 = 2$$

$$\Rightarrow 2 = 2$$

$$\text{And (2) - } \frac{5}{x} + \frac{10}{y} = \frac{35}{6}$$

$$\Rightarrow \frac{5}{2} + \frac{10}{3} = \frac{35}{6}$$

$$\Rightarrow \frac{15}{6} + \frac{20}{6} = \frac{35}{6}$$

$$\Rightarrow \frac{35}{6} = \frac{35}{6}$$

$\therefore$ We can see that $x = 2$ and $y = 3$ satisfy equations (1) and (2).

4 C. Question

Let us solve the following simultaneous equations in two variables by the method of substitution and check whether the solutions satisfy the equations.

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

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

Answer

$$\text{Given } \frac{x+y}{xy} = 3 \dots (1)$$

$$\text{And } \frac{x-y}{xy} = 1 \dots (2)$$

Expressing x of equation (1) in terms of y,

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

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

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

Substituting (3) in (2),

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

$$\Rightarrow \frac{3xy - y - y}{xy} = 1$$

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

$$\Rightarrow 3xy - 2y = xy$$

$$\Rightarrow 3xy - xy = 2y$$

$$\Rightarrow 2xy = 2y$$

$$\therefore x = 1$$

Substituting x value in (3),

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

$$\Rightarrow 1 = 3(1)y - y$$

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

$$\Rightarrow 1 = 2y$$

$$\therefore y = 1/2$$

$\therefore$ By solving, $x = 1$ and $y = 1/2$.

Justification:

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

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

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

$$\Rightarrow 3 = 3$$

$$\text{And (2) - } \frac{x-y}{xy} = 1$$

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

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

$$\Rightarrow 1 = 1$$

$\therefore$ We can see that $x = 1$ and $y = 1/2$ satisfy equations (1) and (2).

4 D. Question

Let us solve the following simultaneous equations in two variables by the method of substitution and check whether the solutions satisfy the equations.

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

$$x+y = \frac{7}{10}$$

Answer

$$\text{Given } \frac{x+y}{x-y} = \frac{7}{3} \dots (1)$$

$$\text{And } x+y = \frac{7}{10} \dots (2)$$

Expressing x of equation (2) in terms of y ,

$$\Rightarrow x+y = \frac{7}{10}$$

$$\therefore x = \frac{7}{10} - y \dots (3)$$

Substituting (3) in (1),

$$\Rightarrow \frac{x+y}{x-y} = \frac{7}{3}$$

$$\Rightarrow \frac{\frac{7}{10} - y + y}{\frac{7}{10} - y - y} = \frac{7}{3}$$

$$\Rightarrow \frac{\frac{7}{10}}{\frac{7}{10} - 2y} = \frac{7}{3}$$

$$\Rightarrow 3\left(\frac{7}{10}\right) = 7\left(\frac{7}{10} - 2y\right)$$

$$\Rightarrow \frac{21}{10} = \frac{49}{10} - 14y$$

$$\Rightarrow 14y = \frac{49}{10} - \frac{21}{10}$$

$$\Rightarrow 14y = \frac{28}{10}$$

$$\Rightarrow y = \frac{28}{10} \times \frac{1}{14}$$

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

Substituting y value in (3),

$$\Rightarrow x = \frac{7}{10} - y$$

$$\Rightarrow x = \frac{7}{10} - \frac{1}{5}$$

$$\Rightarrow x = \frac{7-2}{10}$$

$$\Rightarrow x = \frac{5}{10}$$

$$\therefore x = 1/2$$

$\therefore$ By solving, we get $x = 1/2$ and $y = \frac{1}{5}$

Justification:

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

$$\Rightarrow \frac{\frac{1}{2} + \frac{1}{5}}{\frac{1}{2} - \frac{1}{5}} = \frac{7}{3}$$

$$\Rightarrow \frac{\frac{5}{10} + \frac{2}{10}}{\frac{5}{10} - \frac{2}{10}} = \frac{7}{3}$$

$$\Rightarrow \frac{\frac{7}{10}}{\frac{3}{10}} = \frac{7}{3}$$

$$\Rightarrow \frac{7}{3} = \frac{7}{3}$$

$$\text{And (2) - } x + y = \frac{7}{10}$$

$$\Rightarrow \frac{1}{2} + \frac{1}{5} = \frac{7}{10}$$

$$\Rightarrow \frac{5}{10} + \frac{2}{10} = \frac{7}{10}$$

$$\Rightarrow \frac{7}{10} = \frac{7}{10}$$

$\therefore$ We can see that $x = 1/2$ and $y = \frac{1}{5}$ satisfy the equations (1) and (2).

5 A. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

$$5x + 8y = 14$$

Answer

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

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

$$\text{And } 5x + 8y = 14 \dots (2)$$

Expressing x of (1) in terms of y,

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

$$\Rightarrow 2x = 3 + 2y$$

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

Substituting (3) in (2),

$$\Rightarrow 5x + 8y = 14$$

$$\Rightarrow 5\left(\frac{3+2y}{2}\right) + 8y = 14$$

$$\Rightarrow \frac{15 + 10y + 16y}{2} = 14$$

$$\Rightarrow \frac{15 + 26y}{2} = 14$$

$$\Rightarrow 15 + 26y = 28$$

$$\Rightarrow 26y = 28 - 15$$

$$\Rightarrow 26y = 13$$

$$\Rightarrow y = 13/26$$

$$\therefore y = 1/2$$

Substituting y value in (3),

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

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

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

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

$$\therefore x = 2$$

$\therefore$ By solving, we get $x = 2$ and $y = 1/2$.

5 B. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

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

Answer

$$\text{Given } 2x + \frac{3}{y} = 5 \dots (1)$$

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

Expressing x of equation (1) in terms of y,

$$\Rightarrow 2x + \frac{3}{y} = 5$$

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

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

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

Substituting (3) in (2),

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

$$\Rightarrow \frac{25y - 15}{2y} - \frac{2}{y} = 3$$

$$\Rightarrow \frac{25y - 15 - 4y}{2y} = 3$$

$$\Rightarrow \frac{21y - 15}{2y} = 3$$

$$\Rightarrow 21y - 15 = 6y$$

$$\Rightarrow 21y - 6y = 15$$

$$\Rightarrow 15y = 15$$

$$\therefore y = 1$$

Substituting y value in (3),

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

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

$$\therefore x = 1$$

$\therefore$ By solving, we get $x = 1$ and $y = 1$.

5 C. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

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

Answer

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

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

Expressing x of equation (1) in terms of y,

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

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

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

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

Substituting (3) in (2),

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

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

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

$$\Rightarrow \frac{12 - 4y + 9y}{18} = 1$$

$$\Rightarrow \frac{12 + 5y}{18} = 1$$

$$\Rightarrow 12 + 5y = 18$$

$$\Rightarrow 5y = 18 - 12$$

$$\Rightarrow 5y = 6$$

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

Substituting y value in (3),

$$\Rightarrow x = \frac{6 - 2(\frac{6}{5})}{3}$$

$$\Rightarrow x = \frac{6 - \frac{12}{5}}{3}$$

$$\Rightarrow x = \frac{\frac{30 - 12}{5}}{3}$$

$$\Rightarrow x = \frac{18}{15}$$

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

$\therefore$ By solving, we get $x = \frac{6}{5}$ and $y = \frac{6}{5}$.

5 D. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

$$7x - 5y = 2$$

Answer

$$\text{Given } \frac{x}{3} = \frac{y}{4} \dots (1)$$

$$\text{And } 7x - 5y = 2 \dots (2)$$

Expressing x of equation (1) in terms of y,

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

$$\Rightarrow x = \frac{3y}{4} \dots (3)$$

Substituting (3) in (2),

$$\Rightarrow 7x - 5y = 2$$

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

$$\Rightarrow \left(\frac{21y}{4}\right) - 5y = 2$$

$$\Rightarrow \left(\frac{21y - 20y}{4}\right) = 2$$

$$\Rightarrow \frac{y}{4} = 2$$

$$\therefore y = 8$$

Substituting y value in (3),

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

$$\Rightarrow x = \frac{3(8)}{4}$$

$$\therefore x = 6$$

$\therefore$ By solving, we get $x = 6$ and $y = 8$.

5 E. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

$$\frac{3}{x} + \frac{2}{y} = \frac{19}{20}$$

Answer

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

$$\text{And } \frac{3}{x} + \frac{2}{y} = \frac{19}{20} \dots (2)$$

Expressing x of equation (1) in terms of y,

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

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

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

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

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

Substituting (3) in (2),

$$\Rightarrow \frac{3}{x} + \frac{2}{y} = \frac{19}{20}$$

$$\Rightarrow \frac{3}{\frac{2y}{y-5}} + \frac{2}{y} = \frac{19}{20}$$

$$\Rightarrow \frac{3y-15}{2y} + \frac{2}{y} = \frac{19}{20}$$

$$\Rightarrow \frac{3y-15+4}{2y} = \frac{19}{20}$$

$$\Rightarrow \frac{3y-11}{2y} = \frac{19}{20}$$

$$\Rightarrow 20(3y-11) = 19(2y)$$

$$\Rightarrow 60y - 220 = 38y$$

$$\Rightarrow 220 = 60y - 38y$$

$$\Rightarrow 220 = 22y$$

$$\Rightarrow y = 220/22$$

$$\therefore y = 10$$

Substituting y value in (3),

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

$$\Rightarrow x = \frac{2(10)}{10-5}$$

$$\Rightarrow x = \frac{20}{5}$$

$$\therefore x = 4$$

$\therefore$ By solving, we get $x = 4$ and $y = 10$.

5 F. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

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

$$\frac{1}{7}(4x - 5y) = x - 7$$

Answer

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

$$\text{And } \frac{1}{7}(4x - 5y) = x - 7 \dots (2)$$

Expressing x of equation (1) in terms of y,

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

$$\Rightarrow \frac{x}{3} - \frac{y}{3} = \frac{y}{4} - \frac{1}{4}$$

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

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

$$\Rightarrow \frac{x}{3} = \frac{7y - 3}{12}$$

$$\Rightarrow x = \frac{3(7y - 3)}{12}$$

$$\therefore x = \frac{7y - 3}{4} \dots (3)$$

Substituting (3) in (2),

$$\Rightarrow \frac{1}{7}(4x - 5y) = x - 7$$

$$\Rightarrow \frac{1}{7}\left(4\left(\frac{7y - 3}{4}\right) - 5y\right) = \frac{7y - 3}{4} - 7$$

$$\Rightarrow \frac{7y - 3 - 5y}{7} = \frac{7y - 3 - 28}{4}$$

$$\Rightarrow \frac{2y - 3}{7} = \frac{7y - 31}{4}$$

$$\Rightarrow 4(2y - 3) = 7(7y - 31)$$

$$\Rightarrow 8y - 12 = 49y - 217$$

$$\Rightarrow 217 - 12 = 49y - 8y$$

$$\Rightarrow 205 = 41y$$

$$\therefore y = 5$$

Substituting y value in (3),

$$\Rightarrow x = \frac{7(5) - 3}{4}$$

$$\Rightarrow x = \frac{35 - 3}{4}$$

$$\Rightarrow x = \frac{32}{4}$$

$$\therefore x = 8$$

$\therefore$ By solving, we get $x = 8$ and $y = 5$.

5 G. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

$$\frac{x}{14} + \frac{y}{18} = 1$$

$$\frac{x+y}{2} + \frac{3x-5y}{4} = 2$$

Answer

$$\text{Given } \frac{x}{14} + \frac{y}{18} = 1 \dots (1)$$

$$\text{And } \frac{x+y}{2} + \frac{3x-5y}{4} = 2 \dots (2)$$

Expressing x of equation (1) in terms of y,

$$\Rightarrow \frac{x}{14} + \frac{y}{18} = 1$$

$$\Rightarrow \frac{x}{14} = 1 - \frac{y}{18}$$

$$\Rightarrow \frac{x}{14} = \frac{18 - y}{18}$$

$$\Rightarrow x = \frac{14(18 - y)}{18}$$

$$\Rightarrow x = \frac{7(18 - y)}{9}$$

$$\therefore x = \frac{126-7y}{9} \dots (3)$$

Substituting (3) in (2),

$$\Rightarrow \frac{\left(\frac{126-7y}{9}\right) + y}{2} + \frac{3\left(\frac{126-7y}{9}\right) - 5y}{4} = 2$$

$$\Rightarrow \frac{\frac{126-7y+9y}{9}}{2} + \frac{\frac{126-7y-15y}{3}}{4} = 2$$

$$\Rightarrow \frac{126+2y}{18} + \frac{126-22y}{12} = 2$$

$$\Rightarrow \frac{252+4y+378-66y}{36} = 2$$

$$\Rightarrow 630 - 62y = 72$$

$$\Rightarrow 630 - 72 = 62y$$

$$\Rightarrow 558 = 62y$$

$$\therefore y = 9$$

Substituting y value in (3),

$$\Rightarrow x = \frac{126-7y}{9}$$

$$\Rightarrow x = \frac{126-7(9)}{9}$$

$$\Rightarrow x = \frac{126-63}{9}$$

$$\Rightarrow x = \frac{63}{9}$$

$$\therefore x = 7$$

$\therefore$ By solving, we get $x = 7$ and $y = 9$.

5 H. Question

Let us solve the following simultaneous equations in two variables by the method of substitution.

$$p(x+y) = q(x-y) = 2pq$$

Answer

$$p(x+y) = q(x-y) = 2pq$$

$$\Rightarrow px + py = 2pq \dots (1)$$

$$\Rightarrow qx - qy = 2pq \dots (2)$$

Expressing x of equation (1) in terms of y,

$$\Rightarrow px + py = 2pq$$

$$\Rightarrow px = 2pq - py$$

$$\Rightarrow x = \frac{2pq - py}{p}$$

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

Substituting (3) in (2),

$$\Rightarrow q(2q - y) - qy = 2pq$$

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

$$\Rightarrow 2q - 2y = 2p$$

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

$$\Rightarrow q - y = p$$

$$\therefore y = p - q$$

Substituting y value in (3),

$$\Rightarrow x = 2q - y$$

$$\Rightarrow x = 2q - (p - q)$$

$$\therefore x = 3q - p$$

$\therefore$ By solving, we get $x = 3q - p$ and $y = p - q$.

Let us Work Out 5.6

1. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$8x + 5y = 1$$

$$3x - 4y = 10$$

Answer

$$8x + 5y - 1 = 0$$

$$3x - 4y - 10 = 0$$

$a_1 = 8$	$b_1 = 5$	$c_1 = (-1)$
$a_2 = 3$	$b_2 = (-4)$	$c_2 = (-10)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(5)(-10) - (-4)(-1)} = \frac{y}{(-1)(3) - (-10)(8)} = \frac{1}{(8)(-4) - (3)(5)}$$

$$\frac{x}{(-54)} = \frac{y}{(77)} = \frac{1}{(-47)}$$

$$\text{So, } \frac{x}{(-54)} = \frac{1}{(-47)} \text{ and } \frac{y}{77} = \frac{1}{(-47)}$$

$$\Rightarrow x = \frac{54}{47} \text{ and } y = \frac{-77}{47}$$

2. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$3x - 4y = 1$$

$$4x = 3y + 6$$

Answer

$$3x - 4y - 1 = 0$$

$$4x - 3y - 6 = 0$$

$a_1 = 3$	$b_1 = (-4)$	$c_1 = (-1)$
$a_2 = 4$	$b_2 = (-3)$	$c_2 = (-6)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(-4)(-6) - (-3)(-1)} = \frac{y}{(-1)(4) - (-6)(3)} = \frac{1}{(3)(-3) - (4)(-4)}$$

$$\frac{x}{(21)} = \frac{y}{(14)} = \frac{1}{(7)}$$

$$\text{So, } \frac{x}{(21)} = \frac{1}{(7)} \text{ and } \frac{y}{14} = \frac{1}{(7)}$$

$$\Rightarrow x = 3 \text{ and } y = 2$$

3. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$5x + 3y = 11$$

$$2x - 7y = -12$$

Answer

$$5x + 3y - 11 = 0$$

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

$a_1 = 5$	$b_1 = 3$	$c_1 = (-11)$
$a_2 = 2$	$b_2 = (-7)$	$c_2 = 12$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(3)(12) - (-7)(-11)} = \frac{y}{(-11)(2) - (12)(5)} = \frac{1}{(5)(-7) - (2)(3)}$$

$$\frac{x}{(-41)} = \frac{y}{(-82)} = \frac{1}{(-41)}$$

$$\text{So, } \frac{x}{(-41)} = \frac{1}{(-41)} \text{ and } \frac{y}{(-82)} = \frac{1}{(-41)}$$

$$\Rightarrow x = 1 \text{ and } y = 2$$

4. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$7x - 3y - 31 = 0$$

$$9x - 5y - 41 = 0$$

Answer

$a_1 = 7$	$b_1 = (-3)$	$c_1 = (-31)$
$a_2 = 9$	$b_2 = (-5)$	$c_2 = (-41)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(-3)(-41) - (-5)(-31)} = \frac{y}{(-31)(9) - (-41)(7)} = \frac{1}{(7)(-5) - (9)(-3)}$$

$$\frac{x}{(-32)} = \frac{y}{(8)} = \frac{1}{(-8)}$$

$$\text{So, } \frac{x}{(-32)} = \frac{1}{(-8)} \text{ and } \frac{y}{8} = \frac{1}{(-8)}$$

$$\Rightarrow x = 4 \text{ and } y = -1$$

5. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

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

Answer

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

$$\Rightarrow x - 2y = 24 \text{ (Multiplying both sides by 6)}$$

$$\Rightarrow x - 2y - 24 = 0$$

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

$$\Rightarrow x - 8y - 48 = 0 \text{ (Multiplying both sides by 12)}$$

$a_1 = 1$	$b_1 = (-2)$	$c_1 = (-24)$
$a_2 = 1$	$b_2 = (-8)$	$c_2 = (-48)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(-2)(-48) - (-8)(-24)} = \frac{y}{(-24)(1) - (-48)(1)} = \frac{1}{(1)(-8) - (1)(-2)}$$

$$\frac{x}{(-96)} = \frac{y}{(24)} = \frac{1}{(-6)}$$

$$\text{So, } \frac{x}{(-96)} = \frac{1}{(-6)} \text{ and } \frac{y}{24} = \frac{1}{(-6)}$$

$$\Rightarrow x = 16 \text{ and } y = -4$$

6. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$\frac{x}{5} + \frac{y}{3} = \frac{x}{4} - \frac{y}{3} - \frac{3}{20} = 0$$

Answer

$$\frac{x}{5} + \frac{y}{3} = 0$$

$$\Rightarrow 3x + 5y = 0 \text{ (Multiplying both sides by 15)}$$

$$\frac{x}{4} - \frac{y}{3} - \frac{3}{20} = 0$$

$$\Rightarrow 15x - 20y - 9 = 0 \text{ (Multiplying both sides by 60)}$$

$a_1 = 3$	$b_1 = 5$	$c_1 = 0$
$a_2 = 15$	$b_2 = (-20)$	$c_2 = (-9)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(5)(-9) - (-20)(0)} = \frac{y}{(0)(15) - (-9)(3)} = \frac{1}{(3)(-20) - (15)(5)}$$

$$\frac{x}{(-45)} = \frac{y}{(27)} = \frac{1}{(-135)}$$

$$\text{So, } \frac{x}{(-45)} = \frac{1}{(-135)} \text{ and } \frac{y}{27} = \frac{1}{(-135)}$$

$$\Rightarrow x = 1/3 \text{ and } y = (-1/5)$$

7. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$\frac{x+2}{7} + \frac{y-x}{4} = 2x-8$$

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

Answer

$$\frac{x+2}{7} + \frac{y-x}{4} = 2x-8$$

$$\Rightarrow 4(x+2) + 7(y-x) = 28(2x-8) \text{ (Multiplying both sides by 28)}$$

$$\Rightarrow 59x - 7y - 232 = 0$$

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

$$\Rightarrow (2y-3x) + 6y = 3(3x+4) \text{ (Multiplying both sides by 3)}$$

$$\Rightarrow 12x - 8y + 12 = 0$$

$$\Rightarrow 3x - 2y + 3 = 0$$

$a_1 = 59$	$b_1 = (-7)$	$c_1 = (-232)$
$a_2 = 3$	$b_2 = (-2)$	$c_2 = 3$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(-7)(3) - (-2)(-232)} = \frac{y}{(-232)(3) - (3)(59)} = \frac{1}{(59)(-2) - (3)(-7)}$$

$$\frac{x}{(-485)} = \frac{y}{(-873)} = \frac{1}{(-97)}$$

$$\text{So, } \frac{x}{(-485)} = \frac{1}{(-97)} \text{ and } \frac{y}{(-873)} = \frac{1}{(-97)}$$

$$\Rightarrow x = 5 \text{ and } y = 9$$

8. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$x + 5y = 36$$

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

Answer

$$x + 5y - 36 = 0$$

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

$$\Rightarrow 3(x + y) = 5(x - y) \text{ (Cross Multiplication)}$$

$$\Rightarrow 2x - 8y = 0$$

$$\Rightarrow x - 4y = 0$$

$a_1 = 1$	$b_1 = 5$	$c_1 = (-36)$
$a_2 = 1$	$b_2 = (-4)$	$c_2 = 0$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(5)(0) - (-4)(-36)} = \frac{y}{(-36)(1) - (0)(1)} = \frac{1}{(1)(-4) - (1)(5)}$$

$$\frac{x}{(-144)} = \frac{y}{(-36)} = \frac{1}{(-9)}$$

$$\text{So, } \frac{x}{(-144)} = \frac{1}{(-9)} \text{ and } \frac{y}{(-36)} = \frac{1}{(-9)}$$

$$\Rightarrow x = 16 \text{ and } y = 4$$

9. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$13x - 12y + 15 = 0$$

$$8x - 7y = 0$$

Answer

$a_1 = 13$	$b_1 = (-12)$	$c_1 = 15$
$a_2 = 8$	$b_2 = (-7)$	$c_2 = 0$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(-12)(0) - (-7)(15)} = \frac{y}{(15)(8) - (0)(13)} = \frac{1}{(13)(-7) - (8)(-12)}$$

$$\frac{x}{(105)} = \frac{y}{(120)} = \frac{1}{(5)}$$

$$\text{So, } \frac{x}{(105)} = \frac{1}{(5)} \text{ and } \frac{y}{120} = \frac{1}{(5)}$$

$$\Rightarrow x = 21 \text{ and } y = 24$$

10. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$x + y = 2b$$

$$x - y = 2a$$

Answer

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

$$x - y - 2a = 0$$

$a_1 = 1$	$b_1 = 1$	$c_1 = -2b$
$a_2 = 1$	$b_2 = (-1)$	$c_2 = -2a$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Putting the values, we get:

$$\frac{x}{(1)(-2a) - (-1)(-2b)} = \frac{y}{(-2b)(1) - (-2a)(1)} = \frac{1}{(1)(-1) - (1)(1)}$$

$$\frac{x}{-(2a + 2b)} = \frac{y}{(2a - 2b)} = \frac{1}{(-2)}$$

$$\text{So, } \frac{x}{-(2a+2b)} = \frac{1}{(-2)} \text{ and } \frac{y}{(2a-2b)} = \frac{1}{(-2)}$$

$$\Rightarrow x = (a + b) \text{ and } y = (b - a)$$

11. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$x - y = 2a$$

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

Answer

$$x - y - 2a = 0$$

$$ax + by - (a^2 + b^2) = 0$$

$a_1 = 1$	$b_1 = (-1)$	$c_1 = (-2a)$
$a_2 = a$	$b_2 = b$	$c_2 = -(a^2 + b^2)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(-1)(-a^2 - b^2) - (b)(-2a)} = \frac{y}{(-2a)(a) - (-a^2 - b^2)(1)} = \frac{1}{(1)(b) - (a)(-1)}$$

$$\frac{x}{(a + b)^2} = \frac{y}{(-a^2 + b^2)} = \frac{1}{(a + b)}$$

$$\text{So, } \frac{x}{(a + b)^2} = \frac{1}{(a + b)} \text{ and } \frac{y}{(-a^2 + b^2)} = \frac{1}{(a + b)}$$

$$\Rightarrow x = (a + b) \text{ and } y = (b - a)$$

12. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$\frac{x}{a} + \frac{y}{b} = 2$$

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

Answer

$$\frac{x}{a} + \frac{y}{b} = 2$$

$$\Rightarrow bx + ay = 2ab \text{ (Multiplying both sides by } ab \text{)}$$

$$\Rightarrow bx + ay - 2ab = 0$$

$$ax - by - (a^2 - b^2) = 0$$

$a_1 = b$	$b_1 = a$	$c_1 = (-2ab)$
$a_2 = a$	$b_2 = (-b)$	$c_2 = -(a^2 - b^2)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(a)(-a^2 + b^2) - (-b)(-2ab)} = \frac{y}{(-2ab)(a) - (-a^2 + b^2)(b)}$$

$$= \frac{1}{(b)(-b) - (a)(a)}$$

$$\frac{x}{-a(a^2 + b^2)} = \frac{y}{-b(a^2 + b^2)} = \frac{1}{-(a^2 + b^2)}$$

$$\text{So, } \frac{x}{-a(a^2 + b^2)} = \frac{1}{-(a^2 + b^2)} \text{ and } \frac{y}{-b(a^2 + b^2)} = \frac{1}{-(a^2 + b^2)}$$

$$\Rightarrow x = a \text{ and } y = b$$

13. Question

Let us solve the following simultaneous linear equations in two variables by applying cross multiplication method.

$$ax + by = 1$$

$$bx + ay = \frac{2ab}{a^2 + b^2}$$

Answer

$$ax + by - 1 = 0$$

$$bx + ay - \frac{2ab}{a^2 + b^2} = 0$$

$a_1 = a$	$b_1 = b$	$c_1 = (-1)$
$a_2 = b$	$b_2 = a$	$c_2 = \left(-\frac{2ab}{a^2 + b^2}\right)$

To solve the equation by cross multiplication method, we use:

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{1}{a_1 b_2 - a_2 b_1}$$

Putting the values, we get:

$$\frac{x}{(b)\left(-\frac{2ab}{a^2 + b^2}\right) - (a)(-1)} = \frac{y}{(-1)(b) - \left(-\frac{2ab}{a^2 + b^2}\right)(a)}$$

$$= \frac{1}{(a)(a) - (b)(b)}$$

$$\frac{x}{\frac{a(a^2 - b^2)}{a^2 + b^2}} = \frac{y}{\frac{b(a^2 - b^2)}{a^2 + b^2}} = \frac{1}{(a^2 - b^2)}$$

$$\text{So, } \frac{x}{\frac{a(a^2 - b^2)}{a^2 + b^2}} = \frac{1}{(a^2 - b^2)} \text{ and } \frac{y}{\frac{b(a^2 - b^2)}{a^2 + b^2}} = \frac{1}{(a^2 - b^2)}$$

$$\Rightarrow x = \frac{a}{a^2 + b^2} \text{ and } y = \frac{b}{a^2 + b^2}$$