



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

Question-23

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

(i) $x - 3y - 3 = 0$
 $3x - 9y - 2 = 0$

(ii) $2x + y = 5$
 $3x + 2y = 8$

(iii) $3x - 5y = 20$
 $6x - 10y = 40$

(iv) $x - 3y - 7 = 0$
 $3x - 3y - 15 = 0$

Solution:

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

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

(ii) $2x + y = 5$
 $3x + 2y = 8$

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

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

By cross multiplication method

$2x + y = 5$

$3x + 2y = 8$

$x \quad y \quad 1$

$1 \quad -5 \quad 2 \quad 1$

$2 \quad -8 \quad 3 \quad 2$

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

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

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

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

$$6x - 10y = 40$$

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

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

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

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

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

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

∴ It has a unique solution

By cross multiplication method

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

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

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

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

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

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

Question-24

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

$$2x + 3y = 7$$

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

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

$$3x + y = 1$$

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

Solution:

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

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

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

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

$$(i.e.,) 2(a+b) = 3(a-b)$$

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

$$-a = -5b$$

$$a = 5b$$

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

Substitute a = 5b in (1)

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

$$16b - 2 = 14b$$

$$2b = 2$$

$$b = 1$$

Substitute b = 1 in a = 5b

$$a = 5(1)$$

$$= 5$$

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

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

$$3x + y = 1$$

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

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

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

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

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

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

$$k = 2$$

Hence $k = 2$ satisfies the above condition

Question-25

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

$$8x + 5y = 9$$

$$3x + 2y = 4$$

Solution:

By substitution method

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

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

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

Substitute in (1)

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

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

$$x = 18 - 20$$

$$= -2$$

Substitute $x = -2$ in (3)

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

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

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

By cross multiplication method:

$$8x + 5y = 9$$

$$3x + 2y = 4$$

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

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

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

Question-26

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

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

Solution:

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

In the case of student A

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

In the case of student B

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

Subtracting

(1) from (2)

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

$$6y = 180$$

$$y = 30$$

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

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

$$x = 1000 - 600 = 400$$

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

Question-27

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

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

Solution:

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

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

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

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

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

$$\text{from (2) } 4x = y + 8$$

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

subtracting (4) from (3)

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

$$-x = -5$$

$$x = 5$$

sub $x = 5$ in (3)

$$3x - y = 3$$

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

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

∴ The fraction is $\frac{5}{12}$

Question-28

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

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

Solution:

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

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

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

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

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

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

$$\therefore x = 15$$

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

$$y = 45 - 40 = 5$$

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

Question-29

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

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

Solution:

Let x be the speed of 1st car and y be the speed of the 2nd car

If car (1) meets (2) at C

Distance traveled by car(1) is 5x

Distance traveled by car(2) is 5y

We know that

$$5x - 5y = 100$$

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

Since distance between A and B = 100

$$AB = AC - BC$$

Distance traveled by car (1) = x

Distance traveled by car (2) = y

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

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

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

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

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

$$10x = 600$$

$$x = 60$$

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

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

$$5y = 200$$

$$\therefore y = 40$$

\therefore Speed of car (1) = 60 km/ hr

Speed of car (2) = 40 km/ hr

Question-30

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

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

Solution:

Area of rectangle = lb

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

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

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

becomes

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

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

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

becomes

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

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

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

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

$$6l - 10b = 12$$

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

$$- 19b = -171$$

$$b = 9$$

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

$$3l = 45 + 6$$

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

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

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

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