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Class 10th - NCERT Solutions

Math: Chapter 3 Pair of Linear Equations in Two Variables



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

Class 10: Maths Chapter 3 solutions. Complete Class 10 Maths Chapter 3 Notes.

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

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Exercise 3.1

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1. Aftab tells his daughter, "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be." (Isn't this interesting?) Represent this situation algebraically and graphically.

Answer

Let present age of Aftab be x

And, present age of daughter is represented by y

Then Seven years ago,

Age of Aftab = $x - 7$

Age of daughter = $y - 7$

According to the question,

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

$$x - 7 = 7y - 49$$

$$x - 7y = -49 + 7$$

$$x - 7y = -42 \dots \text{(i)}$$

$$x = 7y - 42$$

Putting $y = 5, 6$ and 7 , we get

$$x = 7 \times 5 - 42 = 35 - 42 = -7$$

$$x = 7 \times 6 - 42 = 42 - 42 = 0$$

$$x = 7 \times 7 - 42 = 49 - 42 = 7$$

Three years from now ,

Age of Aftab = $x + 3$

Age of daughter = $y + 3$

According to the question,

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

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$$x + 3 = 3y + 9$$

$$x - 3y = 9 - 3$$

$$x - 3y = 6 \dots \text{(ii)}$$

$$x = 3y + 6$$

Putting, $y = -2, -1$ and 0 , we get

$$x = 3 \times -2 + 6 = -6 + 6 = 0$$

$$x = 3 \times -1 + 6 = -3 + 6 = 3$$

$$x = 3 \times 0 + 6 = 0 + 6 = 6$$

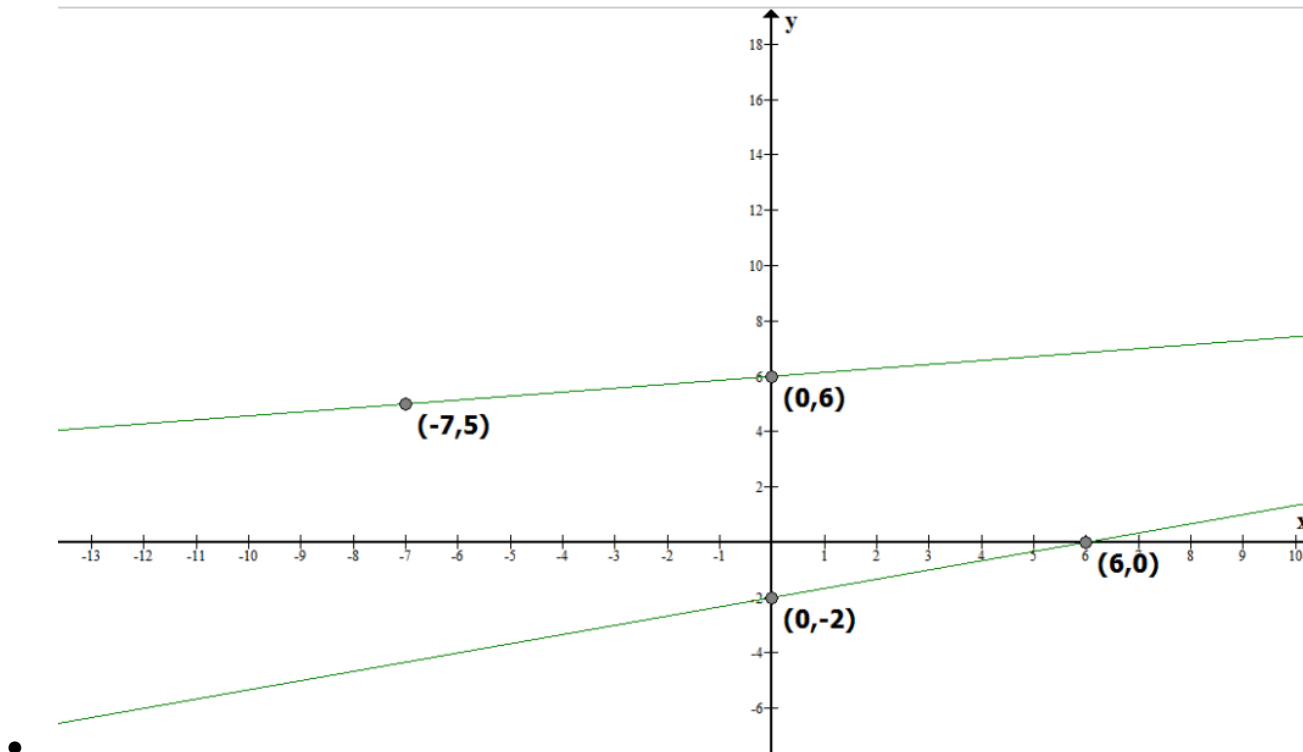
Algebraic representation

From equation **(i)** and **(ii)**

$$x - 7y = -42 \dots \text{(i)}$$

$$x - 3y = 6 \dots \text{(ii)}$$

Graphical representation



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

Answer

Let cost of one bat = Rs x

Cost of one ball = Rs y

3 bats and 6 balls for Rs 3900 So that

$$3x + 6y = 3900 \dots \text{(i)}$$

Dividing equation by 3, we get

$$x + 2y = 1300$$

Subtracting $2y$ both side we get

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$$x = 1300 - 2y$$

Putting $y = -1300, 0$ and 1300 we get

$$x = 1300 - 2(-1300) = 1300 + 2600 = 3900$$

$$x = 1300 - 2(0) = 1300 - 0 = 1300$$

$$x = 1300 - 2(1300) = 1300 - 2600 = -1300$$

$$x \quad 3900 \quad 1300 \quad -1300$$

$$y \quad -1300 \quad 0 \quad 1300$$

Given that she buys another bat and 2 more balls of the same kind for Rs 1300

So, we get

$$x + 2y = 1300 \dots \text{(ii)}$$

Subtracting $2y$ both side we get

$$x = 1300 - 2y$$

Putting $y = -1300, 0$ and 1300 we get

$$x = 1300 - 2(-1300) = 1300 + 2600 = 3900$$

$$x = 1300 - 2(0) = 1300 - 0 = 1300$$

$$x = 1300 - 2(1300) = 1300 - 2600 = -1300$$

$$x \quad 3900 \quad 1300 \quad -1300$$

$$y \quad -1300 \quad 0 \quad 1300$$

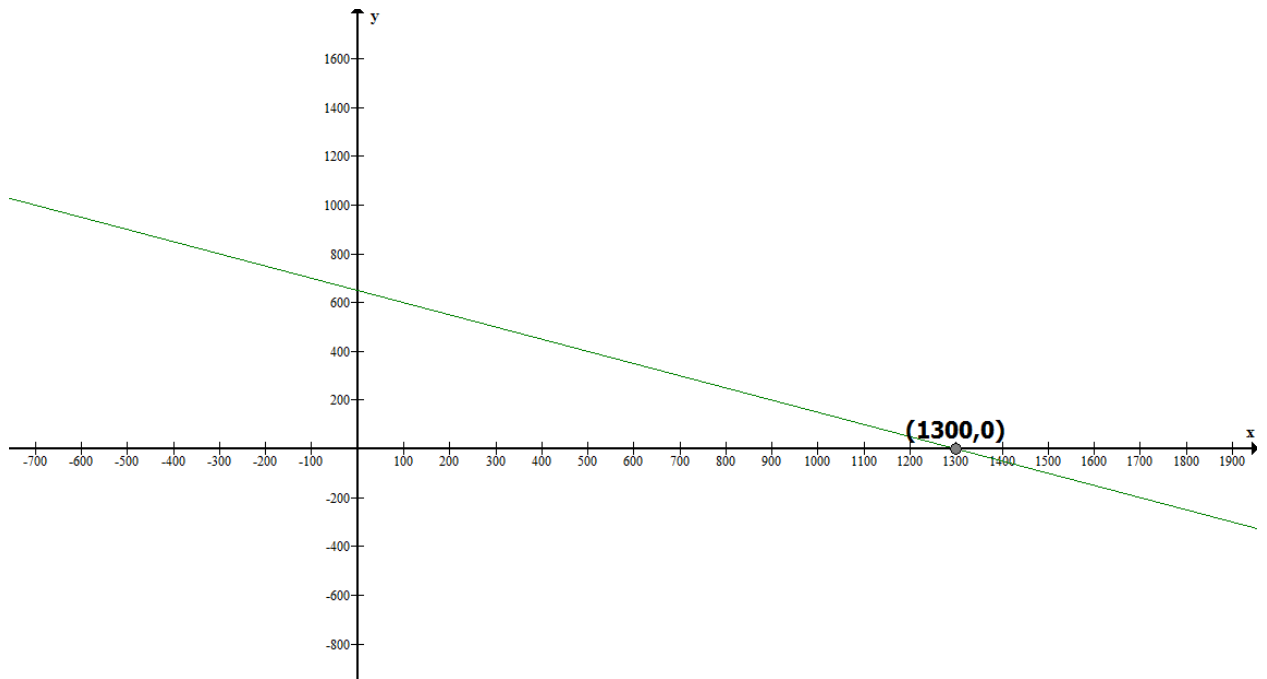
Algebraic representation

$$3x + 6y = 3900 \dots \text{(i)}$$

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$$x + 2y = 1300 \dots \text{(ii)}$$

Graphical representation,



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3. The cost of 2 kg of apples and 1kg of grapes on a day was found to be Rs 160. After a month, the cost of 4 kg of apples and 2 kg of grapes is Rs 300. Represent the situation algebraically and geometrically.

Answer

Let cost each kg of apples = Rs x

Cost of each kg of grapes = Rs y

Given that the cost of 2 kg of apples and 1kg of grapes on a day was found to be Rs 160

So that

$$2x + y = 160 \dots \text{(i)}$$

$$2x = 160 - y$$

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$$x = (160 - y)/2$$

Let $y = 0, 80$ and 160 , we get

$$x = (160 - (0))/2 = 80$$

$$x = (160 - 80)/2 = 40$$

$$x = (160 - 2 \times 80)/2 = 0$$

Given that the cost of 4 kg of apples and 2 kg of grapes is Rs 300

So we get

$$4x + 2y = 300 \dots \text{(ii)}$$

Dividing by 2 we get

$$2x + y = 150$$

Subtracting $2x$ both side, we get

$$y = 150 - 2x$$

Putting $x = 0, 50, 100$ we get

$$y = 150 - 2 \times 0 = 150$$

$$y = 150 - 2 \times 50 = 50$$

$$y = 150 - 2 \times (100) = -50$$

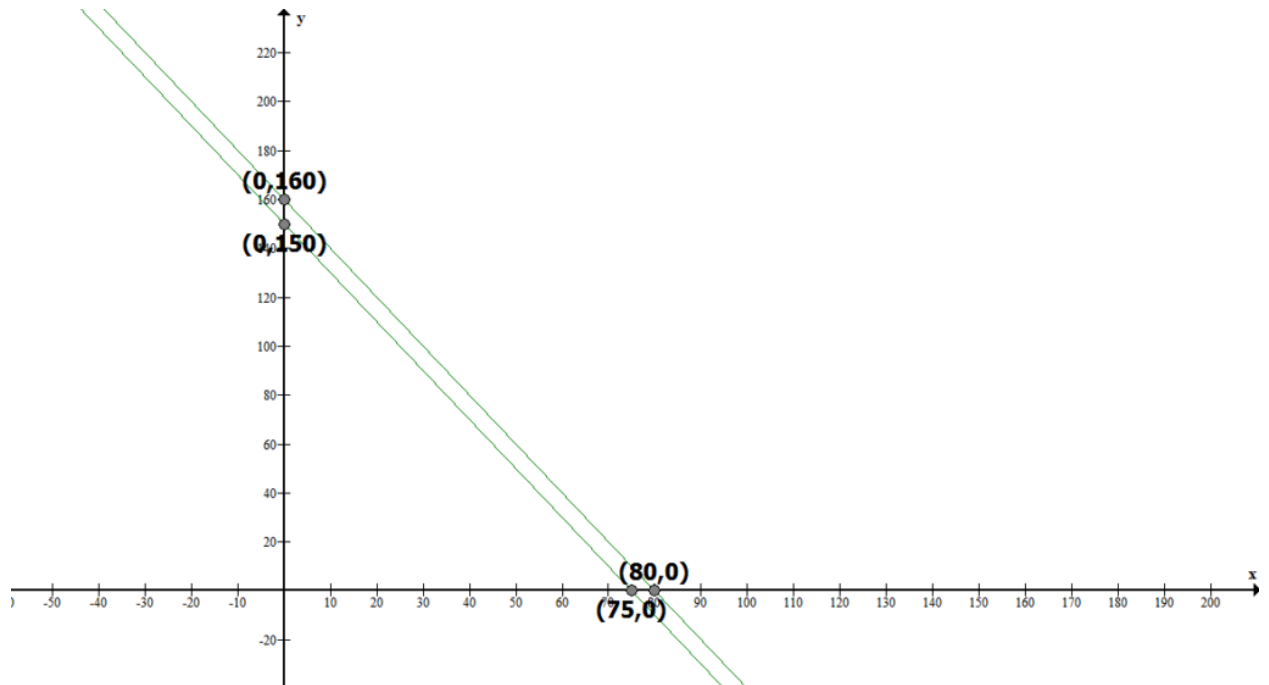
Algebraic representation,

$$2x + y = 160 \dots \text{(i)}$$

$$4x + 2y = 300 \dots \text{(ii)}$$

Graphical representation,

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Exercise 3.2

1. Form the pair of linear equations in the following problems, and find their solutions graphically.

(i) 10 students of Class X took part in a Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.

Answer

Let number of boys = x

Number of girls = y

Given that total number of student is 10 so that

$$x + y = 10$$

Subtract y both side we get

$$x = 10 - y$$

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Putting $y = 0, 5, 10$ we get

$$x = 10 - 0 = 10$$

$$x = 10 - 5 = 5$$

$$x = 10 - 10 = 0$$

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

So that

$$y = x + 4$$

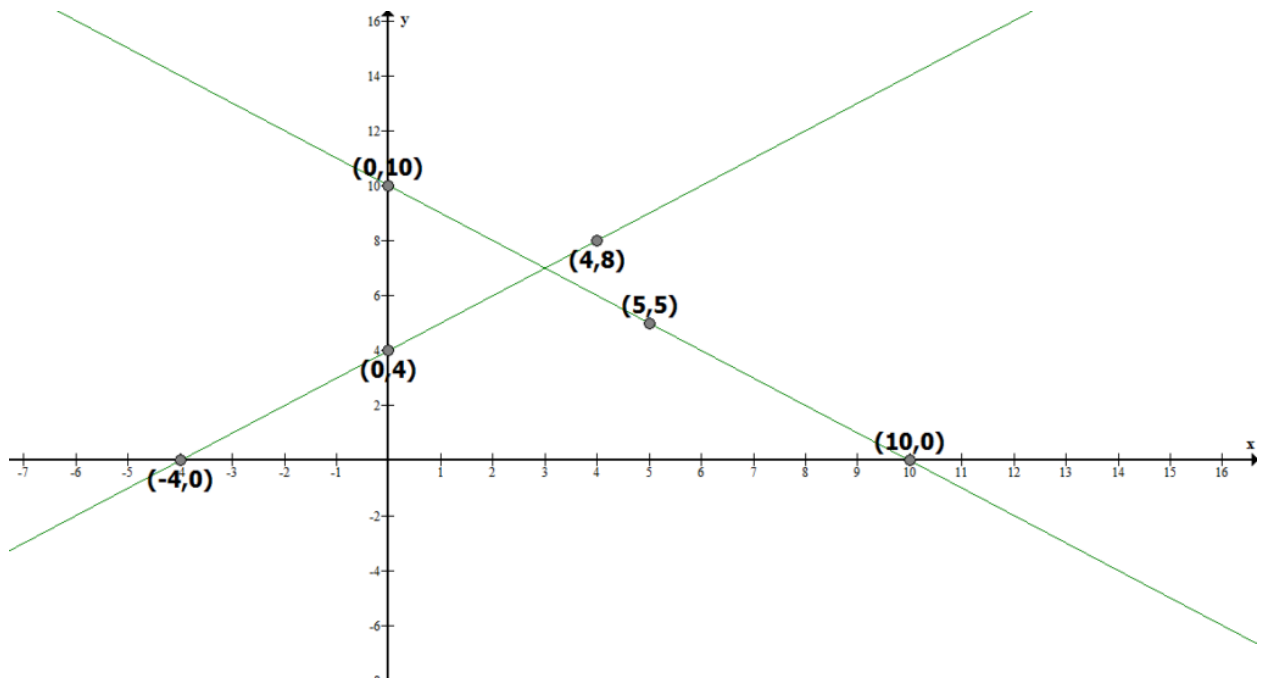
Putting $x = -4, 0, 4,$ and we get

$$y = -4 + 4 = 0$$

$$y = 0 + 4 = 4$$

$$y = 4 + 4 = 8$$

Graphical representation



Therefore, number of boys = 3 and number of girls = 7.

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(ii) 5 pencils and 7 pens together cost Rs 50, whereas 7 pencils and 5 pens together cost Rs 46. Find the cost of one pencil and that of one pen.

Answer

Let cost of pencil = Rs x

Cost of pens = Rs y

5 pencils and 7 pens together cost Rs 50,

So we get

$$5x + 7y = 50$$

Subtracting $7y$ both sides we get

$$5x = 50 - 7y$$

Dividing by 5 we get

$$x = 10 - 7y/5$$

Putting value of $y = 5, 10$ and 15 we get

$$x = 10 - 7 \times 5/5 = 10 - 7 = 3$$

$$x = 10 - 7 \times 10/5 = 10 - 14 = -4$$

$$x = 10 - 7 \times 15/5 = 10 - 21 = -11$$

Given that 7 pencils and 5 pens together cost Rs 46

$$7x + 5y = 46$$

Subtracting $7x$ both side we get

$$5y = 46 - 7x$$

Dividing by 5 we get

$$y = 46/5 - 7x/5$$

$$y = 9.2 - 1.4x$$

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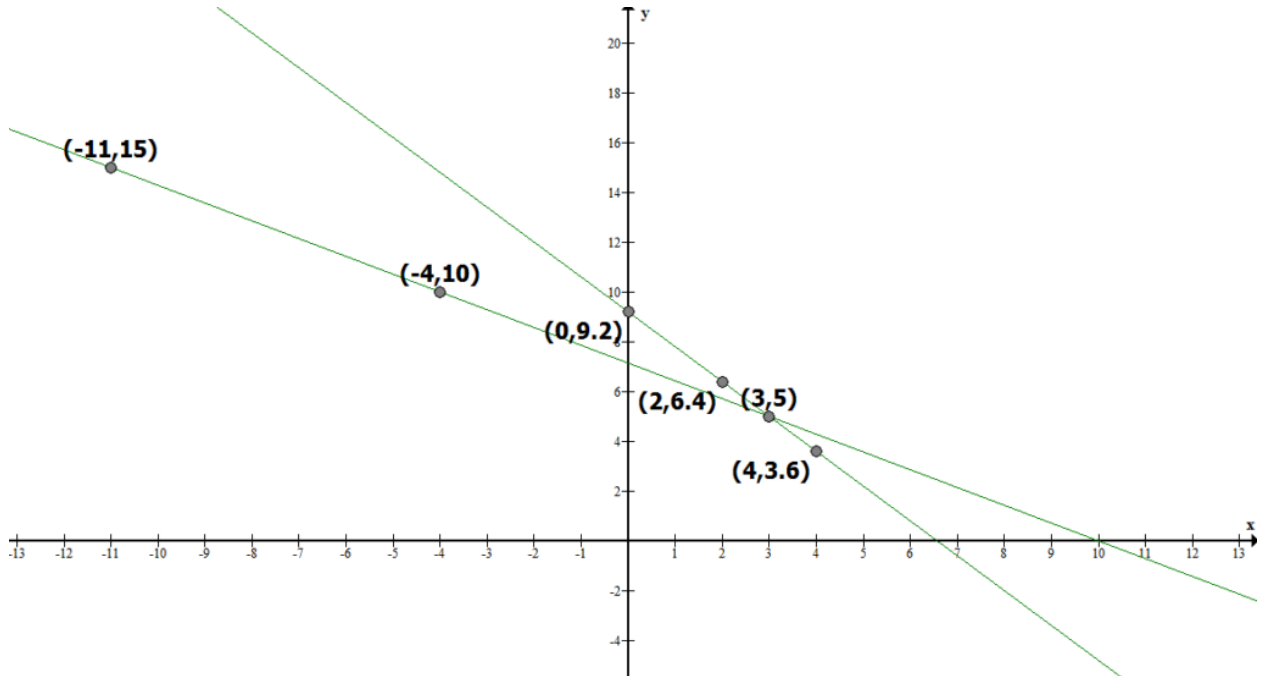
Putting $x = 0, 2$ and 4 we get

$$y = 9.2 - 1.4 \times 0 = 9.2 - 0 = 9.2$$

$$y = 9.2 - 1.4 (2) = 9.2 - 2.8 = 6.4$$

$$y = 9.2 - 1.4 (4) = 9.2 - 5.6 = 3.6$$

Graphical representation



Therefore, cost of one pencil = Rs 3 and cost of one pen = Rs 5.

2. On comparing the ratios a_1/a_2 , b_1/b_2 and c_1/c_2 , find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincident.

Answer

(i) $5x - 4y + 8 = 0$

$$7x + 6y - 9 = 0$$

Comparing these equation with

$$a_1x + b_1y + c_1 = 0$$

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$$a_2x + b_2y + c_2 = 0$$

We get

$$a_1 = 5, b_1 = -4, \text{ and } c_1 = 8$$

$$a_2 = 7, b_2 = 6 \text{ and } c_2 = -9$$

$$a_1/a_2 = 5/7,$$

$$b_1/b_2 = -4/6 \text{ and}$$

$$c_1/c_2 = 8/-9$$

Hence, $a_1/a_2 \neq b_1/b_2$

Therefore, both are intersecting lines at one point.

$$(ii) 9x + 3y + 12 = 0$$

$$18x + 6y + 24 = 0$$

Comparing these equations with

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

We get

$$a_1 = 9, b_1 = 3, \text{ and } c_1 = 12$$

$$a_2 = 18, b_2 = 6 \text{ and } c_2 = 24$$

$$a_1/a_2 = 9/18 = 1/2$$

$$b_1/b_2 = 3/6 = 1/2 \text{ and}$$

$$c_1/c_2 = 12/24 = 1/2$$

Hence, $a_1/a_2 = b_1/b_2 = c_1/c_2$

Therefore, both lines are coincident

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

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$$2x - y + 9 = 0$$

Comparing these equations with

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

We get

$$a_1 = 6, b_1 = -3, \text{ and } c_1 = 10$$

$$a_2 = 2, b_2 = -1 \text{ and } c_2 = 9$$

$$a_1/a_2 = 6/2 = 3/1$$

$$b_1/b_2 = -3/-1 = 3/1 \text{ and}$$

$$c_1/c_2 = 12/24 = 1/2$$

$$\text{Hence, } a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

Therefore, both lines are parallel

3. On comparing the ratios a_1/a_2 , b_1/b_2 and c_1/c_2 find out whether the following pair of linear equations are consistent, or inconsistent.

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

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

(iii) $3/2x + 5/3y = 7$; $9x - 10y = 14$

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

(v) $4/3x + 2y = 8$; $2x + 3y = 12$

Answer

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

$$a_1/a_2 = 3/2$$

$$b_1/b_2 = -2/3 \text{ and}$$

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$$c_1/c_2 = 5/7$$

Hence, $a_1/a_2 \neq b_1/b_2$

These linear equations are intersecting each other at one point and thus have only one possible solution. Hence, the pair of linear equations is consistent.

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

$$a_1/a_2 = 2/4 = 1/2$$

$$b_1/b_2 = -3/-6 = 1/2 \text{ and}$$

$$c_1/c_2 = 8/9$$

Hence, $a_1/a_2 = b_1/b_2 \neq c_1/c_2$

Therefore, these linear equations are parallel to each other and thus have no possible solution. Hence, the pair of linear equations is inconsistent.

$$(iii) 3/2x + 5/3y = 7 ; 9x - 10y = 14$$

$$a_1/a_2 = 3/2/9 = 1/6$$

$$b_1/b_2 = 5/3/-10 = -1/6 \text{ and}$$

$$c_1/c_2 = 7/14 = 1/2$$

Hence, $a_1/a_2 \neq b_1/b_2$

Therefore, these linear equations are intersecting each other at one point and thus have only one possible solution. Hence, the pair of linear equations is consistent.

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

$$a_1/a_2 = 5/-10 = -1/2$$

$$b_1/b_2 = -3/6 = -1/2 \text{ and}$$

$$c_1/c_2 = 11/-22 = -1/2$$

Hence, $a_1/a_2 = b_1/b_2 = c_1/c_2$

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Therefore, these linear equations are coincident pair of lines and thus have infinite number of possible solutions. Hence, the pair of linear equations is consistent.

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

$$a_1/a_2 = 4/3/2 = 2/3$$

$$b_1/b_2 = 1/3 \text{ and}$$

$$c_1/c_2 = 8/12 = 2/3$$

$$\text{Hence, } a_1/a_2 = b_1/b_2 = c_1/c_2$$

Therefore, these linear equations are coincident pair of lines and thus have infinite number of possible solutions. Hence, the pair of linear equations is consistent.

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4. Which of the following pairs of linear equations are consistent/inconsistent? If consistent, obtain the solution graphically:

- (i) $x + y = 5$, $2x + 2y = 10$
- (ii) $x - y = 8$, $3x - 3y = 16$
- (iii) $2x + y - 6 = 0$, $4x - 2y - 4 = 0$
- (iv) $2x - 2y - 2 = 0$, $4x - 4y - 5 = 0$

Answer

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

$$a_1/a_2 = 1/2$$

$$b_1/b_2 = 1/2 \text{ and}$$

$$c_1/c_2 = 5/10 = 1/2$$

$$\text{Hence, } a_1/a_2 = b_1/b_2 = c_1/c_2$$

Therefore, these linear equations are coincident pair of lines and thus have infinite number of possible solutions. Hence, the pair of linear equations is consistent.

$$x + y = 5$$

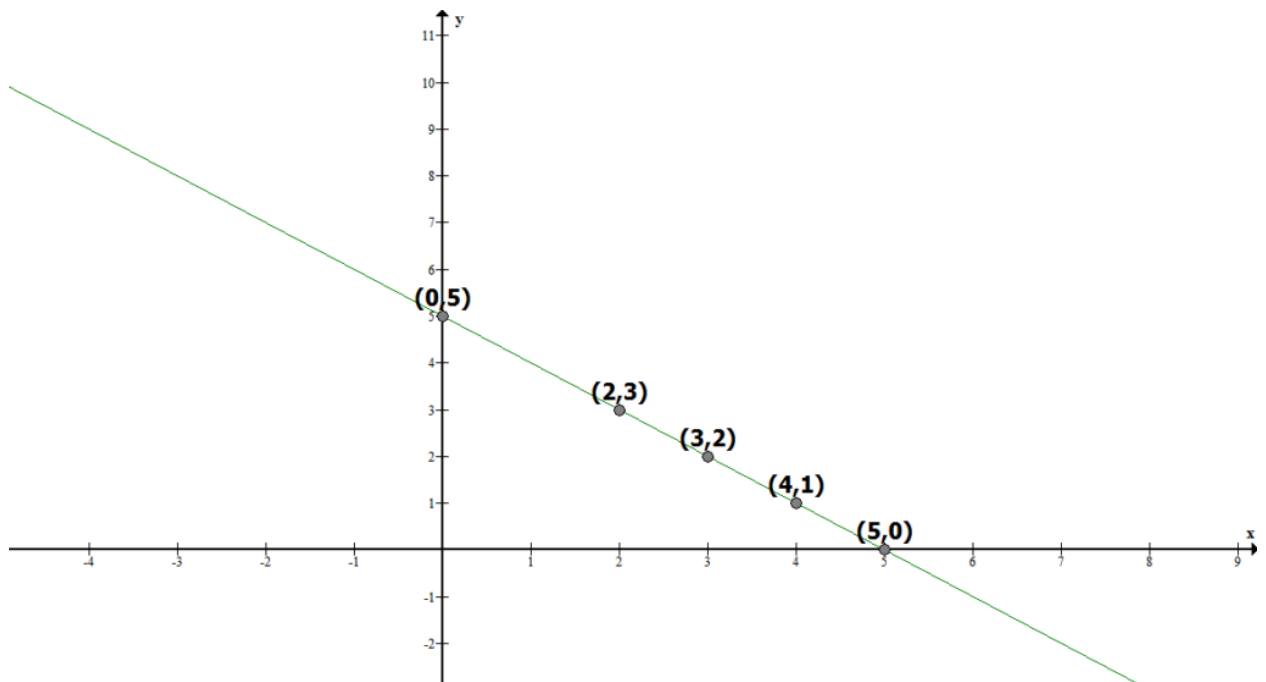
$$x = 5 - y$$

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And, $2x + 2y = 10$

$x = 10 - 2y/2$

Graphical representation



From the figure, it can be observed that these lines are overlapping each other. Therefore, infinite solutions are possible for the given pair of equations.

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

$$a_1/a_2 = 1/3$$

$$b_1/b_2 = -1/-3 = 1/3 \text{ and}$$

$$c_1/c_2 = 8/16 = 1/2$$

$$\text{Hence, } a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

Therefore, these linear equations are parallel to each other and thus have no possible solution. Hence, the pair of linear equations is inconsistent.

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

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$$a_1/a_2 = 2/4 = 1/2$$

$$b_1/b_2 = -1/2 \text{ and}$$

$$c_1/c_2 = -6/-4 = 3/2$$

Hence, $a_1/a_2 \neq b_1/b_2$

Therefore, these linear equations are intersecting each other at one point and thus have only one possible solution. Hence, the pair of linear equations is consistent.

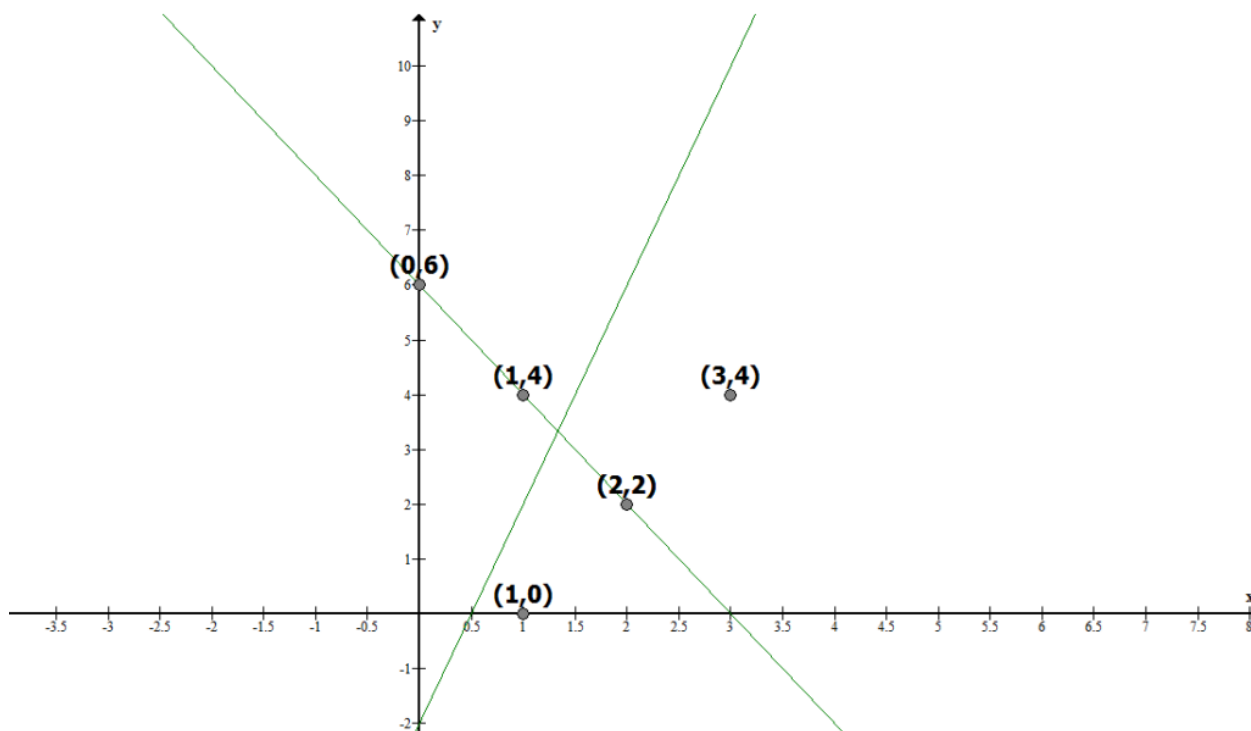
$$2x + y - 6 = 0$$

$$y = 6 - 2x$$

And, $4x - 2y - 4 = 0$

$$y = 4x - 4/2$$

Graphical representation



From the figure, it can be observed that these lines are intersecting each other at the only one point i.e., (2,2) which is the solution for the given pair of equations.

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

$$a_1/a_2 = 2/4 = 1/2$$

$$b_1/b_2 = -2/-4 = 1/2 \text{ and}$$

$$c_1/c_2 = 2/5$$

$$\text{Hence, } a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

Therefore, these linear equations are parallel to each other and thus, have no possible solution. Hence, the pair of linear equations is inconsistent.

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

Answer

Let length of rectangle = x m

Width of the rectangle = y m

According to the question,

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

$$y + x = 36 \dots \text{(ii)}$$

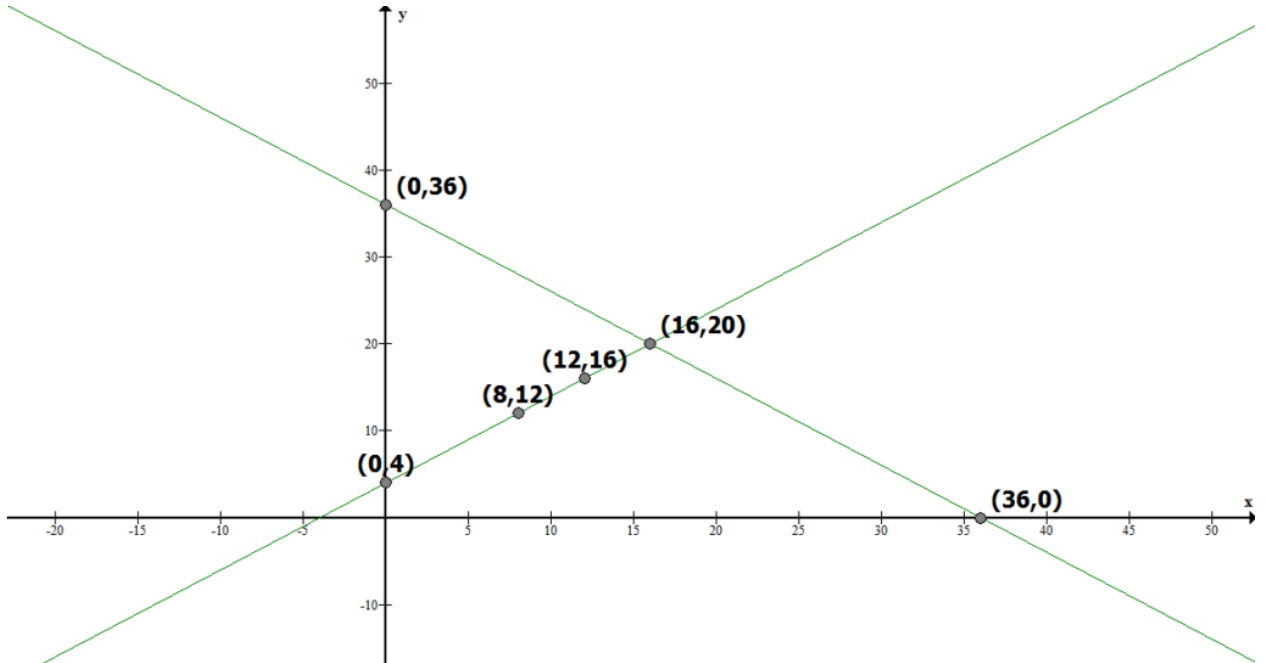
$$y - x = 4$$

$$y = x + 4$$

$$y + x = 36$$

Graphical representation

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From the figure, it can be observed that these lines are intersecting each other at only point i.e., (16, 20). Therefore, the length and width of the given garden is 20 m and 16 m respectively.

6. Given the linear equation $2x + 3y - 8 = 0$, write another linear equations in two variables such that the geometrical representation of the pair so formed is:

- (i) intersecting lines
- (ii) parallel lines
- (iii) coincident lines

Answer

(i) Intersecting lines:

For this condition,

$$a_1/a_2 \neq b_1/b_2$$

The second line such that it is intersecting the given line is

$$2x + 4y - 6 = 0 \text{ as}$$

$$a_1/a_2 = 2/2 = 1$$

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$$b_1/b_2 = 3/4 \text{ and}$$

$$a_1/a_2 \neq b_1/b_2$$

(ii) Parallel lines

For this condition,

$$a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

Hence, the second line can be

$$4x + 6y - 8 = 0 \text{ as}$$

$$a_1/a_2 = 2/4 = 1/2$$

$$b_1/b_2 = 3/6 = 1/2 \text{ and}$$

$$c_1/c_2 = -8/-8 = 1$$

$$\text{and } a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

(iii) Coincident lines

For coincident lines,

$$a_1/a_2 = b_1/b_2 = c_1/c_2$$

Hence, the second line can be

$$6x + 9y - 24 = 0 \text{ as}$$

$$a_1/a_2 = 2/6 = 1/3$$

$$b_1/b_2 = 3/9 = 1/3 \text{ and}$$

$$c_1/c_2 = -8/-24 = 1/3$$

$$\text{and } a_1/a_2 = b_1/b_2 = c_1/c_2$$

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

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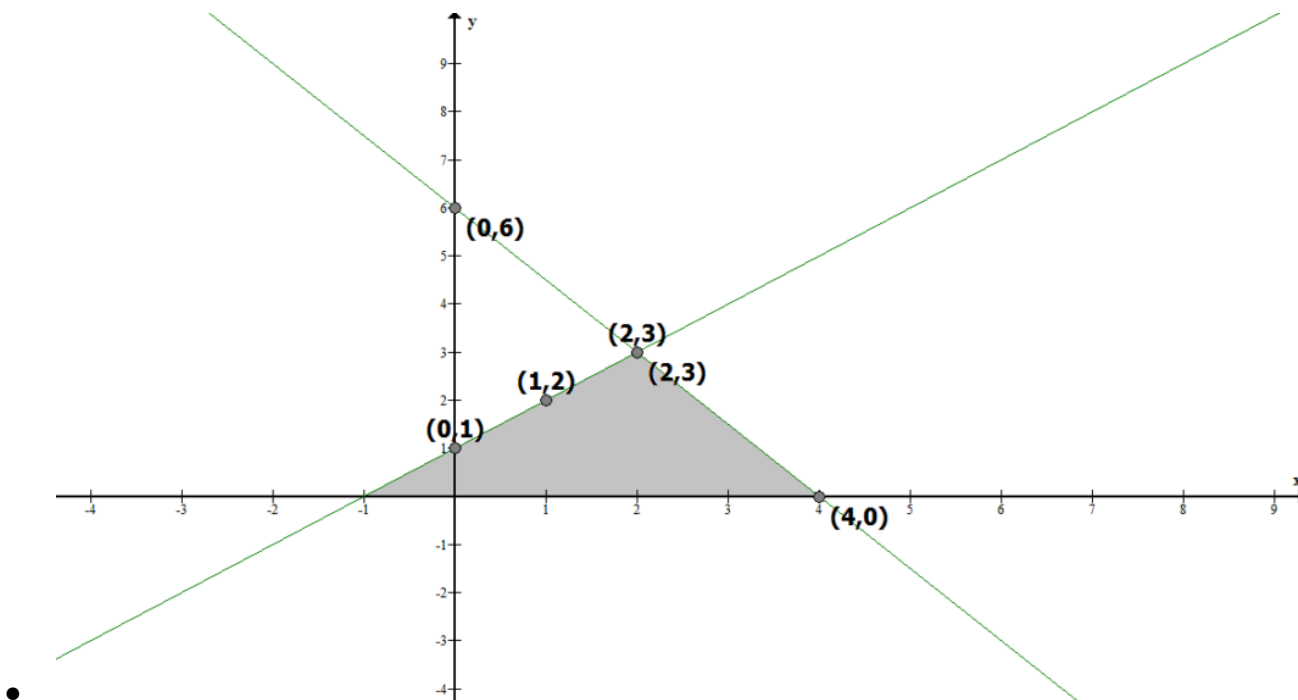
Answer

$$x - y + 1 = 0$$

$$x = y - 1$$

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

Graphical representation



From the figure, it can be observed that these lines are intersecting each other at point (2, 3) and x-axis at (-1, 0) and (4, 0). Therefore, the vertices of the triangle are (2, 3), (-1, 0), and (4, 0).

Exercise 3.3

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

(i) $x + y = 14$; $x - y = 4$

(ii) $s - t = 3$; $s/3 + t/2 = 6$

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(iii) $3x - y = 3$; $9x - 3y = 9$

(iv) $0.2x + 0.3y = 1.3$; $0.4x + 0.5y = 2.3$

(v) $\sqrt{2}x + \sqrt{3}y = 0$; $\sqrt{3}x - \sqrt{8}y = 0$

(vi) $3/2x - 5/3y = -2$; $x/3 + y/2 = 13/6$

Answer

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

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

From equation (i), we get

$x = 14 - y$... (iii)

Putting this value in equation (ii), we get

$(14 - y) - y = 4$

$14 - 2y = 4$

$10 = 2y$

$y = 5$... (iv)

Putting this in equation (iii), we get

$x = 9$

$\therefore x = 9$ and $y = 5$

(ii) $s - t = 3$... (i)

$s/3 + t/2 = 6$... (ii)

From equation (i), we get $s = t + 3$

Putting this value in equation (ii), we get

$t + 3/3 + t/2 = 6$

$2t + 6 + 3t = 36$

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$$5t = 30$$

$$t = 30/5 \dots \text{(iv)}$$

Putting in equation **(iii)**, we obtain

$$s = 9$$

$$\therefore s = 9, t = 6$$

$$\text{(iii) } 3x - y = 3 \dots \text{(i)}$$

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

From equation **(i)**, we get

$$y = 3x - 3 \dots \text{(iii)}$$

Putting this value in equation **(ii)**, we get

$$9x - 3(3x - 3) = 9$$

$$9x - 9x + 9 = 9$$

$$9 = 9$$

This is always true.

Hence, the given pair of equations has infinite possible solutions and the relation between these variables can be given by

$$y = 3x - 3$$

Therefore, one of its possible solutions is $x = 1, y = 0$.

$$\text{(iv) } 0.2x + 0.3y = 1.3 \dots \text{(i)}$$

$$0.4x + 0.5y = 2.3 \dots \text{(ii)}$$

$$0.2x + 0.3y = 1.3$$

Solving equation **(i)**, we get

$$0.2x = 1.3 - 0.3y$$

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Dividing by 0.2, we get

$$x = 1.3/0.2 - 0.3/0.2$$

$$x = 6.5 - 1.5 y \dots(\text{iii})$$

Putting the value in equation (ii), we get

$$0.4x + 0.5y = 2.3$$

$$(6.5 - 1.5y) \times 0.4x + 0.5y = 2.3$$

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

$$-0.1y = 2.3 - 2.6$$

$$y = -0.3/-0.1$$

$$y = 3$$

Putting this value in equation (iii) we get

$$x = 6.5 - 1.5 y$$

$$x = 6.5 - 1.5(3)$$

$$x = 6.5 - 4.5$$

$$x = 2$$

$$\therefore x = 2 \text{ and } y = 3$$

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

$$\sqrt{3}x - \sqrt{8}y = 0 \dots (ii)$$

From equation (i), we get

$$x = \frac{-\sqrt{3}y}{\sqrt{2}} \dots (iii)$$

Putting this value in equation (ii), we get

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

$$-\frac{3y}{\sqrt{2}} - 2\sqrt{2}y = 0$$

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

$$y = 0 \dots (iv)$$

Putting this value in equation (iii), we get

$$x = 0$$

$$\therefore x = 0, y = 0$$

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

$$\frac{x}{3} + \frac{y}{2} = \frac{13}{6} \dots (ii)$$

From equation (i), we get

$$9x - 10y = -12$$

$$x = -12 + 10y/9 \dots (iii)$$

Putting this value in equation (ii), we get

$$\frac{-12 + 10y}{9} + \frac{y}{2} = \frac{13}{6}$$

$$\frac{-12 + 10y}{27} + \frac{y}{2} = \frac{13}{6}$$

$$\frac{-24 + 20y + 27y}{54} = \frac{13}{6}$$

$$47y = 117 + 24$$

$$47y = 141$$

$$y = 3 \dots \text{(iv)}$$

Putting this value in equation (iii), we get

$$x = \frac{-12 + 10 \times 3}{9} = \frac{18}{9} = 2$$

Hence, $x = 2, y = 3$

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

Answer

$$2x + 3y = 11 \dots \text{(i)}$$

Subtracting $3y$ both side we get

$$2x = 11 - 3y \dots \text{(ii)}$$

Putting this value in equation second we get

$$2x - 4y = -24 \dots \text{(iii)}$$

$$11 - 3y - 4y = -24$$

$$7y = -24 - 11$$

$$-7y = -35$$

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$$y = -35/-7$$

$$y = 5$$

Putting this value in equation (iii) we get

$$2x = 11 - 3 \times 5$$

$$2x = 11 - 15$$

$$2x = -4$$

Dividing by 2 we get

$$x = -2$$

Putting the value of x and y

$$y = mx + 3.$$

$$5 = -2m + 3$$

$$2m = 3 - 5$$

$$m = -2/2$$

$$m = -1$$

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

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

Answer

Let larger number = x

Smaller number = y

The difference between two numbers is 26

$$x - y = 26$$

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$$x = 26 + y$$

Given that one number is three times the other

$$\text{So } x = 3y$$

Putting the value of x we get

$$26y = 3y$$

$$-2y = -26$$

$$y = 13$$

So value of $x = 3y$

Putting value of y , we get

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

Hence the numbers are 13 and 39.

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

Answer

Let first angle = x

And second number = y

As both angles are supplementary so that sum will 180

$$x + y = 180$$

$$x = 180 - y \dots \text{(i)}$$

Difference is 18 degree so that

$$x - y = 18$$

Putting the value of x we get

$$180 - y - y = 18$$

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$$-2y = -162$$

$$y = -162/-2$$

$$y = 81$$

Putting the value back in equation (i), we get

$$x = 180 - 81 = 99$$

Hence, the angles are 99° and 81° .

(iii) The coach of a cricket team buys 7 bats and 6 balls for Rs 3800. Later, she buys 3 bats and 5 balls for Rs 1750. Find the cost of each bat and each ball.

Answer

Let cost of each bat = Rs x

Cost of each ball = Rs y

Given that coach of a cricket team buys 7 bats and 6 balls for Rs 3800.

$$7x + 6y = 3800$$

$$6y = 3800 - 7x$$

Dividing by 6, we get

$$y = (3800 - 7x)/6 \dots \text{(i)}$$

Given that she buys 3 bats and 5 balls for Rs 1750 later.

$$3x + 5y = 1750$$

Putting the value of y

$$3x + 5((3800 - 7x)/6) = 1750$$

Multiplying by 6, we get

$$18x + 19000 - 35x = 10500$$

$$-17x = 10500 - 19000$$

$$-17x = -8500$$

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$$x = -8500 / -17$$

$$x = 500$$

Putting this value in equation (i) we get

$$y = (3800 - 7 \times 500) / 6$$

$$y = 300 / 6$$

$$y = 50$$

Hence cost of each bat = Rs 500 and cost of each balls = Rs 50.

(iv) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is Rs 105 and for a journey of 15 km, the charge paid is Rs 155. What are the fixed charges and the charge per km? How much does a person have to pay for traveling a distance of 25 km?

Answer

Let the fixed charge for taxi = Rs x

And variable cost per km = Rs y

Total cost = fixed charge + variable charge

Given that for a distance of 10 km, the charge paid is Rs 105

$$x + 10y = 105 \dots (i)$$

$$x = 105 - 10y$$

Given that for a journey of 15 km, the charge paid is Rs 155

$$x + 15y = 155$$

Putting the value of x we get

$$105 - 10y + 15y = 155$$

$$5y = 155 - 105$$

$$5y = 50$$

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Dividing by 5, we get

$$y = 50/5 = 10$$

Putting this value in equation (i) we get

$$x = 105 - 10 \times 10$$

$$x = 5$$

People have to pay for traveling a distance of 25 km

$$= x + 25y$$

$$= 5 + 25 \times 10$$

$$= 5 + 250$$

$$= 255$$

A person have to pay Rs 255 for 25 Km.

(v) A fraction becomes 9/11, if 2 is added to both the numerator and the denominator. If, 3 is added to both the numerator and the denominator it becomes 5/6 . Find the fraction.

Answer

Let Numerator = x

Denominator = y

Fraction will = x/y

A fraction becomes 9/11, if 2 is added to both the numerator and the denominator

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

By Cross multiplication, we get

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

Subtracting 22 both side, we get

$$11x = 9y - 4$$

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Dividing by 11, we get

$$x = 9y - 4/11 \dots \text{(i)}$$

Given that 3 is added to both the numerator and the denominator it becomes 5/6.

If, 3 is added to both the numerator and the denominator it becomes 5/6

$$(x+3)/y + 3 = 5/6 \dots \text{(ii)}$$

By Cross multiplication, we get

$$6x + 18 = 5y + 15$$

Subtracting the value of x, we get

$$6(9y - 4)/11 + 18 = 5y + 15$$

Subtract 18 both side we get

$$6(9y - 4)/11 = 5y - 3$$

$$54 - 24 = 55y - 33$$

$$-y = -9$$

$$y = 9$$

Putting this value of y in equation (i), we get

$$x = 9y - 4$$

$$11 \dots \text{(i)}$$

$$x = (81 - 4)/77$$

$$x = 77/11$$

$$x = 7$$

Hence our fraction is 7/9.

(vi) Five years hence, the age of Jacob will be three times that of his son. Five years ago, Jacob's age was seven times that of his son. What are their present ages?

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Answer

Let present age of Jacob = x year

And present Age of his son is = y year

Five years hence,

Age of Jacob will = $x + 5$ year

Age of his son will = $y + 5$ year

Given that the age of Jacob will be three times that of his son

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

Adding 5 both side, we get

$$x = 3y + 15 - 5$$

$$x = 3y + 10 \dots \text{(i)}$$

Five years ago,

Age of Jacob will = $x - 5$ year

Age of his son will = $y - 5$ year

Jacob's age was seven times that of his son

$$x - 5 = 7(y - 5)$$

Putting the value of x from equation (i) we get

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

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

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

$$-4y = -40$$

$$y = -40 / -4$$

$$y = 10 \text{ year}$$

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Putting the value of y in equation first we get

$$x = 3 \times 10 + 10$$

$$x = 40 \text{ years}$$

Hence, Present age of Jacob = 40 years and present age of his son = 10 years.

Exercise 3.4

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

- (i) $x + y = 5$ and $2x - 3y = 4$
- (ii) $3x + 4y = 10$ and $2x - 2y = 2$
- (iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$
- (iv) $x/2 + 2y/3 = -1$ and $x - y/3 = 3$

Answer

(i) $x + y = 5$ and $2x - 3y = 4$ By elimination method

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

$$2x - 3y = 4 \dots \text{(ii)}$$

Multiplying equation (i) by (ii), we get

$$2x + 2y = 10 \dots \text{(iii)}$$

$$2x - 3y = 4 \dots \text{(ii)}$$

Subtracting equation (ii) from equation (iii), we get

$$5y = 6$$

$$y = 6/5$$

Putting the value in equation (i), we get

$$x = 5 - (6/5) = 19/5$$

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Hence, $x = 19/5$ and $y = 6/5$ By substitution method

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

Subtracting y both side, we get

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

Putting the value of x in equation **(ii)** we get

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

$$-5y = -6$$

$$y = -6/-5 = 6/5$$

Putting the value of y in equation **(iv)** we get

$$x = 5 - 6/5$$

$$x = 19/5$$

Hence, $x = 19/5$ and $y = 6/5$ again

(ii) $3x + 4y = 10$ and $2x - 2y = 2$ By elimination method

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

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

Multiplying equation **(ii)** by 2, we get

$$4x - 4y = 4 \dots \text{(iii)}$$

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

Adding equation **(i)** and **(iii)**, we get

$$7x + 0 = 14$$

Dividing both side by 7, we get

$$x = 14/7 = 2$$

Putting in equation **(i)**, we get

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$$3x + 4y = 10$$

$$3(2) + 4y = 10$$

$$6 + 4y = 10$$

$$4y = 10 - 6$$

$$4y = 4$$

$$y = 4/4 = 1$$

Hence, answer is $x = 2, y = 1$ By substitution method

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

Subtract $3x$ both side, we get

$$4y = 10 - 3x$$

Divide by 4 we get

$$y = (10 - 3x)/4$$

Putting this value in equation **(ii)**, we get

$$2x - 2y = 2 \dots \text{(i)}$$

$$2x - 2(10 - 3x)/4 = 2$$

Multiply by 4 we get

$$8x - 2(10 - 3x) = 8$$

$$8x - 20 + 6x = 8$$

$$14x = 28$$

$$x = 28/14 = 2$$

$$y = (10 - 3x)/4$$

$$y = 4/4 = 1$$

Hence, answer is $x = 2, y = 1$ again.

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(iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$ By elimination method

$$3x - 5y - 4 = 0$$

$$3x - 5y = 4 \dots \text{(i)}$$

$$9x = 2y + 7$$

$$9x - 2y = 7 \dots \text{(ii)}$$

Multiplying equation (i) by 3, we get

$$9x - 15y = 11 \dots \text{(iii)}$$

$$9x - 2y = 7 \dots \text{(ii)}$$

Subtracting equation (ii) from equation (iii), we get

$$-13y = 5$$

$$y = -5/13$$

Putting value in equation (i), we get

$$3x - 5y = 4 \dots \text{(i)}$$

$$3x - 5(-5/13) = 4$$

Multiplying by 13 we get

$$39x + 25 = 52$$

$$39x = 27$$

$$x = 27/39 = 9/13$$

Hence our answer is $x = 9/13$ and $y = -5/13$ By substitution method

$$3x - 5y = 4 \dots \text{(i)}$$

Adding 5y both side we get

$$3x = 4 + 5y$$

Dividing by 3 we get

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$$x = (4 + 5y)/3 \dots \text{(iv)}$$

Putting this value in equation (ii) we get

$$9x - 2y = 7 \dots \text{(ii)}$$

$$9((4 + 5y)/3) - 2y = 7$$

Solve it we get

$$3(4 + 5y) - 2y = 7$$

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

$$13y = -5$$

$$y = -5/13$$

$$\begin{aligned} x &= \frac{4 + 5 \times \left(-\frac{5}{13}\right)}{3} \\ &= \frac{4 - \frac{25}{13}}{3} = \frac{4 \times 13 - 25}{13} \\ &= \frac{27}{13 \times 3} = \frac{27}{39} = \frac{9}{13} \end{aligned}$$

Hence we get $x = 9/13$ and $y = -5/13$ again.

(iv) $x/2 + 2y/3 = -1$ and $x - y/3 = 3$ By elimination method

$$x/2 + 2y/3 = -1 \dots \text{(i)}$$

$$x - y/3 = 3 \dots \text{(ii)}$$

Multiplying equation (i) by 2, we get

$$x + 4y/3 = -2 \dots \text{(iii)}$$

$$x - y/3 = 3 \dots \text{(ii)}$$

Subtracting equation (ii) from equation (iii), we get

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$$5y/3 = -5$$

Dividing by 5 and multiplying by 3, we get

$$y = -15/5$$

$$y = -3$$

Putting this value in equation **(ii)**, we get

$$x - y/3 = 3 \dots \text{(ii)}$$

$$x - (-3)/3 = 3$$

$$x + 1 = 3$$

$$x = 2$$

Hence our answer is $x = 2$ and $y = -3$. By substitution method

$$x - y/3 = 3 \dots \text{(ii)}$$

Add $y/3$ both side, we get

$$x = 3 + y/3 \dots \text{(iv)}$$

Putting this value in equation **(i)** we get

$$x/2 + 2y/3 = -1 \dots \text{(i)}$$

$$(3 + y/3)/2 + 2y/3 = -1$$

$$3/2 + y/6 + 2y/3 = -1$$

Multiplying by 6, we get

$$9 + y + 4y = -6$$

$$5y = -15$$

$$y = -3$$

Hence our answer is $x = 2$ and $y = -3$.

NCERT 10th Maths Chapter 3

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2. Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:

(i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

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

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

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

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

Answer

(i) Let the fraction be $\frac{x}{y}$

According to the question, $x + \frac{1}{y} - 1 = 1$

$$\Rightarrow x - y = -2 \dots \text{(i)} \quad \frac{x}{y+1} = \frac{1}{2}$$

$$\Rightarrow 2x - y = 1 \dots \text{(ii)}$$

Subtracting equation (i) from equation (ii), we get

$$x = 3 \dots \text{(iii)}$$

Putting this value in equation (i), we get

$$3 - y = -2$$

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$$-y = -5$$

$$y = 5$$

Hence, the fraction is $\frac{3}{5}$

(ii) Let present age of Nuri = x

and present age of Sonu = y

According to the given information, question, $(x - 5) = 3(y - 5)$

$$x - 3y = -10 \dots \text{(i)}$$

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

$$x - 2y = 10 \dots \text{(ii)}$$

Subtracting equation (i) from equation (ii), we get

$$y = 20 \dots \text{(iii)}$$

Putting this value in equation (i), we get

$$x - 60 = -10$$

$$x = 50$$

Hence, age of Nuri = 50 years and age of Sonu = 20 years.

(iii) Let the unit digit and tens digits of the number be x and y respectively.

Then, number = $10y + x$

Number after reversing the digits = $10x + y$

According to the question,

$$x + y = 9 \dots \text{(i)}$$

$$9(10y + x) = 2(10x + y)$$

$$88y - 11x = 0$$

$$-x + 8y = 0 \dots \text{(ii)}$$

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Adding equation (i) and (ii), we get

$$9y = 9$$

$$y = 1 \dots \text{(iii)}$$

Putting the value in equation (i), we get

$$x = 8$$

Hence, the number is $10y + x = 10 \times 1 + 8 = 18$.

(iv) Let the number of Rs 50 notes and Rs 100 notes be x and y respectively.

According to the question,

$$x + y = 25 \dots \text{(i)}$$

$$50x + 100y = 2000 \dots \text{(ii)}$$

Multiplying equation (i) by 50, we get

$$50x + 50y = 1250 \dots \text{(iii)}$$

Subtracting equation (iii) from equation (ii), we get

$$50y = 750$$

$$y = 15$$

Putting this value in equation (i), we have $x = 10$

Hence, Meena has 10 notes of Rs 50 and 15 notes of Rs 100.

(v) Let the fixed charge for first three days and each day charge thereafter be Rs x and Rs y respectively.

According to the question,

$$x + 4y = 27 \dots \text{(i)}$$

$$x + 2y = 21 \dots \text{(ii)}$$

Subtracting equation (ii) from equation (i), we get

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$$2y = 6$$

$$y = 3 \dots \text{(iii)}$$

Putting in equation (i), we get

$$x + 12 = 27$$

$$x = 15$$

Hence, fixed charge = Rs 15 and Charge per day = Rs 3.

Exercise 3.5

NCERT 10th Maths Chapter 3

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

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

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

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

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

Answer

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

$$3x - 9y - 2 = 0$$

$$a_1/a_2 = 1/3$$

$$b_1/b_2 = -3/-9 = 1/3 \text{ and}$$

$$c_1/c_2 = -3/-2 = 3/2$$

$$a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

Therefore, the given sets of lines are parallel to each other. Therefore, they will not intersect each other and thus, there will not be any solution for these equations.

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

$$3x + 2y = 8$$

$$a_1/a_2 = 2/3$$

$$b_1/b_2 = 1/2 \text{ and}$$

$$c_1/c_2 = -5/-8 = 5/8$$

$$a_1/a_2 \neq b_1/b_2$$

Therefore, they will intersect each other at a unique point and thus, there will be a unique solution for these equations.

By cross-multiplication method,

$$x/b_1c_2 - b_2c_1 = y/c_1a_2 - c_2a_1 = 1/a_1b_2 - a_2b_1$$

$$x/-8 - (-10) = y/-15 + 16 = 1/4 - 3$$

$$x/2 = y/1 = 1$$

$$x/2 = 1, y/1 = 1$$

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

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

$$6x - 10y = 40$$

$$a_1/a_2 = 3/6 = 1/2$$

$$b_1/b_2 = -5/-10 = 1/2 \text{ and}$$

$$c_1/c_2 = -20/-40 = 1/2$$

$$a_1/a_2 = b_1/b_2 = c_1/c_2$$

Therefore, the given sets of lines will be overlapping each other i.e., the lines will be coincident to each other and thus, there are infinite solutions possible for these equations.

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

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

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$$a_1/a_2 = 1/3$$

$$b_1/b_2 = -3/-3 = 1 \text{ and}$$

$$c_1/c_2 = -7/-15 = 7/15$$

$$a_1/a_2 \neq b_1/b_2$$

Therefore, they will intersect each other at a unique point and thus, there will be a unique solution for these equations.

By cross-multiplication,

$$x/45 - (21) = y/-21 - (-15) = 1/-3 - (-9)$$

$$x/24 = y/-6 = 1/6$$

$$x/24 = 1/6 \text{ and } y/-6 = 1/6$$

$$x = 4 \text{ and } y = -1$$

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

NCERT 10th Maths Chapter 3

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

$$2x + 3y = 7$$

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

Answer

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

$$(a - b)x + (a + b)y - (3a + b - 2) = 0$$

$$a_1/a_2 = 2/a - b = 1/2$$

$$b_1/b_2 = -7/a + b \text{ and}$$

$$c_1/c_2 = -7/-(3a + b - 2) = 7/(3a + b - 2)$$

For infinitely many solutions, $a_1/a_2 = b_1/b_2 = c_1/c_2$

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$$2/a-b = 7/3a+b-26a + 2b - 4 = 7a - 7b$$

$$a - 9b = -4 \dots \text{(i)}$$

$$2/a-b = 3/a+b$$

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

$$a - 5b = 0 \dots \text{(ii)}$$

Subtracting equation (i) from (ii), we get

$$4b = 4$$

$$b = 1$$

Putting this value in equation (ii), we get

$$a - 5 \times 1 = 0$$

$$a = 5$$

Hence, $a = 5$ and $b = 1$ are the values for which the given equations give infinitely many solutions.

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

$$3x + y = 1$$

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

Answer

$$3x + y - 1 = 0$$

$$(2k - 1)x + (k - 1)y - (2k + 1) = 0$$

$$a_1/a_2 = 3/2k-1$$

$$b_1/b_2 = 1/k-1 \text{ and}$$

$$c_1/c_2 = -1/-2k-1 = 1/2k+1$$

For no solutions,

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$$a_1/a_2 = b_1/b_2 \neq c_1/c_2$$

$$3/2k-1 = 1/k-1 \neq 1/2k+1$$

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

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

$$k = 2$$

Hence, for $k = 2$, the given equation has no solution.

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

$$8x + 5y = 9$$

$$3x + 2y = 4$$

Answer

$$8x + 5y = 9 \dots \text{(i)}$$

$$3x + 2y = 4 \dots \text{(ii)}$$

From equation (ii), we get

$$x = 4 - 2y/3 \dots \text{(iii)}$$

Putting this value in equation (i), we get

$$8(4 - 2y/3) + 5y = 9$$

$$32 - 16y + 15y = 27$$

$$-y = -5$$

$$y = 5 \dots \text{(iv)}$$

Putting this value in equation (ii), we get

$$3x + 10 = 4$$

$$x = -2$$

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Hence, $x = -2$, $y = 5$

By cross multiplication again, we get

$$8x + 5y - 9 = 0$$

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

$$x/-20 - (-18) = y/-27 - (-32) = 1/16-15$$

$$x/-2 = y/5 = 1/1$$

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

$$x = -2 \text{ and } y = 5$$

NCERT 10th Maths Chapter 3

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

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

Answer

Let x be the fixed charge of the food and y be the charge for food per day.

According to the question,

$$x + 20y = 1000 \dots \text{(i)}$$

$$x + 26y = 1180 \dots \text{(ii)}$$

Subtracting equation (i) from equation (ii), we get

$$6y = 180$$

$$y = 180/6 = 30$$

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Putting this value in equation (i), we get

$$x + 20 \times 30 = 1000$$

$$x = 1000 - 600$$

$$x = 400$$

Hence, fixed charge = Rs 400 and charge per day = Rs 30

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

Answer

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

According to the question,

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

$$\Rightarrow 3x - y = 3 \dots \text{(i)}$$

$$\frac{x}{y+8} = \frac{1}{4}$$

$$\Rightarrow 4x - y = 8 \dots \text{(ii)}$$

Subtracting equation (i) from equation (ii), we get

$$x = 5 \dots \text{(iii)}$$

Putting this value in equation (i), we get

$$15 - y = 3$$

$$y = 12$$

Hence, the fraction is $\frac{5}{12}$.

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

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Answer

Let the number of right answers and wrong answers be x and y respectively.

According to the question,

$$3x - y = 40 \dots \text{(i)}$$

$$4x - 2y = 50$$

$$\Rightarrow 2x - y = 25 \dots \text{(ii)}$$

Subtracting equation (ii) from equation (i), we get

$$x = 15 \dots \text{(iii)}$$

Putting this value in equation (ii), we get

$$30 - y = 25$$

$$y = 5$$

Therefore, number of right answers = 15

And number of wrong answers = 5

Total number of questions = 20

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

Answer

Let the speed of 1st car and 2nd car be u km/h and v km/h.

Respective speed of both cars while they are travelling in same direction = $(u - v)$ km/h

Respective speed of both cars while they are travelling in opposite directions i.e., travelling towards each other = $(u + v)$ km/h

According to the question,

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$$5(u - v) = 100$$

$$\Rightarrow u - v = 20 \dots \text{(i)}$$

$$1(u + v) = 100 \dots \text{(ii)}$$

Adding both the equations, we get

$$2u = 120$$

$$u = 60 \text{ km/h} \dots \text{(iii)}$$

Putting this value in equation (ii), we obtain

$$v = 40 \text{ km/h}$$

Hence, speed of one car = 60 km/h and speed of other car = 40 km/h

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

Answer

Let length and breadth of rectangle be x unit and y unit respectively.

$$\text{Area} = xy$$

According to the question,

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

$$\Rightarrow 3x - 5y - 6 = 0 \dots \text{(i)}$$

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

$$\Rightarrow 2x - 3y - 61 = 0 \dots \text{(ii)}$$

By cross multiplication, we get

$$x/305 - (-18) = y/-12 - (-183) = 1/9 - (-10)$$

$$x/323 = y/171 = 1/19$$

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$$x = 17, y = 9$$

Hence, the length of the rectangle = 17 units and breadth of the rectangle = 9 units.

Exercise 3.6

NCERT 10th Maths Chapter 3

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

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

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

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

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

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

$$\frac{3}{x} - 4y = 23$$

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

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

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

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

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

$$2x + 4y = 5xy$$

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

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

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

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

Answer

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

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

Let $\frac{1}{x} = p$ and $\frac{1}{y} = q$, then the equations changes as below:

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

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

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

$$\Rightarrow 2p + 3q - 13 = 0 \dots (ii)$$

By cross-multiplication method, we get

$$\frac{p}{-26 - (-36)} = \frac{q}{-24 - (-39)} = \frac{1}{9 - 4}$$

$$\frac{p}{10} = \frac{q}{15} = \frac{1}{5}$$

$$\frac{p}{10} = \frac{1}{5} \text{ and } \frac{q}{15} = \frac{1}{5}$$

$$p = 2 \text{ and } q = 3$$

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

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

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

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

Let $\frac{1}{\sqrt{x}} = p$ and $\frac{1}{\sqrt{y}} = q$, then the equations changes as below:

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$$2p + 3q = 2 \dots \text{(i)}$$

$$4p - 9q = -1 \dots \text{(ii)}$$

Multiplying equation (i) by 3, we get

$$6p + 9q = 6 \dots \text{(iii)}$$

Adding equation (ii) and (iii), we get

$$10p = 5$$

$$p = 1/2 \dots \text{(iv)}$$

Putting in equation (i), we get

$$2 \times 1/2 + 3q = 2$$

$$3q = 1$$

$$q = 1/3$$

$$p = 1/\sqrt{x} = 1/2$$

$$\sqrt{x} = 2$$

$$x = 4$$

and

$$q = 1/\sqrt{y} = 1/3$$

$$\sqrt{y} = 3$$

$$y = 9$$

Hence, $x = 4$, $y = 9$

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

$$3/x - 4y = 23$$

Putting $1/x = p$ in the given equations, we get

$$4p + 3y = 14$$

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$$\Rightarrow 4p + 3y - 14 = 0$$

$$3p - 4y = 23$$

$$\Rightarrow 3p - 4y - 23 = 0$$

By cross-multiplication, we get

$$p/-69-56 = y/-42-(-92) = 1/-16-9$$

$$\Rightarrow -p/125 = y/50 = -1/25$$

Now,

$$-p/125 = -1/25 \text{ and } y/50 = -1/25$$

$$\Rightarrow p = 5 \text{ and } y = -2$$

Also, $p = 1/x = 5$

$$\Rightarrow x = 1/5$$

So, $x = 1/5$ and $y = -2$ is the solution.

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

$$6/x-1 - 3/y-2 = 1$$

Putting $1/x-1 = p$ and $1/y-2 = q$ in the given equations, we obtain

$$5p + q = 2 \dots \text{(i)}$$

$$6p - 3q = 1 \dots \text{(ii)}$$

Now, by multiplying equation (i) by 3 we get

$$15p + 3q = 6 \dots \text{(iii)}$$

Now, adding equation (ii) and (iii)

$$21p = 7$$

$$\Rightarrow p = 1/3$$

Putting this value in equation (ii) we get,

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$$6 \times \frac{1}{3} - 3q = 1$$

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

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

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

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

Now,

$$p = \frac{1}{x-1} = \frac{1}{3}$$

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

$$\Rightarrow 3 = x - 1$$

$$\Rightarrow x = 4$$

Also,

$$q = \frac{1}{y-2} = \frac{1}{3}$$

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

$$\Rightarrow 3 = y - 2$$

$$\Rightarrow y = 5$$

Hence, $x = 4$ and $y = 5$ is the solution.

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

$$\Rightarrow \frac{7x}{xy} - \frac{2y}{xy} = 5$$

$$\Rightarrow \frac{7}{y} - \frac{2}{x} = 5 \dots (i)$$

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

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

$$\Rightarrow \frac{8}{y} + \frac{7}{x} = 15 \dots (ii)$$

Putting $\frac{1}{x} = p$ and $\frac{1}{y} = q$ in (i) and (ii) we get,

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$$7q - 2p = 5 \dots \text{(iii)}$$

$$8q + 7p = 15 \dots \text{(iv)}$$

Multiplying equation (iii) by 7 and multiplying equation (iv) by 2 we get,

$$49q - 14p = 35 \dots \text{(v)}$$

$$16q + 14p = 30 \dots \text{(vi)}$$

Now, adding equation (v) and (vi) we get,

$$49q - 14p + 16q + 14p = 35 + 30$$

$$\Rightarrow 65q = 65$$

$$\Rightarrow q = 1$$

Putting the value of q in equation (iv)

$$8 + 7p = 15$$

$$\Rightarrow 7p = 7$$

$$\Rightarrow p = 1$$

Now,

$$p = 1/x = 1$$

$$\Rightarrow 1/x = 1$$

$$\Rightarrow x = 1$$

$$\text{also, } q = 1 = 1/y$$

$$\Rightarrow 1/y = 1$$

$$\Rightarrow y = 1$$

Hence, $x = 1$ and $y = 1$ is the solution.

$$\text{(vi) } 6x + 3y = 6xy$$

$$\Rightarrow 6x/xy + 3y/xy = 6$$

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$$\Rightarrow 6/y + 3/x = 6 \dots \text{(i)}$$

$$2x + 4y = 5xy$$

$$\Rightarrow 2x/xy + 4y/xy = 5$$

$$\Rightarrow 2/y + 4/x = 5 \dots \text{(ii)}$$

Putting $1/x = p$ and $1/y = q$ in (i) and (ii) we get,

$$6q + 3p - 6 = 0$$

$$2q + 4p - 5 = 0$$

By cross multiplication method, we get

$$p/-30 - (-12) = q/-24 - (-15) = 1/6 - 24$$

$$p/-18 = q/-9 = 1/-18$$

$$p/-18 = 1/-18 \text{ and } q/-9 = 1/-18$$

$$p = 1 \text{ and } q = 1/2$$

$$p = 1/x = 1 \text{ and } q = 1/y = 1/2$$

$$x = 1, y = 2$$

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

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

$$15/x+y - 5/x-y = -2$$

Putting $1/x+y = p$ and $1/x-y = q$ in the given equations, we get:

$$10p + 2q = 4$$

$$\Rightarrow 10p + 2q - 4 = 0 \dots \text{(i)}$$

$$15p - 5q = -2$$

$$\Rightarrow 15p - 5q + 2 = 0 \dots \text{(ii)}$$

Using cross multiplication, we get

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$$p/4 - 20 = q/-60 - (-20) = 1/-50 - 30$$

$$p/-16 = q/-80 = 1/-80$$

$$p/-16 = 1/-80 \text{ and } q/-80 = 1/-80$$

$$p = 1/5 \text{ and } q = 1$$

$$p = 1/x+y = 1/5 \text{ and } q = 1/x-y = 1$$

$$x + y = 5 \dots \text{(iii)}$$

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

Adding equation (iii) and (iv), we get

$$2x = 6$$

$$x = 3 \dots \text{(v)}$$

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

$$y = 2$$

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

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

$$1/2(3x-y) - 1/2(3x-y) = -1/8$$

Putting $1/3x+y = p$ and $1/3x-y = q$ in the given equations, we get

$$p + q = 3/4 \dots \text{(i)}$$

$$p/2 - q/2 = -1/8$$

$$p - q = -1/4 \dots \text{(ii)}$$

Adding (i) and (ii), we get

$$2p = 3/4 - 1/4$$

$$2p = 1/2$$

$$p = 1/4$$

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Putting the value in equation (ii), we get

$$1/4 - q = -1/4$$

$$q = 1/4 + 1/4 = 1/2$$

$$p = 1/3x+y = 1/4$$

$$3x + y = 4 \dots \text{(iii)}$$

$$q = 1/3x-y = 1/2$$

$$3x - y = 2 \dots \text{(iv)}$$

Adding equations (iii) and (iv), we get

$$6x = 6$$

$$x = 1 \dots \text{(v)}$$

Putting the value in equation (iii), we get

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

$$y = 1$$

Hence, $x = 1$ and $y = 1$

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

2. Formulate the following problems as a pair of equations, and hence find their solutions:

(i) Ritu can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.

Answer

Let the speed of Ritu in still water and the speed of stream be x km/h

and y km/h respectively.

Speed of Ritu while rowing

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Upstream = $(x - y)$ km/h

Downstream = $(x + y)$ km/h

According to question,

$$2(x + y) = 20$$

$$\Rightarrow x + y = 10 \dots \text{(i)}$$

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

$$\Rightarrow x - y = 2 \dots \text{(ii)}$$

Adding equation (i) and (ii), we get

Putting this equation in (i), we get

$$y = 4$$

Hence, Ritu's speed in still water is 6 km/h and the speed of the current is 4 km/h.

(ii) 2 women and 5 men can together finish an embroidery work in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the work, and also that taken by 1 man alone.

Answer

Let the number of days taken by a woman and a man be x and y respectively.

Therefore, work done by a woman in 1 day = $1/x$

According to the question,

$$4(2/x + 5/y) = 1$$

$$2/x + 5/y = 1/4$$

$$3(3/x + 6/y) = 1$$

$$3/x + 6/y = 1/3$$

Putting $1/x = p$ and $1/y = q$ in these equations, we get

$$2p + 5q = 1/4$$

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By cross multiplication, we get

$$p/-20-(-18) = q/-9-(-18) = 1/144-180$$

$$p/-2 = q/-1 = 1/-36$$

$$p/-2 = -1/36 \text{ and } q/-1 = 1/-36$$

$$p = 1/18 \text{ and } q = 1/36$$

$$p = 1/x = 1/18 \text{ and } q = 1/y = 1/36$$

$$x = 18 \text{ and } y = 36$$

Hence, number of days taken by a woman = 18 and number of days taken by a man = 36

(iii) Roohi travels 300 km to her home partly by train and partly by bus. She takes 4 hours if she travels 60 km by train and remaining by bus. If she travels 100 km by train and the remaining by bus, she takes 10 minutes longer. Find the speed of the train and the bus separately.

Answer

Let the speed of train and bus be u km/h and v km/h respectively.

According to the given information,

$$60/u + 240/v = 4 \dots \text{(i)}$$

$$100/u + 200/v = 25/6 \dots \text{(ii)}$$

Putting $1/u = p$ and $1/v = q$ in the equations, we get

$$60p + 240q = 4 \dots \text{(iii)}$$

$$100p + 200q = 25/6$$

$$600p + 1200q = 25 \dots \text{(iv)}$$

Multiplying equation (iii) by 10, we get

$$600p + 2400q = 40 \dots \text{(v)}$$

Subtracting equation (iv) from (v), we get $1200q = 15$

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$$q = 15/200 = 1/80 \dots \text{(vi)}$$

Putting equation (iii), we get

$$60p + 3 = 4$$

$$60p = 1$$

$$p = 1/60$$

$$p = 1/u = 1/60 \text{ and } q = 1/v = 1/80$$

$$u = 60 \text{ and } v = 80$$

Hence, speed of train = 60 km/h and speed of bus = 80 km/h.

Exercise 3.7 (Optional)

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

Answer

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Let the ages of Ani and Biju be x year and y year respectively.

According to the given condition,

$$x - y = \pm 3 \quad \dots(i)$$

Also, age of Ani's father Dharam = $2x$ year

and age of Biju's sister = $\frac{y}{2}$ year

According to the given condition,

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

$$\Rightarrow 4x - y = 60 \quad \dots(ii)$$

Case I When $x - y = 3 \quad \dots(iii)$

On subtracting Eq. (iii) from Eq. (i), we get

$$3x = 57 \Rightarrow x = 19 \text{ yr}$$

On putting $x = 19$ in Eq. (iii), we get

$$19 - y = 3 \Rightarrow y = 16 \text{ yr}$$

$\therefore x = 19 \text{ yr}$ and $y = 16 \text{ yr}$

Case II When $x - y = -3 \quad \dots(iv)$

On subtracting Eq. (iv) from Eq. (ii), we get

$$\therefore 3x = 60 + 3$$

$$\Rightarrow 3x = 63$$

$$\Rightarrow x = 21$$

On putting $x = 21$ in Eq. (iv), we get

$$21 - y = -3 \Rightarrow y = 24 \text{ yr}$$

Hence, age of Ani is 19 yr and age of Biju is 16 yr or age of Ani is 21 yr and age of Biju is 24 yr.

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

[Hint : $x + 100 = 2(y - 100)$, $y + 10 = 6(x - 10)$].

Answer

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Let the amount of their respective capitals be ₹ x and ₹ y .

∴ According to the given condition,

$$\begin{aligned} x + 100 &= 2(y - 100) \\ \Rightarrow x - 2y &= -300 \quad \dots(i) \end{aligned}$$

$$\begin{aligned} \text{and} \quad 6(x - 10) &= y + 10 \\ \Rightarrow 6x - y &= 70 \quad \dots(ii) \end{aligned}$$

On multiplying Eq. (i) by 2 and subtracting from Eq. (i)

$$\begin{aligned} x - 12x &= -300 - 140 \\ \Rightarrow -11x &= -440 \Rightarrow x = ₹ 40 \end{aligned}$$

On putting $x = 40$ in Eq. (i), we get

$$\begin{aligned} 40 - 2y &= -300 \\ \Rightarrow 2y &= 340 \\ \Rightarrow y &= ₹ 170 \end{aligned}$$

Hence, the amount of their respective capitals are ₹ 40 and ₹ 170.

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

Answer

Solution Let the actual speed of the train be $x \text{ kmh}^{-1}$ and actual time taken by $y \text{ yr}$.

∴ Distance = Speed \times Times = $(xy) \text{ km}$

∴ According to the given condition,

$$\begin{aligned} xy &= (x + 10)(y - 2) \\ \Rightarrow xy &= xy - 2x + 10y - 20 \\ \Rightarrow 2x - 10y + 20 &= 0 \\ \Rightarrow x - 5y + 10 &= 0 \quad \text{(Divide by 2) } \dots(i) \end{aligned}$$

$$\begin{aligned} \text{and} \quad xy &= (x - 10)(y + 3) \\ \Rightarrow xy &= xy + 3x - 10y - 30 \\ \Rightarrow 3x - 10y - 30 &= 0 \quad \dots(ii) \end{aligned}$$

On multiplying Eq. (i) by 3 and subtracting Eq. (ii) from Eq. (i),

$$\begin{aligned} 3(x - 5y + 10) - (3x - 10y - 30) &= 0 \\ \Rightarrow -5y &= 60 \\ \Rightarrow y &= 12 \end{aligned}$$

On putting $y = 12$ in Eq. (i), we get

$$\begin{aligned} x - 5 \times 12 + 10 &= 0 \\ \Rightarrow x - 60 + 10 &= 0 \\ \Rightarrow x &= 50 \end{aligned}$$

Hence, the distance covered by the train = $50 \times 12 = 600 \text{ km}$

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

Answer

Let the number of students in the class be x and the number of rows be y .

∴ The number of rows in each row = $\frac{x}{y}$

According to the given condition,

$$x = \left(\frac{x}{y} + 3\right)(y - 1)$$

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

$$\Rightarrow \frac{x}{y} - 3y + 3 = 0 \quad \dots(i)$$

and $x = \left(\frac{x}{y} - 3\right)(y + 2)$

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

$$\Rightarrow \frac{2x}{y} - 3y - 6 = 0 \quad \dots(ii)$$

Putting $\frac{x}{y} = u$ in Eqs. (i) and (ii),

$$u - 3y + 3 = 0 \quad \dots(iii)$$

and $2u - 3y - 6 = 0 \quad \dots(iv)$

On subtracting Eq. (iii) from Eq. (iv),

$$u - 9 = 0 \Rightarrow u = 9$$

On substituting $u = 9$ in Eq. (iii), we get

$$9 - 3y + 3 = 0 \Rightarrow 3y = 12$$

$$\Rightarrow y = 4 \quad \dots(v)$$

Now, $u = 9 \Rightarrow \frac{x}{y} = 9$

$$\frac{x}{4} = 9 \quad \text{[From Eq. (v), } y = 4\text{]}$$

$$\Rightarrow x = 36$$

∴ The number of students in the class = $xy = 36 \times 4 = 144$

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

Answer

We have,

$$\angle C = 3 \angle B = 2 (\angle A + \angle B) \quad \dots(i)$$

\therefore The sum of the three angles of a triangle is 180° .

$$\therefore \angle A + \angle B + \angle C = 180^\circ$$

$$\Rightarrow \angle A + \angle B + 2 (\angle A + \angle B) = 180^\circ \quad [\text{From Eq. (i)}]$$

$$\Rightarrow 3 \angle A + 3 \angle B = 180^\circ$$

$$\Rightarrow \angle A + \angle B = 60^\circ \quad (\text{Divide by 3}) \dots(ii)$$

Again $\angle A + \angle B + \angle C = 180^\circ$

$$\Rightarrow \angle A + \angle B + 3 \angle B = 180^\circ \quad [\text{From Eq. (i)}]$$

$$\Rightarrow \angle A + 4 \angle B = 180^\circ \quad \dots(iii)$$

On subtracting Eq. (ii) from Eq. (iii),

$$3 \angle B = 120^\circ$$

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

On putting $\angle B = 40^\circ$ in Eq. (ii), we get

$$\angle A + 40^\circ = 60^\circ$$

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

On putting $\angle B = 40^\circ$ in Eq. (i), we get

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

$$= 120^\circ$$

Hence, the angles are $\angle A = 20^\circ$, $\angle B = 40^\circ$ and $\angle C = 120^\circ$.

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

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

Answer

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The given equations are

$$5x - y = 5 \quad \dots(i)$$

and

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

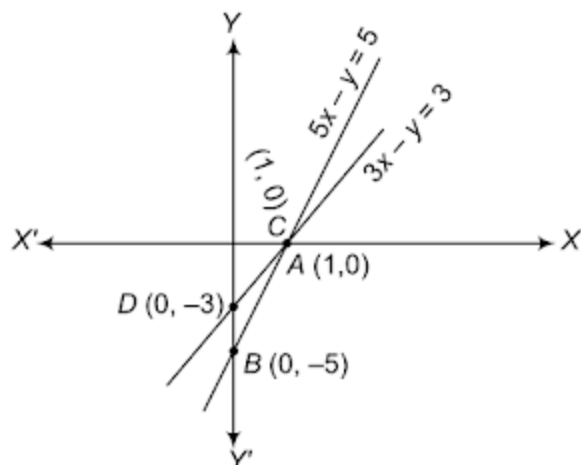
Table for $5x - y = 5$

x	1	0
y	0	-5
Points	A	B

Table for $3x - y = 3$

x	1	0
y	0	-3
Points	C	D

Now, we plot the points $A(1, 0)$ and $B(0, -5)$ on a graph paper and join these points to form a line AB . Also we plot the points $C(1, 0)$ and $D(0, -3)$ on the same graph paper and join these points form the line CD .



\therefore Required triangle is of ΔABD and whose vertices are $A(1, 0)$, $B(0, -5)$ and $D(0, -3)$.

NCERT 10th Maths Chapter 3, class 10 Maths Chapter 3 solutions

7. Solve the following pair of linear equations:

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- (i) $px + qy = p - q$ (ii) $ax + by = c$
 $qx - py = p + q$ $bx + ay = 1 + c$
- (iii) $\frac{x}{a} - \frac{y}{b} = 0$ (iv) $(a - b)x + (a + b)y = a^2 - 2ab - b^2$
 $ax + by = a^2 + b^2$ $(a + b)(x + y) = a^2 + b^2$
- (v) $152x - 378y = -74$
 $-378x + 152y = -604$

Answer (i) Given pair of linear equations is

$$px + qy = p - q \quad \dots(i)$$

and $qx - py = p + q \quad \dots(ii)$

On multiplying Eq. (i) by p and Eq. (ii) by q and then adding, we get

$$p^2x + q^2x = (p^2 - pq) + (pq + q^2)$$

$$\Rightarrow x(p^2 + q^2) = p^2 + q^2 \Rightarrow x = 1$$

On putting $x = 1$ in Eq. (i), we get

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

Hence, solution is $x = 1$ and $y = -1$.

(ii) Given pair of linear equations is

$$ax + by = c \quad \dots(i)$$

and $bx + ay = 1 + c \quad \dots(ii)$

On multiplying Eq. (i) by b and Eq. (ii) by a and subtracting Eq. (ii) from Eq. (i),

$$b^2y - a^2y = bc - (a + ac)$$

$$\Rightarrow y(b^2 - a^2) = \frac{bc - a - ac}{b^2 - a^2}$$

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

On putting the value of y in Eq. (i), we get

$$ax + b \left(\frac{a + ac - bc}{a^2 - b^2} \right) = c$$

$$\Rightarrow ax = c - \left(\frac{ab + abc - b^2c}{a^2 - b^2} \right)$$

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

$$\Rightarrow ax = \frac{a(ac - b - bc)}{a^2 - b^2}$$

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

Hence, solution is $x = \frac{ac - b - bc}{a^2 - b^2}$ and $y = \frac{a + ac - bc}{a^2 - b^2}$.

(iii) Given pair of linear equations is

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

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

$$bx - ay = a^2 - b^2 \quad \dots(i)$$

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

On multiplying Eq. (i) by b and Eq. (ii) by a and adding, we get

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

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



8. ABCD is a cyclic quadrilateral (see Fig. 3.7). Find the angles of the cyclic quadrilateral.

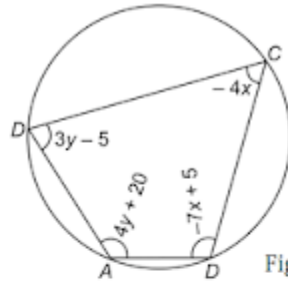


Fig: 3.7

Answer

Since, in cyclic quadrilateral, the sum of two opposite angles is 180° .

$$\therefore \angle B + \angle D = 180^\circ$$

$$\angle A + \angle C = 180^\circ$$

$$\Rightarrow 3y - 5 - 7x + 5 = 180^\circ$$

$$\text{and } 4y + 20 - 4x = 180^\circ$$

$$\Rightarrow 3y - 7x = 180^\circ \quad \dots(i)$$

$$\text{and } 4y - 4x = 160^\circ$$

$$\Rightarrow 3y - 7x = 180^\circ \quad \dots(ii)$$

$$\text{and } y - x = 40^\circ \quad \text{(Divide by 4)} \dots(ii)$$

On multiplying Eq. (ii) by 7 and subtracting from Eq. (i), we get

$$-4y = 180^\circ - 280^\circ$$

$$\Rightarrow -4y = -100 \Rightarrow y = 25^\circ$$

On putting $y = 25^\circ$ in Eq. (ii), we get

$$25^\circ - x = 40^\circ \Rightarrow x = -15^\circ$$

Hence, solution is $x = -15^\circ$ and $y = 25^\circ$.



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- Chapter 4 Quadratic Equations
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