

R D Sharma Solutions For Class 10 Maths Chapter 3- Pair of Linear Equations in Two Variables

Exercise 3.4

Solve each of the following systems of equations by the method of cross-multiplication:

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

Solution:

The given system of equations is

$$x + 2y + 1 = 0$$

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

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

$$a_1 = 1, b_1 = 2, c_1 = 1$$

$$a_2 = 2, b_2 = -3, c_2 = -12$$

By cross multiplication method,

$$\frac{x}{-24 + 3} = \frac{-y}{-12 - 2} = \frac{1}{-3 - 4}$$

$$\frac{x}{-21} = \frac{-y}{-14} = \frac{1}{-7}$$

Now,

$$\frac{x}{-21} = \frac{1}{-7}$$

$$= x = 3$$

And,

$$\frac{-y}{-14} = \frac{1}{-7}$$

$$= y = -2$$

Hence, the solution for the given system of equations is $x = 3$ and $y = -2$.

2. $3x + 2y + 25 = 0$
 $2x + y + 10 = 0$

Solution:

The given system of equations is

$$3x + 2y + 25 = 0$$

$$2x + y + 10 = 0$$

For cross multiplication we use,

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$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

$$a_1 = 3, b_1 = 2, c_1 = 25$$

$$a_2 = 2, b_2 = 1, c_2 = 10$$

By cross multiplication method,

$$\frac{x}{20 - 25} = \frac{-y}{30 - 50} = \frac{1}{3 - 4}$$

$$\frac{x}{-5} = \frac{-y}{-20} = \frac{1}{-1}$$

Now,

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

$$= x = 5$$

And,

$$\frac{-y}{-20} = \frac{1}{-1}$$

$$= y = -20$$

Hence, the solution for the given system of equations is $x = 5$ and $y = -20$.

3. $2x + y = 35, 3x + 4y = 65$

Solution:

The given system of equations can be written as

$$2x + y - 35 = 0$$

$$3x + 4y - 65 = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = 2, b_1 = 1, c_1 = -35$$

$$a_2 = 3, b_2 = 4, c_2 = -65$$

By cross multiplication method,

$$\frac{x}{-65+140} = \frac{-y}{-130+105} = \frac{1}{8-3}$$

$$\frac{x}{75} = \frac{-y}{-25} = \frac{1}{5}$$

Now,

$$\frac{x}{75} = \frac{1}{5}$$

$$=x= 15$$

And,

$$\frac{-y}{-25} = \frac{1}{5}$$

$$=y=5$$

Hence, the solution for the given system of equations is $x = 15$ and $y = 5$.

4. $2x - y = 6, x - y = 2$

Solution:

The given system of equations can be written as

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

$$x - y - 2 = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = 2, b_1 = -1, c_1 = -6$$

$$a_2 = 1, b_2 = -1, c_2 = -2$$

By cross multiplication method,

$$\frac{x}{2-6} = \frac{-y}{-4+6} = \frac{1}{-2+1}$$

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

Now,

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

$$= x = 4$$

And,

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

$$= y = 2$$

Hence, the solution for the given system of equations is $x = 4$ and $y = 2$.

5. $(x + y)/xy = 2$

$$(x - y)/xy = 6$$

Solution:

The given system of equations is

$$(x + y)/xy = 2 \quad \Rightarrow \quad 1/y + 1/x = 2 \dots\dots\dots (i)$$

$$(x - y)/xy = 6 \quad \Rightarrow \quad 1/y - 1/x = 6 \dots\dots\dots (ii)$$

Let $1/x = u$ and $1/y = v$, so the equation becomes

$$u + v = 2 \dots\dots\dots (iii)$$

$$u - v = 6 \dots\dots\dots (iv)$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations (iii) & (iv) with the general form, we get

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$$a_1 = 1, b_1 = 1, c_1 = -2$$

$$a_2 = 1, b_2 = -1, c_2 = -6$$

By cross multiplication method,

$$\frac{u}{6-2} = \frac{-v}{6+2} = \frac{1}{-1-1}$$

$$\frac{u}{4} = \frac{-v}{8} = \frac{1}{-2}$$

Now,

$$\frac{u}{4} = \frac{1}{-2}$$

$$= u = -2$$

And,

$$\frac{-v}{-8} = \frac{1}{-2}$$

$$= v = 4$$

$$\frac{1}{u} = x = \frac{-1}{2}$$

$$\frac{1}{v} = y = \frac{1}{4}$$

Hence, the solution for the given system of equations is $x = -1/2$ and $y = 1/4$.

6. $ax + by = a-b$

$bx - ay = a+b$

Solution:

The given system of equations can be written as

$$ax + by - (a-b) = 0$$

$$bx - ay - (a+b) = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = a, b_1 = b, c_1 = -(a-b)$$

$$a_2 = b, b_2 = -a, c_2 = -(a+b)$$

By cross multiplication method,

$$\frac{x}{-ab - b^2 + ab - a^2} = \frac{-y}{-a^2 - ab - b^2 + ab} = \frac{1}{-a^2 - b^2}$$

$$\frac{x}{-b^2 - a^2} = \frac{-y}{-a^2 - b^2} = \frac{1}{-a^2 - b^2}$$

Now,

$$\frac{x}{-ab - b^2 + ab - a^2} = \frac{1}{-a^2 - b^2}$$

$$= x = 1$$

And,

$$\frac{-y}{-a^2 - ab - b^2 + ab} = \frac{1}{-a^2 - b^2}$$

$$= y = -1$$

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

7. $x + ay = b$
 $ax + by = c$

Solution:

The given system of equations can be written as

$$x + ay - b = 0$$

$$ax + by - c = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = 1, b_1 = a, c_1 = -b$$

$$a_2 = a, b_2 = -b, c_2 = -c$$

By cross multiplication method,

$$\frac{x}{-ac - b^2} = \frac{-y}{-c + ab} = \frac{1}{-a^2 - b}$$

Now,

$$\frac{x}{-ac - b^2} = \frac{1}{-a^2 - b}$$

$$= x = \frac{b^2 + ac}{a^2 + b}$$

And,

$$\frac{-y}{-c + ab} = \frac{1}{-a^2 - b}$$

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

Hence, the solution for the given system of equations is $x = (b^2 + ac)/(a^2 + b^2)$
and $y = (-c^2 + ab)/(a^2 + b^2)$.

8. $ax + by = a^2$

$bx + ay = b^2$

Solution:

The given system of equations can be written as

$$ax + by - (a^2) = 0$$

$$bx + ay - (b^2) = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

$$\Rightarrow \frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Here, According to the question,

$$a_1 = a, b_1 = b, c_1 = a^2$$

$$a_2 = b, b_2 = a, c_2 = b^2$$

By cross multiplication method,

$$\frac{x}{-b^2 + a^2} = \frac{-y}{-ab^2 - a^2b} = \frac{1}{a^2 - b^2}$$

Now,

$$\frac{x}{-b^2 + a^2} = \frac{1}{a^2 - b^2}$$

$$= x = \frac{a^2 + ab + b^2}{a + b}$$

And,

$$\frac{-y}{-ab^2 - a^2b} = \frac{1}{a^2 - b^2}$$

$$= y = \frac{-ab(a - b)}{(a - b)(a + b)}$$

Hence, the solution for the given system of equations is $x = (a^2 + ab + b^2)/(a + b)$
and $y = -ab / (a + b)$.

9. $5/(x + y) - 2/(x - y) = -1$

$15/(x + y) + 7/(x - y) = 10$

Solution:

Let's substitute $1/(x + y) = u$ and $1/(x - y) = v$, so the given equations becomes

$$5u - 2v = -1$$

$$15u + 7v = 10$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = 5, b_1 = -2, c_1 = 1$$

$$a_2 = 15, b_2 = 7, c_2 = -10$$

By cross multiplication method,

$$\frac{u}{20-7} = \frac{-v}{-50-15} = \frac{1}{35+30}$$

$$\frac{u}{13} = \frac{-v}{-65} = \frac{1}{65}$$

Now,

$$\frac{u}{13} = \frac{1}{65}$$

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

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

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

And,

$$\frac{-v}{-65} = \frac{1}{-65}$$

$$= v = -1$$

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

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

Adding equation (i) and (ii)

$$2x = 6$$

$$= x = 3$$

Substituting the value of x in equation (i)

$$3 + y = 5$$

$$= y = 2$$

Hence, the solution for the given system of equations is $x = 3$ and $y = 2$.

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

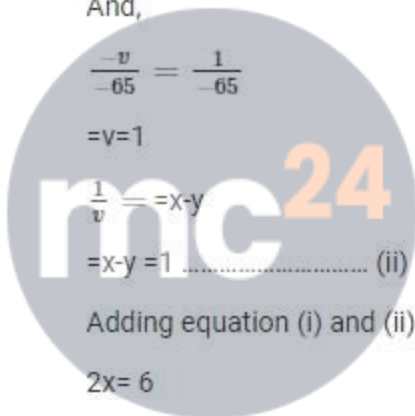
$\frac{5}{x} - \frac{4}{y} = -2$

Solution:

Let $\frac{1}{x} = u$ and $\frac{1}{y} = v$, so the equation becomes

$$2u + 3v = 13 \quad \Rightarrow \quad 2u + 3v - 13 = 0$$

$$5u - 4v = -2 \quad \Rightarrow \quad 5u - 4v + 2 = 0$$



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For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

$$a_1 = 2, b_1 = 3, c_1 = -13$$

$$a_2 = 5, b_2 = -4, c_2 = 2$$

By cross multiplication method,

$$\frac{u}{6-52} = \frac{-v}{4+65} = \frac{1}{-8-15}$$

$$\frac{u}{-46} = \frac{-v}{69} = \frac{1}{-23}$$

Now,

$$\frac{u}{-46} = \frac{1}{-23}$$

$$= u = 2$$

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

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

And,

$$\frac{-v}{69} = \frac{1}{-23}$$

$$= v = 3$$

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

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

Hence, the solution for the given system of equations is $x = 1/2$ and $y = 1/3$.

11. $57/(x + y) + 6/(x - y) = 5$

$38/(x + y) + 21/(x - y) = 9$

Solution:

Let's substitute $1/(x + y) = u$ and $1/(x - y) = v$, so the given equations becomes

$$57u + 6v = 5 \quad \Rightarrow \quad 57u + 6v - 5 = 0$$

$$38u + 21v = 9 \quad \Rightarrow \quad 38u + 21v - 9 = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

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Comparing the above two equations with the general form, we get

$$a_1 = 57, b_1 = 6, c_1 = -5$$

$$a_2 = 38, b_2 = 21, c_2 = -9$$

By cross multiplication method,

$$\frac{u}{-54+105} = \frac{-v}{-513+190} = \frac{1}{1193-228}$$

$$\frac{u}{51} = \frac{-v}{-323} = \frac{1}{969}$$

Now,

$$\frac{u}{51} = \frac{1}{969}$$

$$= u = \frac{1}{19}$$

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

$$= x+y=19 \dots\dots\dots(i)$$

And,

$$\frac{-v}{-323} = \frac{1}{969}$$

$$= v = \frac{1}{3}$$

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

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

Adding equation (i) and (ii)

$$2x = 22$$

$$= x = 11$$

Substituting the value of x in equation (i)

$$11+y=19$$

$$= y = 8$$

Hence, the solution for the given system of equations is $x = 11$ and $y = 8$.

- 12. $xa - yb = 2$
 $ax - by = a^2 - b^2$**

Solution:

The given system of equations can be written as

$$xa - yb - 2 = 0$$

$$ax - by - (a^2 - b^2) = 0$$



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For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

$$a_1 = \frac{1}{a}, \text{ Let } b_1 = \frac{1}{b}, \text{ Let } c_1 = -2$$

$$a_2 = a, \quad b_2 = -b, \quad c_2 = b^2 - a^2$$

By cross multiplication method

$$= \frac{x}{\frac{b^2 - a^2}{b} - 2b} = \frac{-y}{\frac{b^2 - a^2}{b} + 2b} = \frac{1}{\frac{-b}{a} - \frac{a}{b}}$$

$$= \frac{x}{\frac{b^2 - a^2 - 2b^2}{b}} = \frac{-y}{\frac{b^2 - a^2 + 2b^2}{b}} = \frac{1}{\frac{-b^2 - a^2}{ab}}$$

$$\text{Now, } \frac{x}{\frac{b^2 - a^2 - 2b^2}{b}} = \frac{1}{\frac{-b^2 - a^2}{ab}}$$

$$x = a$$

$$\text{and, } \frac{-y}{\frac{b^2 - a^2 + 2b^2}{b}} = \frac{1}{\frac{-b^2 - a^2}{ab}}$$

$$y = b$$

Hence, the solution for the given system of equations is $x = a$ and $y = b$.

13. $x/a + y/b = a + b$

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

Solution:

The given system of equations can be written as

$$x/a + y/b - (a + b) = 0$$

$$x/a^2 + y/b^2 - 2 = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = \frac{1}{a}, \text{ Let } b_1 = \frac{1}{b}, \text{ Let } c_1 = -(a+b)$$

$$a_2 = \frac{1}{a^2}, \quad b_2 = \frac{1}{b^2}, \quad c_2 = -2$$

By cross multiplication method

$$= \frac{x}{\frac{-2}{b} + \frac{a}{b^2} + \frac{1}{b}} = \frac{-y}{\frac{-2}{a} + \frac{1}{a} + \frac{b}{a^2}} = \frac{1}{\frac{-1}{ab^2} - \frac{-1}{a^2b}}$$

$$= \frac{x}{\frac{a-b}{b^2}} = \frac{-y}{\frac{-a-b}{a^2} + \frac{1}{a} + \frac{b}{a^2}} = \frac{1}{\frac{-1}{ab^2} - \frac{-1}{a^2b}}$$

$$\text{Now, } \frac{x}{\frac{a-b}{b^2}} = \frac{1}{\frac{-1}{ab^2} - \frac{-1}{a^2b}}$$

$$= x = a^2$$

$$\frac{-y}{\frac{-a-b}{a^2} + \frac{1}{a} + \frac{b}{a^2}} = \frac{1}{\frac{-1}{ab^2} - \frac{-1}{a^2b}}$$

$$= y = b^2$$

Hence, the solution for the given system of equations is $x = a^2$ and $y = b^2$.

14. $x/a = y/b$

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

Solution:

The given system of equations can be written as

$$x/a - y/b = 0$$

$$ax + by - (a^2 + b^2) = 0$$

For cross multiplication we use,

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Comparing the above two equations with the general form, we get

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$$a_1 = \frac{1}{a}, \text{ Let } b_1 = \frac{1}{b}, c_1 = 0$$

$$\text{Hence, } a_2 = a, b_2 = b, \text{ Let } c_2 = -(a^2 + b^2)$$

By cross multiplication method

$$\frac{x}{\frac{a^2 + b^2}{b}} = \frac{y}{\frac{a^2 + b^2}{a}} = \frac{1}{\frac{a}{b} + \frac{b}{a}}$$

$$\text{Now, } \frac{x}{\frac{a^2 + b^2}{b}} = \frac{1}{\frac{a}{b} + \frac{b}{a}}$$

$$= x = a$$

$$\text{And } \frac{y}{\frac{a^2 + b^2}{a}} = \frac{1}{\frac{a}{b} + \frac{b}{a}}$$

$$= y = b$$

Hence, the solution for the given system of equations is $x = a$ and $y = b$.



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