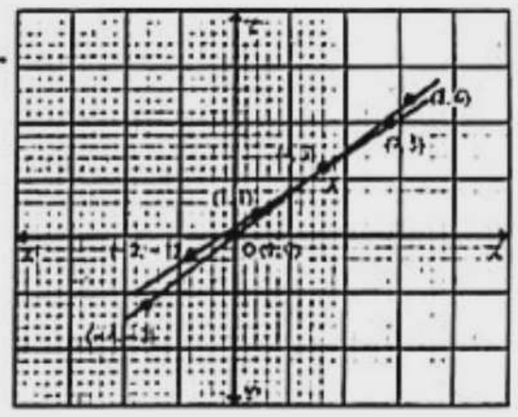
Chapter 06

Simple Simultaneous Equations

Contents for Discussion

• Simple Simultaneous equations • Method of solution of simple simultaneous equatuions of two variables • Formation and solution to simultaneous equations of real life problems • Graphical solution of simple simultaneous equations.

Learning Outcomes : After studying this chapter, I will be able to–



- explain the method of substitution and elimination
- solve simple simultaneous equations with two variables
- form and solve simple simultaneous equations of mathematical problems
- show the solution of simple simultaneous equation in graph
- solve simple simultaneous equations with the help of graph

Practice

Solutions to Mathematical Problems following 100% accurate format for best prep.

Dear learners, mathematical problems of this chapter have been divided into exercise, multiple choice, short, creative and exercise-based activities in light of the learning outcomes. Practice the solutions well to ensure the best preparation in the exam.

Exercise 6.1 : Method of Solution of Simple Simultaneous Equations of Two Variables

At a Glance Important Contents of Exercise

- **Equation :** Mathematical sentence including variables, operational sign and equality sign is called an equation. For example, $x + 4y - 1 = 0$.
- **Simple Equation :** Equations in which the highest degree of the variable is 1 are called simple equations.
- **Axioms for solving equation :** There are four axioms for solving equations. These are as follows :
  (1) If the same quantity is added to each of two equal quantities, their sum will also be equal.
  (2) If the same quantity is subtracted from each of two equal quantities, their differences will also be equal.
  (3) If each of two equal quantities is multiplied by the same quantity, their products will also be equal.
  (4) If each of two equal quantities is divided by the same non-zero quantity, their quotients will also be equal.
- **Simultaneous equations :** If two or more equations are connected by the same set of variables, the equations are called simultaneous equations.
- **Simple Simultaneous equations :** If each of the variables is of one dimension, they ae known as simple simultaneous equations.

Solutions to Exercise Problems — Let's solve the textbook problems

Solutions to Mathematical Problems

A. Solve the following by using the method of substitution (1 – 12) :

1. $x + y = 4$
$x - y = 2$

Solution : Given equation,
$x + y = 4$ ..... (1)
$x - y = 2$ ..... (2)
From (2) we have,
$x = 2 + y$ ..... (3)

Now, putting the value of x from (3) in (1), we have,

$2 + y + y = 4$

or, $2y = 4 - 2$

or, $2y = 2$

or, $y = 1$, dividing both sides by 2

Again putting $y = 1$ in (3) we get,

$x = 2 + 1$ or, $x = 3$

So, the calculated solution : $(x, y) = (3, 1)$.

2. $\mathbf{2x + y = 5}$

$\mathbf{x - y = 1}$

Solution : Given equation,

$2x + y = 5$ ..... (1)

$x - y = 1$ ..... (2)

From (2) we have,

$x = y + 1$ ..... (3)

Putting the value of x from (3) in (1) we get,

$2(y + 1) + y = 5$

or, $2y + 2 + y = 5$

or, $3y = 5 - 2$

or, $3y = 3$

or, $y = 1$

Now putting $y = 1$ in (3) we get,

$x = 1 + 1$ or, $x = 2$

So, the calculated solution : $(x, y) = (2, 1)$

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

$\mathbf{x - y = 0}$

Solution : Given equation,

$3x + 2y = 10$ ..... (1)

$x - y = 0$ ..... (2)

From (2) we have,

$x = y$ ..... (3)

Now putting $x = y$ from (3) in (1), we get,

$3y + 2y = 10$

or, $5y = 10$

or, $y = \frac{10}{5}$

or, $y = 2$

Putting $y = 2$ in (3) we have,

$x = 2$

So, the calculated solution : $(x, y) = (2, 2)$

4. $\mathbf{\frac{x}{a} + \frac{y}{b} = \frac{1}{a} + \frac{1}{b}}$

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

Solution : Given equation,

$\frac{x}{a} + \frac{y}{b} = \frac{1}{a} + \frac{1}{b}$ ..... (1)

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

From (2) we have,

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

or, $\frac{bx - ay}{ab} = \frac{b - a}{ab}$

or, $bx - ay = b - a$, multiplying both sides by ab.

or, $bx = ay + b - a$

or, $x = \frac{ay + b - a}{b}$ ..... (3)

Putting from (3) the value of x in (1), we have,

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

or, $\frac{ay + b - a + ay}{ab} = \frac{a + b}{ab}$

or, $2ay + b - a = a + b$

or, $2ay = 2a + b - b$

or, $2ay = 2a$

or, $y = 1$, dividing both sides by 2a

Now putting $y = 1$ in (3), we have,

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

or, $x = 1$

So, the calculated solution : $(x, y) = (1, 1)$.

5. $\mathbf{3x - 2y = 0}$

$\mathbf{17x - 7y = 13}$

Solution : Given equation,

$3x - 2y = 0$..... (1)

$17x - 7y = 13$ ..... (2)

From (1), we have,

$3x = 2y$

or, $y = \frac{3x}{2}$ ..... (3)

Putting $y = \frac{3x}{2}$ from (3) in (2), we get,

$17x - 7 \times \frac{3x}{2} = 13$

or, $17x - \frac{21x}{2} = 13$

or, $\frac{34x - 21x}{2} = 13$

or, $34x - 21x = 13 \times 2$

or, $13x = 26$

or, $x = 2$, dividing both sides by 13

Now putting $x = 2$, in (3), we have,

$y = \frac{3 \times 2}{2}$

or, $y = 3$

So, the calculated solution : $(x, y) = (2, 3)$.

6. **$x - y = 2a$**
$ax - by = a^2 + b^2$

Solution : Given equation,

$x - y = 2a$ ..... (1)
$ax - by = a^2 + b^2$ ..... (2)
From (1), we have,
$x - y = 2a$
or, $x = 2a + y$ ..... (3)
Putting $x = 2a + y$, from (3) in (2), we have,
$a \times (2a + y) - by = a^2 + b^2$
or, $2a^2 + ay - by = a^2 + b^2$
or, $ay - by = a^2 + b^2 - 2a^2$
or, $y(a - b) = b^2 - a^2$
or, $y = \frac{b^2 - a^2}{a - b}$
or, $y = \frac{(b + a)(b - a)}{(a - b)}$
or, $y = -(a + b)$.
Again, putting $y = -(a + b)$ in (3), we get,
$x = 2a - (a + b)$
or, $x = a - b$
So, the calculated solution :
$(x, y) = \{a - b, -(a + b)\}$

7. **$ax + by = ab$**
$bx + ay = ab$

Solution : Given equation,
$ax + by = ab$ ..... (1)
$bx + ay = ab$ ..... (2)
From (1), we have,
$ax = ab - by$
or, $x = \frac{ab - by}{a}$ ..... (3)
Now putting $x = \frac{ab - by}{a}$ from (3) in (2), we get,
$b \times \frac{ab - by}{a} + ay = ab$
or, $\frac{ab^2 - b^2y}{a} + ay = ab$
or, $\frac{ab^2}{a} - \frac{b^2y}{a} + ay = ab$
or, $ay - \frac{b^2y}{a} = ab - b^2$
or, $\frac{(a^2 - b^2)y}{a} = ab - b^2$
or, $(a^2 - b^2)y = a(ab - b^2)$
or, $y = \frac{ab(a - b)}{a^2 - b^2}$
or, $y = \frac{ab(a - b)}{(a + b)(a - b)}$
or, $y = \frac{ab}{a + b}$
Again, putting $y = \frac{ab}{a + b}$ in (3), we have,
$x = \frac{ab - b \times \frac{ab}{a + b}}{a}$
or, $x = \frac{ab(a + b) - ab^2}{a(a + b)}$
or, $x = \frac{a^2b + ab^2 - ab^2}{a(a + b)}$
or, $x = \frac{a^2b}{a(a + b)}$
or, $x = \frac{ab}{a + b}$
So, the calculated solution : $(x, y) = \left(\frac{ab}{a + b}, \frac{ab}{a + b}\right)$.

8. **$ax - by = ab$**
$bx - ay = ab$

Solution : Given equation,
$ax - by = ab$ ..... (1)
$bx - ay = ab$ ..... (2)
From (1), we have,
$ax = ab + by$
or, $x = \frac{ab + by}{a}$ ..... (3)
Putting $x = \frac{ab + by}{a}$ from (3) in (2), we have,
$\frac{b(ab + by)}{a} - ay = ab$
or, $\frac{ab^2}{a} + \frac{b^2y}{a} - ay = ab$
or, $\frac{b^2y}{a} - ay = ab - b^2$
or, $\left(\frac{b^2 - a^2}{a}\right)y = b(a - b)$
or, $y = \frac{b(a - b)}{\frac{b^2 - a^2}{a}}$
or, $y = \frac{ab(a - b)}{(b - a)(a + b)}$
or, $y = \frac{-ab(a - b)}{(a - b)(a + b)}$
or, $y = \frac{-ab}{a + b}$

Again, putting $y = \frac{-ab}{a+b}$ in (3), we get,

$$x = \frac{ab + b \times \frac{-ab}{a+b}}{a}$$

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

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

or, $x = \frac{a^2b}{a(a+b)}$

or, $x = \frac{ab}{a+b}$

So, the calculated solution : $(x, y) = \left(\frac{ab}{a+b}, \frac{-ab}{a+b}\right)$.

9. $\mathbf{ax - by = a - b}$
$\mathbf{ax + by = a + b}$

Solution : Given equation,

$ax - by = a - b$ ..... (1)

$ax + by = a + b$ ..... (2)

From (1), we have,

$ax = by + a - b$

or, $x = \frac{by + a - b}{a}$ ..... (3)

Putting the value of x from (3) in (2), we have,

$a \times \frac{by + a - b}{a} + by = a + b$

or, $by + a - b + by = a + b$

or, $2by = a + b - a + b$

or, $2by = 2b$

or, $y = 1$, dividing both sides by 2b.

Again, putting $y = 1$ in (3), we get,

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

or, $x = \frac{a}{a}$

or, $x = 1$.

So, the calculated solution : $(x, y) = (1, 1)$.

10. $\mathbf{\frac{1}{x} + \frac{1}{y} = \frac{5}{6}}$
$\mathbf{\frac{1}{x} - \frac{1}{y} = \frac{1}{6}}$

Solution : Given equation,

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

$\frac{1}{x} - \frac{1}{y} = \frac{1}{6}$ ..... (2)

From (2), we get,

$\frac{1}{x} = \frac{1}{6} + \frac{1}{y}$ ..... (3)

Now putting $\frac{1}{x} = \frac{1}{6} + \frac{1}{y}$ from (3) in (1), we have,

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

or, $\frac{2}{y} = \frac{5}{6} - \frac{1}{6}$

or, $\frac{2}{y} = \frac{4}{6}$

or, $4y = 12$, by cross-multiplication,

or, $y = 3$, dividing both sides by 4

Again, putting $y = 3$ in (3), we get,

$\frac{1}{x} = \frac{1}{6} + \frac{1}{3}$

or, $\frac{1}{x} = \frac{3}{6}$

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

or, $x = 2$, by cross-multiplication.

So, the calculated solution : $(x, y) = (2, 3)$.

11. $\mathbf{\frac{x}{a} + \frac{y}{b} = \frac{2}{a} + \frac{1}{b}}$
$\mathbf{\frac{x}{b} - \frac{y}{a} = \frac{2}{b} - \frac{1}{a}}$

Solution : Given equation,

$\frac{x}{a} + \frac{y}{b} = \frac{2}{a} + \frac{1}{b}$ ..... (1)

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

From (2), we get,

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

or, $\frac{x}{b} \times \frac{b}{a} = \frac{y}{a} \times \frac{b}{a} + \frac{2}{b} \times \frac{b}{a} - \frac{1}{a} \times \frac{b}{a}$, multiplying both sides by $\frac{b}{a}$.

or, $\frac{x}{a} = \frac{by}{a^2} + \frac{2}{a} - \frac{b}{a^2}$ ..... (3)

Putting the value of $\frac{x}{a}$ from (3) in (1), we get,

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

or, $\frac{by}{a^2} + \frac{y}{b} = \frac{2}{a} + \frac{1}{b} - \frac{2}{a} + \frac{b}{a^2}$

or, $\frac{b^2y + a^2y}{a^2b} = \frac{a^2 + b^2}{a^2b}$

or, $\left(\frac{a^2 + b^2}{a^2b}\right) y = \frac{a^2 + b^2}{a^2b}$

or, $y = 1$, dividing both sides by $\frac{a^2 + b^2}{a^2b}$.

Again, putting $y = 1$ in (3), we get,

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

or, $\frac{x}{a} = \frac{2}{a}$

or, $x = 2$, multiplying both sides by a.

So, the calculated solution : $(x,y) = (2, 1)$.

12. $\frac{a}{x}+\frac{b}{y}=\frac{a}{2}+\frac{b}{3}$

$\frac{a}{x}-\frac{b}{y}=\frac{a}{2}-\frac{b}{3}$

Solution : Given equation,

The given two equations are–

$\frac{a}{x}+\frac{b}{y}=\frac{a}{2}+\frac{b}{3}$ .....(i)

$\frac{a}{x}-\frac{b}{y}=\frac{a}{2}-\frac{b}{3}$.....(ii)

From (ii) we get,

$\frac{a}{x}=\frac{b}{y}+\frac{a}{2}-\frac{b}{3}$ .....(iii)

Now putting the value of $\frac{a}{x}$ from (iii) in (i),

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

or $\frac{b}{y}+\frac{b}{y}=\frac{b}{3}+\frac{b}{3}$, cancelling $\frac{a}{2}$ from both sides.

or, $\frac{2b}{y}=\frac{2b}{3}\Rightarrow y=3$

Now putting y = 3 in (iii), we get

$\frac{a}{x}=\frac{b}{3}+\frac{a}{2}-\frac{b}{3}$ or, $\frac{a}{x}=\frac{a}{2}\Rightarrow x=2$

∴ The required solution, (x, y) = (2, 3).

B. Solve the following by using the method of elimination : (13 to 26).

13. **x – y = 4**
x + y = 6

Solution : Given,

x – y = 4 ..... (1)
x + y = 6 ..... (2)

2x = 10, adding (1) and (2)

or, $x=\frac{10}{2}$

or, x = 5,

Putting x = 5 in (2), we have,

5 + y = 6

or, y = 6 – 5

or, y = 1

So, the calculated solution : (x, y) = (5, 1).

14. **2x + 3y = 7**
6x – 7y = 5

Solution : Given,

2x + 3y = 7 ..... (1)

6x – 7y = 5 ..... (2)

Multiplying (1) by 3 and (2) by (1), we get,

6x + 9y = 21 ..... (3)
6x – 7y = 5 ..... (4)

16y = 16, subtracting (4) from (3)

or, y = 1, dividing both sides by 16.

Now putting y = 1 in (2), we have,

6x – 7 × 1 = 5

or, 6x = 5 + 7

or, 6x = 12

or, x = 2, dividing both sides by 6.

So, the calculated solution : (x, y) = (2, 1).

15. **4x + 3y = 15**
5x + 4y = 19

Solution : Given,

4x + 3y = 15 ..... (1)

5x + 4y = 19 ..... (2)

Multiplying (1) by 5 and (2) by 4, we have,

20x + 15y = 75 ..... (3)
20x + 16y = 76 ..... (4)

– y = – 1, subtracting (4) from (3)

or, y = 1, multiplying both sides by – 1.

Now putting y = 1 in (1), we get,

4x + 3 = 15

or, 4x = 12

or, x = 3, dividing both sides by 4.

So, the calculated solution : (x, y) = (3, 1).

16. **3x – 2y = 5**
2x + 3y = 12

Solution : Given,

3x – 2y = 5 ..... (1)

2x + 3y = 12 ..... (2)

Multiplying (1) by 2 and (2) by 3, we get,

6x – 4y = 10 ..... (3)
6x + 9y = 36 ..... (4)

– 13y = – 26, subtracting (4) from (3)

or, y = 2, dividing both sides by – 13.

Putting y = 2 in (1), we get,

3x – 2 × 2 = 5

or, 3x = 5 + 4

or, 3x = 9

or, x = 3, dividing both sides by 3

So, the calculated solution : (x, y) = (3, 2).

17. **4x – 3y = – 1**
3x – 2y = 0

Solution : Given equation,

4x – 3y = – 1 ..... (1)

3x – 2y = 0 ..... (2)

Multiplying (1) by 2 and (2) by 3, we get,

8x – 6y = – 2 ..... (3)
9x – 6y = 0 ..... (4)

– x = – 2, subtracting (4) from (3)

or, x = 2, dividing both sides by – 1.

Putting x = 2 in (2), we have,

3 × 2 – 2y = 0

or, 2y = 6

or, y = 3, dividing both sides by 2.

So, the calculated solution : (x, y) = (2, 3).

18. $3x - 5y = -9$
$5x - 3y = 1$

Solution : Given equation,

$3x - 5y = -9$ ..... (1)

$5x - 3y = 1$ ..... (2)

Multiplying (1) by 5 and (2) by 3, we get,

$15x - 25y - 45$ ..... (3)

$15x - 9y = 3$..... (4)

$-16y = -48$, subtracting (4) from (3)

or, $y = 3$, dividing both sides by -16.

Now putting $y = 3$ in (2), we get,

$5x - 3 \times 3 = 1$

or, $5x = 1 + 9$

or, $5x = 10$

or, $x = 2$, dividing both sides by 5.

So, the calculated solution : $(x, y) = (2, 3)$

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

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

Solution : Given equation,

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

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

Adding (2) to (1), we get,

$2 \times \frac{x}{2} = 4$

or, $x = 4$

Putting $x = 4$ in (1), we have,

$\frac{4}{2} + \frac{y}{2} = 3$

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

or, $y = 2$, multiplying both sides by 2.

So, the calculated solution : $(x, y) = (4, 2)$.

20. $x + ay = b$
$ax - by = c$

Solution : Given equation,

$x + ay = b$ ..... (1)

$ax - by = c$ ..... (2)

Multiplying (1) by a and (2) by 1, we get,

$ax + a^2y = ab$ ..... (3)

$ax - by = c$ ..... (4)

$a^2y + by = ab - c$, subtrcting (4) from (3)

or, $(a^2 + b)\, y = ab - c$.

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

Now putting the value of y in (1), we have,

$x + a \times \frac{ab - c}{a^2 + b} = b$.

or, $x = b - \frac{a^2b - ca}{a^2 + b}$

or, $x = \frac{b(a^2 + b) - (a^2b - ca)}{a^2 + b}$

or, $x = \frac{a^2b + b^2 - a^2b + ca}{a^2 + b}$

or, $x = \frac{b^2 + ca}{a^2 + b}$.

So, the calculated solution :

$(x, y) = \left(\frac{b^2 + ca}{a^2 + b}, \frac{ab - c}{a^2 + b}\right)$.

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

Solution : Given equation,

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

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

Adding (1) to (2), we have,

$\frac{x}{2} + x = 6$

or, $\frac{x + 2x}{2} = 6$

or, $3x = 12$, by cross multiplication,

or, $x = 4$, dividing both sides by 3

Putting $x = 4$ in (1), we get,

$\frac{4}{2} + \frac{y}{3} = 3$

or, $\frac{y}{3} = 3 - 2$

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

or, $y = 3$, by cross-multiplication,

So, the calculated solution : $(x, y) = (4, 3)$.

22. $\frac{x}{3} - \frac{2}{y} = 1;\ \frac{x}{4} + \frac{3}{y} = 3$

Solution : Given equation,

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

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

Multiplying (1) by 3 and (2) by 2, we get,

$x - \frac{6}{y} = 3$ ..... (3)

$\frac{x}{2} + \frac{6}{y} = 6$ ..... (4)

$\therefore\ x + \frac{x}{2} = 9$, adding (3) and (4)

or, $\frac{2x + x}{2} = 9$

or, $3x = 9 \times 2$

or, $3x = 18$

or, $x = 6$, dividing both sides by 3.

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Now putting x = 6 in (1), we have,

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

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

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

or, $y=2$

So, the required solution : (x, y) = (6, 2).

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

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

Solution : Given equation,

$\frac{x}{a}+\frac{y}{b}=\frac{2}{a}+\frac{1}{b}$ ..... (1)

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

Multiplying (1) by b and (2) by a, we have,

$\frac{bx}{a}+y=\frac{2b}{a}+1$ ..... (3)

$\frac{ax}{b}-y=\frac{2a}{b}-1$ ..... (4)

$\therefore$ $\frac{bx}{a}+\frac{ax}{b}=\frac{2b}{a}+\frac{2a}{b}$, adding (3) and (4)

or, $\left(\frac{b}{a}+\frac{a}{b}\right)x=2\left(\frac{b}{a}+\frac{a}{b}\right)$

or, x = 2, dividing both sides by $\frac{b}{a}+\frac{a}{b}$

Now putting x = 2 in (1), we get,

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

or, $\frac{y}{b}=\frac{2}{a}+\frac{1}{b}-\frac{2}{a}$

or, $\frac{y}{b}=\frac{1}{b}$

or, y = 1, multiplying both sides by b.

So, the calculated solution : (x, y) = (2, 1).

24. $\frac{a}{x}+\frac{b}{y}=\frac{a}{2}+\frac{b}{3}; \frac{a}{x}-\frac{b}{y}=\frac{a}{2}-\frac{b}{3}$

Solution : Given equation,

$\frac{a}{x}+\frac{b}{y}=\frac{a}{2}+\frac{b}{3}$ ..... (1)

$\frac{a}{x}-\frac{b}{y}=\frac{a}{2}-\frac{b}{3}$ ..... (2)

From (1) + (2),

$\frac{a}{x}+\frac{a}{x}=\frac{a}{2}+\frac{a}{2}$

or, $\frac{2a}{x}=\frac{2a}{2}$

or, $\frac{1}{x}=\frac{1}{2}$ (Multiplying both sides by $\frac{1}{2a}$)

$\therefore$ x = 2 (By using cross-multiplication method)

Now, from (I) we have,

$\frac{a}{2}+\frac{b}{y}=\frac{a}{2}+\frac{b}{3}$ ($\therefore$ x = 2)

or, $\frac{b}{y}=\frac{b}{3}$ (Concelling $\frac{a}{2}$ from both sides)

or, $\frac{1}{y}=\frac{1}{3}$ (Dividing both sides by b)

$\therefore$ y = 3 (Using cross- multiplication method)

So, the calculated solution : (x, y) = (2, 3).

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

Solution : Given equation,

$\frac{x}{6}+\frac{2}{y}=2$ ..... (1)

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

Multiplying (1) by 1 and (2) by 2, we get,

$\frac{x}{6}+\frac{2}{y}=2$ ..... (3)

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

$\therefore$ $\frac{x}{6}+\frac{x}{2}=4$, adding (3) and (4)

or, $\frac{x+3x}{6}=4$

or, 4x = 24, by cross-multiplication,

or, x = 6, Dividing both sides by 4.

Now putting x = 6 in (1), we have,

$\frac{6}{6}+\frac{2}{y}=2$ or, $\frac{2}{y}=1$

or, y = 2, by cross-multiplication.

So, the calculated solution : (x, y) = (6, 2).

26. $x+y=a-b; ax-by=a^2+b^2$ *[All Board 2013]*

Solution : Given equation,

$x+y=a-b$ ..... (1)

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

Multiplying (1) by a and (2) by 1, we get,

$ax+ay=a^2-ab$ ..... (3)

$ax-by=a^2+b^2$ ..... (4)

$\therefore$ $ay+by=-ab-b^2$, subtracting (4) from (3)

or, $(a+b)y=-b(a+b)$

or, y = – b, dividing both sides by a + b,

Putting y = – b in (1), we get,

$x-b=a-b$

or, $x=a-b+b$

or, x = a.

So, the calculated solution : (x, y) = (a, – b).

Multiple Choice Q/A Designed as per topic

6.1 Simple Simultaneous equations

▸ Textbook Page 101

1. **An equation of the form ax + by + c = 0, where a, b and c are constants, a ≠ 0, b ≠ 0, is called a linear equation with the variables x and y. Now which one of the following is a linear equation?** *(Easy)*
   ⓐ x = 0 ⓑ x + y = 10
   ⓑ ⓒ y = 6 ⓓ a, b & c
2. **When a system of equations has a solution, it is called a consistent system. Now which one of the following is not a consistent system?** *(Easy)*
   ⓐ x + 2y = 5 and 3x – 2y + 1 = 0
   ⓑ x = 5 and 3x – 2y + 1 = 0
   ⓒ x – y = 5 and x – 2y + 1 = 0
   ⓓ ⓓ 6x – 4y = 5 and 3x – 2y + 1 = 0
3. **When a system has no solution, it is called an inconsistent system. Now which one of the following is an inconsistent system?** *(Easy)*
   ⓐ x + 2y = 5 and 3x – 2y + 1 = 0
   ⓑ x = 5 and 3x – 2y + 1 = 0
   ⓒ x – y = 5 and x – 2y + 1 = 0
   ⓓ ⓓ x – y = 5 and 2x – 2y + 1 = 0
4. **The system of equations is consistent and has an infinitely many solutions. What do you mean by this?** *(Easy)*
   ⓐ The two equations represent two straight lines and they intersect each other at a unique point.
   ⓑ The two equations represent two straight lines coinciding or representing the same straight line.
   ⓒ The two equations represent two straight lines and they are parallel to each other.
   ⓑ ⓓ a, b & c
5. **The system of equations is inconsistent or has no solution. What do you mean by this?** *(Easy)*
   ⓐ The two equations represent two straight lines and they intersect each other at a unique point.
   ⓑ The two equations represent two straight lines and they coincide or represent the same straight line.
   ⓒ The two equations represent two straight lines and they are parallel to each other.
   ⓒ ⓓ a, b & c
6. **How many dimension in each of the variables of Simple Simultaneous Equations?** *(Easy)* *[Ideal School & College, Dhaka]*
   ⓐ ⓐ 1 ⓑ 2 ⓒ 3 ⓓ None
7. i. A system of equations can be solved in five methods
   ii. x = 5 represents a line parallel to y-axis
   iii. x + y = 5 has infinite number of solutions
   What is/are the correct answer/answers after the above statements? *(Easy)*
   ⓐ i & ii ⓑ i, ii & iii
   ⓑ ⓒ ii & iii ⓓ i & iii
8. **What is the power of equation 2x + 3y = 10.** *(Medium)* *[JB '17]*
   ⓐ ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4
9. **3x + 2y = 7.** *[CB '17]*
   i. A simultaneous equation
   ii. Has infinite solution of the equation
   iii. Has two variables of the equation
   Which one is correct? *(Easy)*
   ⓒ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

6.2 Method of solution of simple simultaneous equations of two variables

▸ Textbook Page 102

10. **A pair of values, one for x and another one for y, which satisfy the equation, are called a solution to the equation with two variables. Now which one is not the solution of the equation x + 2y = 5.** *(Easy)*
    ⓐ (1, 2) ⓑ (9, – 2)
    ⓐ ⓒ (3, 1) ⓓ (2, 2)
11. **A solution of a system of two equations with two variables is an ordered pair which when substituted into each equation, makes each equation a true statement. Now what is the solution of the system of equations x + 2y = 5 and 3x – 2y + 1 = 0?** *(Medium)*
    ⓐ ⓐ (1, 2) ⓑ (1, 1) ⓒ (2, 1) ⓓ (2, 2)
12. **How many methods are there for finding the solution set of a system of linear equations of two variables?** *(Easy)*
    ⓒ ⓐ 3 ⓑ 4 ⓒ 5 ⓓ 6
13. **What is solution to the equations x + y = 2a and $\frac{a}{x} + \frac{a}{y} = 2$?** *(Medium)*
    ⓐ (1, 1) ⓑ (a, a)
    ⓑ ⓒ (2a, 1) ⓓ (1, 2a)
14. **If the sum of the numerator and the denominator is 14 and the difference is 8 of a proper fraction, which one of the following is the fraction?** *(Medium)* *[DB '19]*
    ⓓ ⓐ $\frac{5}{9}$ ⓑ $\frac{9}{5}$ ⓒ $\frac{3}{11}$ ⓓ $\frac{11}{3}$
15. **Which equation is satisfied by the point (3, 2)?** *(Medium)* *[CB '19]*
    ⓐ x – y = 0 ⓑ 2x – 3y = 0
    ⓑ ⓒ $x = \frac{1}{y}$ ⓓ 2x + 3y = 5

16. The sum and the difference of the numerator and the denominator of a proper fraction are 12 and 2. What is the denominator of the fraction? *(Medium)* *[CB '19]*
ⓒ ⓐ 3 ⓑ 5 ⓒ 7 ⓓ 9

17. If $x - y = 2p$ and $px + qy = p^2 + q^2$, then (x, y) = ? *(Medium)* *[CtgB '19]*
ⓐ $(p - q, p + q)$ ⓑ $(q - p, p + q)$
ⓓ ⓒ $(p + q, p - q)$ ⓓ $(p + q, q - p)$

18. If $2x + 3y = 8$, $3x - 2y = -1$, which one of the following will be the value of (x, y)? *(Medium)* *[SB '19]*
ⓐ $(-2, 4)$ ⓑ $(3, 5)$
ⓒ ⓒ $(1, 2)$ ⓓ $(-3, -4)$

19. Which point satisfy $2x - 3y = 18$? *(Easy)* *[DB '18]*
ⓐ $(-3, 4)$ ⓑ $(-4, 3)$
ⓓ ⓒ $(4, -3)$ ⓓ $(3, -4)$

20. If $x + y = 5$ and $x - y = 7$ then, (x, y) = ? *(Medium)* *[RB '18]*
ⓐ $(6, 1)$ ⓑ $(6, -1)$
ⓑ ⓒ $(1, 6)$ ⓓ $(-1, 6)$

21. If $x + 2y = 6$ and $x - 3y = 1$, which one of the following will be the value of $\frac{x}{y}$? *(Medium)* *[CtgB '18]*
ⓒ ⓐ $\frac{1}{4}$ ⓑ $\frac{1}{2}$ ⓒ 4 ⓓ 5

22. If $2x + y = 5$ and $2y = 6$, what is the value of (x, y)? *(Medium)* *[SB '18]*
ⓐ $(1, 3)$ ⓑ $(3, 1)$
ⓐ ⓒ $\left(\frac{3}{2}, 2\right)$ ⓓ $\left(2, \frac{3}{2}\right)$

23. If $x + 2y = 9$, $2x - y = 3$, which one of the following will be the value of (x, y)? *(Medium)* *[DB '17]*
ⓒ ⓐ $(1, 1)$ ⓑ $(2, 2)$ ⓒ $(3, 3)$ ⓓ $(3, 2)$

24. If $x + 2y = 5$ and $2x = 6$ then which is the root of equations. *(Hard)* *[JB '17]*
ⓓ ⓐ $(-3, 5)$ ⓑ $(1 - 3)$ ⓒ $(1, 2)$ ⓓ $(3, 1)$

25. Which is the solution of the equations $3x + 4y = 10$ and $x - y = 1$? *(Medium)* *[SB '17]*
ⓐ $(1, 2)$ ⓑ $(2, 1)$
ⓑ ⓒ $(4, 5)$ ⓓ $(0, -1)$

26. If $x - y = 2a$ and $ax + by = a^2 + b^2$, then (x, y) = what? *(Hard)* *[BB '17]*
ⓐ (a, b) ⓑ (b, a)
ⓓ ⓒ $(a + b, a - b)$ ⓓ $(a + b, b - a)$

27. Solution of the equations $2x + 5y = 16$ and $x - 2y = -1$ is? *(Medium)* *[DjB '17]*
ⓐ $(8, 0)$ ⓑ $(3, 2)$
ⓑ ⓒ $(1, 2)$ ⓓ $\left(\frac{1}{2}, 3\right)$

28. What is the distance of the point A (3, 4) from X axis? *(Hard)* *[DjB '17]*
ⓑ ⓐ 3 ⓑ 4 ⓒ 5 ⓓ 7

29. For which value of (x, y) the equation $2x + 3y = 14$ is satisfied? *(Medium)* *[DB '16]*
ⓐ $(4, 2)$ ⓑ $(4, 1)$
ⓐ ⓒ $(1, 4)$ ⓓ $(2, 4)$

30. If $x + y = 7$ and $x - y = 3$ then, what is the value of (x, y)? *(Hard)* *[RB '16]*
ⓐ $(2, 2)$ ⓑ $(2, 5)$
ⓓ ⓒ $(10, 4)$ ⓓ $(5, 2)$

31. What is the solution of the equation $2x + y = 7$ and $x + 2y = 8$? *(Hard)* *[SB '16]*
ⓐ $(8, 0)$ ⓑ $(6, 1)$
ⓓ ⓒ $(4, 2)$ ⓓ $(2, 3)$

32. Which is the solution of equations $x + y = 5$ and $2x - y = 4$? *(Medium)* *[DjB '16]*
ⓐ $(2, 3)$ ⓑ $(3, 2)$
ⓑ ⓒ $(4, 1)$ ⓓ $(1, 4)$

33. If $x + y = 4$, $x - y = 2$, then which is the root of simultaneous equations? *(Hard)* *[RB' 15]*
ⓐ $(1, 3)$ ⓑ $(3, 1)$
ⓑ ⓒ $(3, -1)$ ⓓ $(3, 4)$

34. Which one of the following is correct if $x = \frac{3}{4}$? *(Hard)* *[JB' 15]*
ⓐ $4x + 3 = 0$ ⓑ $4x + 3 = 4$
ⓓ ⓒ $4x - 6 = 0$ ⓓ $4x - 3 = 0$

35. If $x = 0$ in equation $x + 7y = 14$, which one is the value of y? *(Medium)* *[Ctg.B' 15]*
ⓐ ⓐ 2 ⓑ 4 ⓒ 0 ⓓ 8

36. Which one is the common point of the equations $x + y = 7$ and $x - y = 1$. *(Hard)* *[Ctg.B' 15]*
ⓐ $(-3, -4)$ ⓑ $(3, 4)$
ⓒ ⓒ $(4, 3)$ ⓓ $(-4, 3)$

37. If $x + 2y = 6$ and $x - 3y = 1$, which one of the following will be the value of $\frac{x}{y}$? *(Hard)* *[Rajuk Uttara Model College, Dhaka]*
ⓒ ⓐ $\frac{1}{4}$ ⓑ $\frac{1}{2}$ ⓒ 4 ⓓ 5

38. $\frac{2}{x} + \frac{1}{y} = 1$ and $\frac{4}{x} - \frac{9}{y} = -1$ are two equations. What is the value of (x, y)? *(Hard)* *[Ideal School & College, Dhaka]*
ⓐ $\left(\frac{4}{11}, \frac{3}{11}\right)$ ⓑ $\left(\frac{11}{3}, \frac{11}{4}\right)$
ⓒ ⓒ $\left(\frac{11}{4}, \frac{11}{3}\right)$ ⓓ $(4, 3)$

39. i. If a system of equations is consistent and independent, they have only one point of intersection
ii. If a system of equations is consistent and independent, they have infinite number of point of intersections
iii. If a system of equations is consistent and dependent, they have infinite number of point of intersections
What is/are the correct answer/answers after the above statements? *(Easy)*
ⓐ i & ii
ⓑ ii & iii
ⓒ i & iii
ⓒ ⓓ i, ii & iii

40. **If $x + y = 6$ and $xy = 5$, then—** *[SB '17]*
i. $x - y = 4$
ii. $x^3 - y^3 = 124$ iii. $x^3 + y^3 = 130$
Which one is correct? *(Medium)*
ⓐ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Using the following information answer the question No. 41 and 42 :
$(x + y - z)$ and $(x + y + z)$ are two algebraic expression. *[Rajuk Uttara Model College, Dhaka]*

41. **$x + y = 2$ and $z = 2$, then what is the product of two expressions?** *(Medium)*
ⓒ ⓐ 9 ⓑ 4 ⓒ 0 ⓓ 1

42. **If $x^2 + y^2 + z^2 = p$ and $xy + yz + zx = q$, then what is the square of 2nd expression?** *(Hard)*
ⓐ $p + 2q$ ⓑ $p^2 + 2q$
ⓐ ⓒ $p + 4q^2$ ⓓ $p^2 + q^2$

Short Q/A Designed as per topic

6.1 Simple Simultaneous equation

▸ Textbook Page 101

Question 1. What is meant by simultaneous equations and simple simultaneous equations?
Solution: Simultaneous equations and simple simultaneous equations : If more than one equation is satisfied by the value of the variable, the equations are called simultaneous equations and if the variable is of one dimension, the simultaneous equations are called simple simultaneous equations.

Question 2. What is meant by equation and simple equation?
Solution: Equation : A mathematical sentence containing a process symbol and an equal sign is called an equation. For example, $x + y = 10$.
Simple equation : An equation with a variable of one dimension is called a simple equation.
A simple equation can have one or more variables. For example, $x + 3y = 10$, $2x + 2y = 1$.

Question 3. What is the root of a simultaneous equation?
Solution : The values of the variables that satisfy the simultaneous equations are called the roots or solutions of the simultaneous equations.
Here, $x + y = 5$ and $x - y = 3$ are two simultaneous equations.
Their only solution is $x = 4$ and $y = 1$ which is expressed by $(x, y) = (4, 1)$.

6.2 Method of solution of simple simultaneous equations of two variables

▸ Textbook Page 102

Question 4. Solve the two equations 1x+y=7 and x-y=1 by the method of substitution.
Solution: Given equations, $x + y = 7$.....(i)
$x - y = 1$.....(ii)
From (ii), we get–
$x - y = 1$
or, $x = y + 1$.....(iii)
Substituting $x = y + 1$ in equation (i), we get–
$y + 1 + y = 7$
or, $2y = 7 - 1$
or, $2y = 6$
or, $y = \frac{6}{2}$
$\therefore y = 3$
Substituting the value of y in (iii),
we get– $x = 3 + 1 = 4$
Required solution : $(x, y) = (4, 3)$.

Question 5. $x + 2y = 5$ and $2x = 6$ solve the equations by the method of substitution.
Solution: Given equations,
$x + 2y = 5$.....(i)
$2x = 6$.....(ii)
From (ii), we get–
$2x = 6$
or, $x = \frac{6}{2} = 3$
Substituting the value of x in (i),
we get– $3 + 2y = 5$
or, $2y = 5 - 3$
or, $2y = 2$
$\therefore y = \frac{2}{2} = 1$
Required solution $(x, y) = (3, 1)$.

Question 6. Solve by the method of substitution: $x + y = 12$ and $x - y = 6$.
Solution:
$x + y = 12$ .....(i)
$x - y = 6$ .....(ii)

From (i), we get $y = 12 - x$ .....(iii)
Substituting the value of y in (ii), we get
$x - (12 - x) = 6$
or, $x - 12 + x = 6$
or, $2x = 6 + 12 = 18$
$\therefore \quad x = \frac{18}{2} = 9$
Substituting the value of x in (iii), we get
$y = 12 - 9 = 3$
Required solution $(x, y) = (9, 3)$

Question 7. If x = 2 in equation $y = \frac{10 - 9x}{4}$, (x, y) = what?

Solution : Given equation, $y = \frac{10 - 3x}{4}$

If, $x = 2$, then $y = \frac{10 - 3 \times 2}{4}$

or, $y = \frac{10 - 6}{4}$

or, $y = \frac{4}{4} \quad \therefore y = 1$

Required solution $(x, y) = (2, 1)$.

Question 8. Solve by the method of elimination :
$2x + y = 10$
$x - 2y = 5$

Solution : Given equations: $2x + y = 10$..... (i)
$x - 2y = 5$.....(ii)
Multiplying (i) by 2 and (ii) by 1 we get,

$$\begin{array}{rcrcr} 4x & + & 2y & = & 20 \\ x & - & 2y & = & 5 \\ (-) & & (+) & & (-) \\ \hline 5x & & & = & 25 \end{array}$$

or. $x = \frac{25}{5} = 5$
Substituting the value of x in (i), we get–
$2 \times 5 + y = 10$
or, $10 + y = 10$
or, $y = 10 - 10 \quad \therefore y = 0$
Required solution $(x, y) = (5, 0)$.

Question 9. Solve the equations x − y = 4 and x + y = 6 by the method of elimination.

Solution : Given equations : $x - y = 4$.....(i)
$x + y = 6$ .....(ii)
Multiplying (i) by 1 and (ii) by 1 and adding, we get,

$$\begin{array}{rcl} x - y & = & 4 \\ x + y & = & 6 \\ \hline 2x & = & 10 \text{ [Adding]} \end{array}$$

or, $x = \frac{10}{2}$
$\therefore \quad x = 5$
Substituting the value of x in (ii), we get,
$5 + y = 6$
or, $y = 6 - 5$
$\therefore y = 1$
Required solution $(x, y) = (5, 1)$

Question 10. Solve the equations ax − by = a − b and ax + by = a + b by the method of elimination.

Solution : Given equations,
$ax - by = a - b$ ..... (i)
$ax + by = a + b$ ..... (ii)
(Adding) $2ax = 2a$
or, $x = 1$
Substituting the value of x in (ii), we get,
$a.1 + by = a + b$
or, $by = a + b - a$
or, $by = b$
$\therefore \quad y = \frac{b}{b} = 1$
Required value $(x, y) = (1, 1)$.

Question 11. What is the solution of $\frac{x}{2} + \frac{y}{3} = 3$ and $x - \frac{y}{3} = 3$?

Solution : Given equations,
Adding (i) and (ii), we get–

$$\begin{array}{l} \frac{x}{2} + \frac{y}{3} = 3 \\ x - \frac{y}{3} = 3 \\ \hline \frac{x}{2} + x = 6 \end{array}$$

or, $\frac{x + 2x}{2} = 6$
or, $3x = 12$
$\therefore \quad x = \frac{12}{3} = 4$
Substituting the value of x in (i), we get–
$\frac{4}{2} + \frac{y}{3} = 3$
or, $2 + \frac{y}{3} = 3$
or, $\frac{y}{3} = 3 - 2 = 1$
$\therefore \quad y = 3$
Required solution $(x, y) = (4, 3)$

Question 12. What is the value of x in the system of equations 2x − y = 5, x − y = 2?

Solution: Given equations, $2x - y = 5$ .....(i)
$x - y = 2$ .....(ii)
Subtracting (ii) from (i) we get.

$$\begin{array}{rcrcr} 2x & - & y & = & 5 \\ x & - & y & = & 2 \\ (-) & & (+) & & (-) \\ \hline x & & & = & 3 \end{array}$$

Required value $x = 3$

Creative Q/A Designed as per learning outcomes

Ques. 01 Read the following statement and answer the questions given below :
The length and the breadth of a rectangular garden are x metres and y metres respectively. The relationship between the length and breadth can be expressed by the equations $\frac{x}{7}+\frac{y}{3}=\frac{67}{7}$ and $\frac{x}{5}-\frac{y}{4}=\frac{1}{2}$.

a. Now express the given equations in the form $ax + by = c$. 2
b. Solve the derived system of equations by using the method of elimination and find the length and breadth of the garden. 4
c. There is a road around inside the garden of 3 metres breadth. How many square stones of length 50 cm each are needed to cover the road? 4

Solution to Question No. 01 :

a Given equations are $\frac{x}{7}+\frac{y}{3}=\frac{67}{7}$ ... ... (i)

and $\frac{x}{5}-\frac{y}{4}=\frac{1}{2}$ ... ... (ii)

From equation (i) we get, $\frac{x}{7}+\frac{y}{3}=\frac{67}{7}$

or, $\frac{3x+7y}{21}=\frac{67}{7}$

or, $3x+7y=\frac{67}{7}\times 21$ i.e $3x+7y=201$

Again from equation (ii) we get, $\frac{x}{5}-\frac{y}{4}=\frac{1}{2}$

or, $\frac{4x-5y}{20}=\frac{1}{2}$

or, $4x-5y=\frac{1}{2}\times 20$ i.e. $4x-5y=10$

Hence, $3x + 7y = 201$ and $4x - 5y = 10$ are in the form $ax + by = c$ of the equations $\frac{x}{7}+\frac{y}{3}=\frac{67}{7}$ and $\frac{x}{5}-\frac{y}{4}=\frac{1}{2}$ respectively.

b From 'a' we get, $3x + 7y = 201$ ... ... (iii) and $4x - 5y = 10$ ... ... (iv)
Multiplying equations (iii) and (iv) by 5 and 7 respectively and then by adding we get,

$$\begin{array}{r} 15x+35y=1005 \\ 28x-35y=70 \\ \hline \text{or, } 43x=1075 \end{array}$$

or, $x=\frac{1075}{43}=25$

By putting, $x = 25$ in equation (iii) we get,
$3\times 25+7y=201$
or, $7y=201-75$
or, $y=\frac{126}{7}=18$

∴ The length and the breadth of the garden are 25 metres and 18 metres respectively.

c From 'b' we get, length and breadth of the garden are 25 metres and 18 metres respectively.
The area of the garden with road = (25×18) sq m = 450 sq m
The length of the garden without road = $\{25-(3\times 2)\}$ m = $(25-6)$ m = 19 m.
The breadth of the garden without road = $\{18-(3\times 2)\}$ m = $(18-6)$ m = 12 m.
∴ The area of the garden without road = (19×12) sq m = 228 sq m.
∴ The area of the road = $(450 - 228)$ sq m = 222 sq m.
Now 50 cm = 0·5 m
∴ The area of a square stone = $(0{\cdot}5)^2$ sq m = 0·25 sq m.
∴ The number of required stones to cover the road = $\frac{222}{0{\cdot}25}$ pieces = 888 pieces.

Ques. 02
(i) $3x - 4y = 2$ and $5x + 3y = 42$ are two simple equations.
(ii) If 5 is added with the numerator of a fraction, it will be 2. Again if 2 is added with the denominator it will be $\frac{1}{2}$.

a. If $a + b = 5$ and $a - b = 3$ then find the value of (a, b). 2
b. Solve the equations from (i) by using elimination method. 4
c. Find the fraction from (ii). 4

[Cumilla Board-2018]

Solution to Question No. 02 :

a Here, $a + b = 5$ ..... (1)
and $a - b = 3$ ..... (2)
Adding (1) and (2), we get,
$2a = 8 \Rightarrow a = 4$
Putting $a = 4$ in (1), we get,
$4 + b = 5 \Rightarrow b = 1$
∴ $(a, b) = (4, 1)$

b From (i), we get,
$3x - 4y = 2 \Rightarrow 9x - 12y = 6$, multiplying by 3 .. (1)
And $5x + 3y = 42 \Rightarrow 20x + 12y = 168$, " " 4 .... (2)

Now, adding (1) and (2), we get,

$29x = 174 \Rightarrow x = \frac{174}{29} \Rightarrow x = 6$

Again, $3x - 4y = 2 \Rightarrow 15x - 20y = 10$, multiplying by 5 .... (3)

And $5x + 3y = 42 \Rightarrow 15x + 9y = 126$ " " 3 .....(4)

Now, subtracting (4) from (3), we get,

$-29y = -116 \Rightarrow y = 4$

$\therefore$ The required solution : $(x, y) = (6, 4)$

c Let the fraction $= \frac{x}{y}$

Now, according to the given information,

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

$\Rightarrow x - 2y + 2 = 0$ ..... (1)

Again, $\frac{x}{y+2} = \frac{1}{2} \Rightarrow 2x = y + 2$

$\Rightarrow 2x - y - 2 = 0$ ..... (2)

From (2) we get, $y = 2x - 2$ ..... (3)

Putting $y = 2x - 2$ in (1), we get,

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

or, $x - 4x + 4 + 2 = 0$

or, $-3x = -6$

or, $x = 2$

Now, putting $x = 2$ in (3), we get, $y = 2 \times 2 - 2$

or, $y = 2$

$\therefore$ The desired fraction is $\frac{2}{2}$.

Exercise 6.2 : Formation and solution of simultaneous equations of real life problem

At a Glance Important Contents of Exercise

- **Formation of simultaneous equations of real life problems :** From the conception of simple simultaneous equations, we can solve many problems of real life. We use more than one variable in many problems. We form the equation using a separate symbol for each variable.
- **Graphical solution of simple simultaneous equations :** There are two equations in simple simultaneous equations with two variables. By drawing the graphs of two simple equations, we get two straight lines. The point of intersection of these lines lies on both the straight lines. The co-ordinates (x, y) of this point of intersection will be the solution of the given simple simultaneous equations. The two equations are satisfied simultaneously by the obtained values of x and y. Therefore, only solution to a pair of simple simultaneous equations is the abscissa and the ordinate of the point of intersection.

Solutions to Exercise Problems — Let's solve the textbook problems

MCQs with Answers

1. Given that $x + y = 5$, $x - y = 3$. Which one of the following will be the value of (x, y)?

ⓐ (4, 1) ⓑ (1, 4)
a ⓒ (2, 3) ⓓ (3, 2)

Explanation : Adding two equaions,

or, $2x = 8$

or, $x = \frac{8}{2}$

$\therefore x = 4$

Putting value of x in 1st equation,

$4 + y = 5$

or, $y = 5 - 4$

$\therefore y = 1$

2. Which one of the following does not denote the equation for the straight line?

ⓐ $3x - 3y = 0$ ⓑ $x + y = 5$
c ⓒ $x = \frac{1}{y}$ ⓓ $4x + 5y = 9$

Explanation : Equations in which the highest degree of the variable is 1 are called simple equations.

3. What would be the value of x in the system of equations, $x - 2y = 8$ and $3x - 2y = 4$?

ⓐ -5 ⓑ -2
b ⓒ 2 ⓓ 5

Explanation : Subtracting 2nd equation from 1st equation,

$-2x = 4$

or, $x = \frac{4}{-2}$

$\therefore x = -2$

4. How many variables are there in the equation $4x + 5y = 9$?

ⓐ 0 ⓑ 1
c ⓒ 2 ⓓ 3

Explanation : x and y are 2 variable of the equation $4x + 5y = 9$.

5. **Which one is the co-ordinate of the main point (origin)?**
ⓐ (0, 0) ⓑ (0, 1)
ⓐ ⓒ (1, 0) ⓓ (1, 1)

6. **In which quadrant the point (– 3, – 5) will be?**
ⓒ ⓐ First ⓑ Second ⓒ Third ⓓ Fourth
Explanation : In the 3rd quadrant, both abscissa and ordinates are negative in the xy plane. So, (– 3, – 5) lies in the 3rd quadrant.

7. **The points on the graphs of the equation x + 2y = 30.**
i. (10, 10)
ii. (0, 15)
iii. (10, 20)
Which one of the following is correct?
ⓐ i & ii ⓑ i & iii
ⓐ ⓒ ii & iii ⓓ i, ii & iii
Explanation : Given, $x + 2y = 30$
(i) (10, 10), L.H.S $= x + 2y = 10 + 2 \times 10$
$= 10 + 20 = 30 =$ R.H.S
(ii) (0, 15), L.H.S $= x + 2y = 0 + 2 \times 15$
$= 30 =$ R.H.S
(iii) (10, 20), L.H.S $= x + 2y$
$= 10 + 2 \times 20$
$= 10 + 40 = 50 \neq$ R.H.S
That is, (i) and (ii) are correct.

Answer to the questions 8 and 9 on the basis of the following statement :
Half of the difference between the numbers x and y is 4. How many times of smaller number will be added to get the sum 20. Here, $x > y$.

8. **Which one is the first condition?**
ⓐ $x - y = 4$ ⓑ $x - y = 8$
ⓑ ⓒ $y - x = 4$ ⓓ $y - x = 8$
Explanation : $\frac{x-y}{2} = 4$ or, $x - y = 8$

9. **Which one is the value of (x, y)?**
ⓐ (3, 11) ⓑ (7, 3)
ⓓ ⓒ (11, 7) ⓓ (11, 3)
Explanation : 1st condition : $x - y = 8$ [From 8]
or, $x = 8 + y$ ..... (i)
2nd condition : $x + 3y = 20$
or, $8 + y + 3y = 20$ [From (i)]
or, $8 + 4y = 20$
or, $4y = 20 - 8 = 12$
or, $y = \frac{12}{4} = 3$
$\therefore y = 3$
Putting value of y in equation (i), $x = 8 + 3$
$\therefore x = 11$
$\therefore (x, y) = (11, 3)$.

Solutions to Mathematical Problems

10. If the sum and the difference of two numbers are 100 and 20 respectively, find the two numbers.
Solution : Let us suppose,
the greater number = x and the smaller number = y
So, to satisfy 1st condition, we have,
$x + y = 100$ ..... (1)
Again, as per 2nd condition, we have,
$x - y = 20$ ..... (2)
Now adding (1) to (2), we get,
$2x = 120$
or, $x = 60$, dividing both sides by 2.
Putting the value of x in (1), we have,
$60 + y = 100$
or, $y = 100 - 60$
or, $y = 40$
That is, the greater number is 60 and smaller number is 40.

11. If the sum of two numbers is 160 and one number is thrice the other, find the two numbers.
Solution :
Let us suppose,
One of the two numbers = x,
∴ Other number = 3x, as per 2nd condition.
So, $3x + x = 160$, as per 1st condition,
or, $4x = 160$
or, $x = 40$, dividing both sides by 4.
That is, one number = 40
So, the other number = 40×3, or, 120.

12. Of two numbers the sum of thrice of the first and double of the second is 59. Again, the difference of the second number from double of the first is 9. Find the two numbers.
Solution :
Let us suppose,
the 1st number = x and
the 2nd number = y.
As per 1st condition :
$3x + 2y = 59$ ..... (1)
As per 2nd condition :
$2x - y = 9$ ..... (2)
Adding (1) to 2 times of (2), we have,
$3x + 4x = 59 + 18$
or, $7x = 77$
or, $x = 11$, dividing both sides by 7,
Putting $x = 11$ in (1), we get,
$3 \times 11 + 2y = 59$
or, $2y = 59 - 33$
or, $2y = 26$
or, $y = 13$, dividing both sides by 2.
That is, the 1st number is 11 and the 2nd number is 13.

13. 5 years ago the ratio of the ages of father and son was 3 : 1 and after 15 years that will be 2 : 1. Find the present age of father and son.

Solution :

Let us suppose,

Father's present age = x years and

Son's present age = y years.

So, 5 years ago, father's age was (x – 5) years and " " " son's " " (y – 5) years.

∴ As per 1st condition :

$(x - 5) : (y - 5) = 3 : 1$

or, $\frac{x-5}{y-5} = \frac{3}{1}$

or, $x - 5 = 3y - 15$

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

or, $x = 3y - 10$ ---------- (1)

As per 2nd condition :

$(x + 15) : (y + 15) = 2 : 1$

or, $\frac{x+15}{y+15} = \frac{2}{1}$

or, $x + 15 = 2y + 30$

or, $x = 2y + 30 - 15$

or, $x = 2y + 15$ ---------- (2)

Now balancing (1) and (2), we have,

$3y - 10 = 2y + 15$

or, $3y - 2y = 10 + 15$

or, $y = 25$

Putting y = 25 in (2),

$x = 2 \times 25 + 15$

or, $x = 50 + 15$

or, $x = 65$.

That is, father's present age is 65 and son's present age is 25.

14. If 5 is added to the numerator of a fraction, it will be 2. Again, if 1 is subtracted from the denominator, it will be 1. Find the fraction.

Solution :

Let us suppose,

the numerator of the fraction = x and

the denominator of the fraction = y.

∴ The fraction $= \frac{x}{y}$ ..... (1)

As per 1st condition :

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

or, $x + 5 = 2y$

or, $x = 2y - 5$ ..... (2)

As per 2nd condition :

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

or, $x = y - 1$ ..... (3)

Now balancing (2) and (3), we have,

$2y - 5 = y - 1$

or, $2y - y = 5 - 1$

or, $y = 4$

Putting the value of y in (3), we get,

$x = 4 - 1$

or, $x = 3$

So, from (1), we get,

the required fraction : $\frac{x}{y} = \frac{3}{4}$

15. If the sum and the difference of the numerator and the denominator of a proper fraction are 14 and 8 respectively, find the fraction.

Solution :

Let, the numerator of the fraction = x

and the denominator of the fraction = y.

And x < y.

As per first condition :

$x + y = 14$ ..... (1)

As per 2nd condition :

$y - x = 8$ ..... (2)

Adding (1) and (2), we have,

$2y = 22$

or, $y = 11$.

Putting y = 11 in (1), we get, $x + 11 = 14$

or, $x = 3$

∴ The required proper fraction is $\frac{x}{y} = \frac{3}{11}$

16. If the sum and the difference of two digits of a two digit number are 10 and 4 respectively, find the number.

Solution : Let us suppose,

the digits of ones and tens places are x and y, so that x > y.

∴ As per 1st condition :

$x + y = 10$ ..... (1)

And as per 2nd condition :

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

Adding (1) and (2), we have, $2x = 14$

or, $x = 7$

Putting the value of x in (1), we get,

$7 + y = 10$

or, $y = 10 - 7$

or, $y = 3$

Again for y > x,

$y - x = 4$; in this case,

$x = 3$ and $y = 7$

∴ The required number = 37 or 73.

17. The length of a rectangle is 25 metre more than the breadth. If the perimeter of the rectangle is 150 metre, find the length and the breadth of the rectangle.

Solution : Let, the breadth = x metre

∴ Its length = (x + 25) metre

So, the perimeter of the rectangular land = 2(x + x + 25) metre = 2(2x + 25) metre.

But the given perimeter = 150 metre

∴ $2(2x + 25) = 150$

or, $4x + 50 = 150$

or, $4x = 150 - 50$

or, $4x = 100$

or, $x = 25$

That is, the breadth of the land = 25 metre.

∴ Its length = (25 + 25) metre = 50 metre.

∴ Breadth 25 metre, length 50 metre.

18. A boy bought 15 notebooks and 10 pencils at Tk. 300. Again, another boy bought same type of 10 note-books and 15 pencils at Tk. 250. Find the price of each notebook and each pencil.

Solution :

Let the price per piece of notebook = x taka and the price per piece of pencil = y taka.

So, the total price of 15 pcs notebook and 10 pcs pencils = (15x + 10y) taka.

As per 1st condition :

$15x + 10y = 300$ ..... (1)

Again, the total price of 10 pcs notebook and 15 pcs pencil = (10x + 15y) taka.

As per 2nd condition :

$10x + 15y = 250$ ..... (2)

Now multiplying (1) by 10 and (2) by 15, we get,

$150x + 100y = 3000$ ..... (3)

$150x + 225y = 3750$ ..... (4)

Subtracting (4) from (3), we get,

$-125y = -750$

or, $y = \frac{-750}{-125}$

or, $y = 6$

Putting the value of y in (1), we have,

$15x + 60 = 300$

or, $15x = 300 - 60$

or, $15x = 240$

or, $x = 16$.

That is the price per piece of notebook is 16 taka and that of pencil is 6 taka.

19. A person has Tk. 5,000. He divides that amount between two persons in such a way that the first person's share is 4 times the second one. Again, if the first person gives Tk. 1,500 to the second person, both the amounts become equal. Find the amount of each person.

Solution :

Let us suppose, 1st person's share = x taka and 2nd person's share = y taka.

Now according to 1st condition, $x = 4y$ ..... (i)

Again, according 2nd condition,

$x - 1500 = y + 1500$

or, $x = y + 1500 + 1500$

or, $x = y + 3000$, ... (ii)

Now putting the value of x from (i) to (ii), we get.

$4y = y + 3000$

or, $3y = 3000$

or, $y = 1000$, dividing both sides by 3. That is, 2nd person's share 1000 taka. Putting y = 1000 in (i) we get $x = 4 \times 1000 = 4000$ ie. 1st person's share.

So, 1st person's share is 4000 taka and 2nd person's share is 1000 taka.

20. Solve with the help of graphs :

a. $\mathbf{x + y = 6}$

$\mathbf{x - y = 2}$

Solution :

Here,

$x + y = 6$ ..... (1)

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

For solution let us find out some points against equations (1) and (2) for the required graph as under :

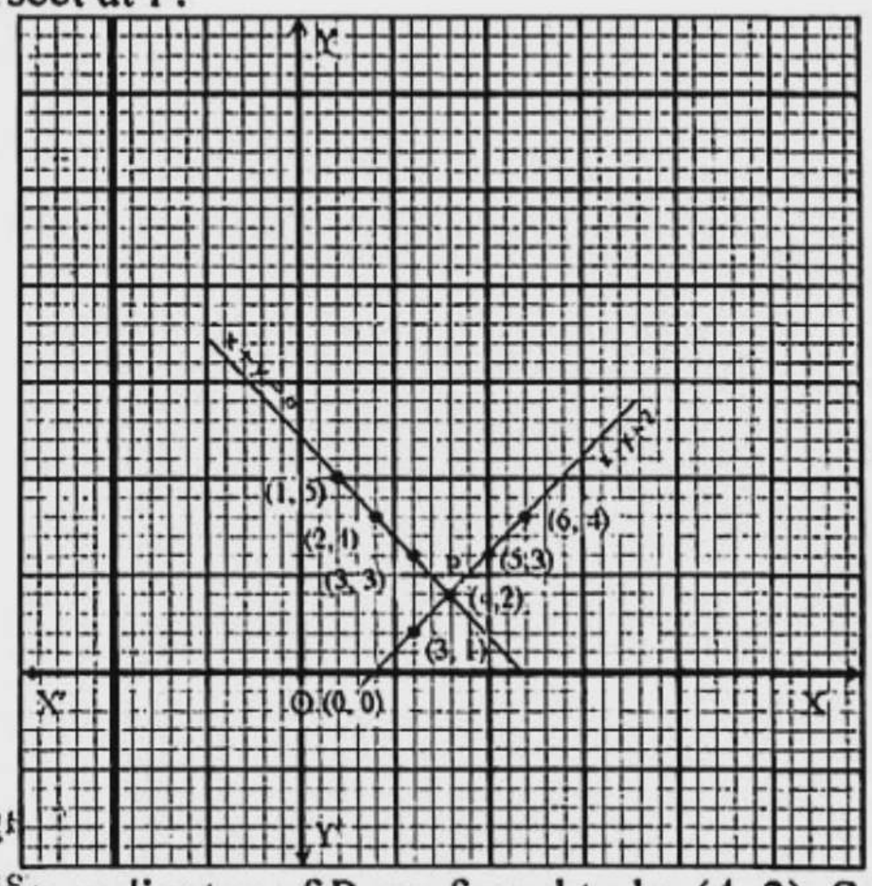
For equation (1) : $y = 6 - x$

For equation (2) : $y = x - 2$

For equation (1)		For equation (2)	
x	y	x	y
1	5	5	3
4	2	4	2
3	3	3	1
2	4	6	4

Let us plot the above points of the equations on a graph paper taking X'OX as x-axis and Y'OY as y-axis with the origin at O. Let us also consider the length of sides of the two smallest square of the graph paper as unit along both the axes.

After plotting and joining the points of the given equations, we have the following graph, showing two straight lines. Let, the two straight lines intersect at P.



The co-ordinates of P are found to be (4, 2). So, the solution of the given equation, (x, y) = (4, 2).

b. $x + 4y = 11$
$4x - y = 10$

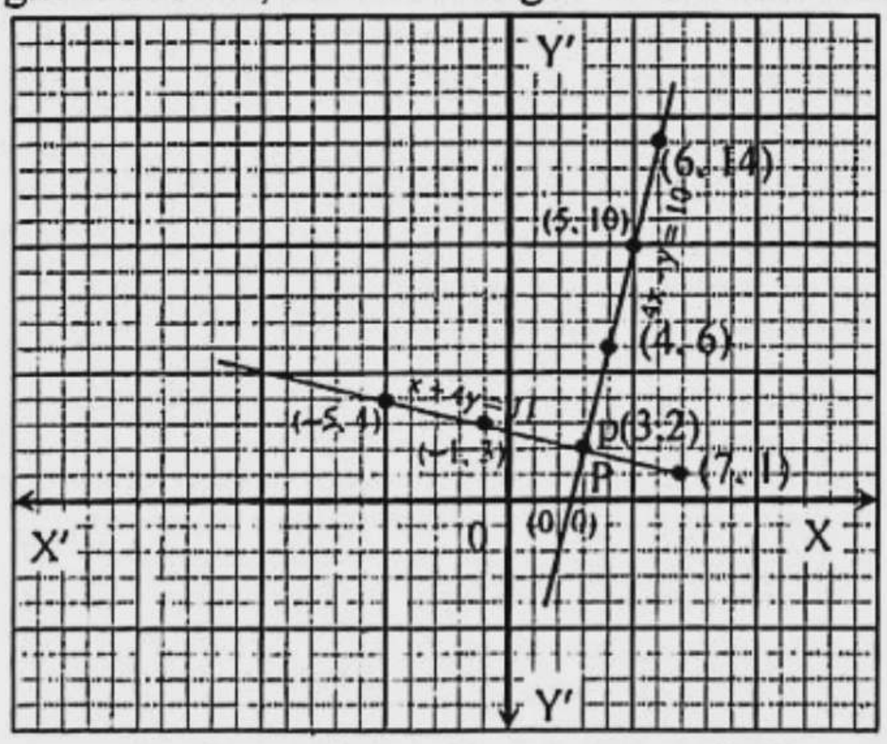
Solution :
Here,
$x + 4y = 11$ ..... (1)
$4x - y = 10$ ..... (2)
For solution, let us find out some points against equations (1) and (2) for the required graph as under :

For equation (1) : $x = 11 - 4y$

For equation (2) : $x = \frac{y + 10}{4}$

For equation (1)		For equation (2)	
x	y	x	y
7	1	3	2
3	2	4	6
– 1	3	5	10
– 5	4	6	14

Let us plot the above points of the given equations on a graph paper taking X′OX as x- axis and Y′OY as y-axis with the origin at O. Let us also consider the length of each of the smallest square of the graph as unit along both the axes.
After plotting and joining the points of the given equations, we have the following graph showing two straight lines. Let, the two straight lines intersect at P.



The co-ordinates of P are found to be (3, 2).
So, the solution of the given equations is (x, y) = (3, 2).

c. $3x + 2y = 21$
$2x - 3y = 1$

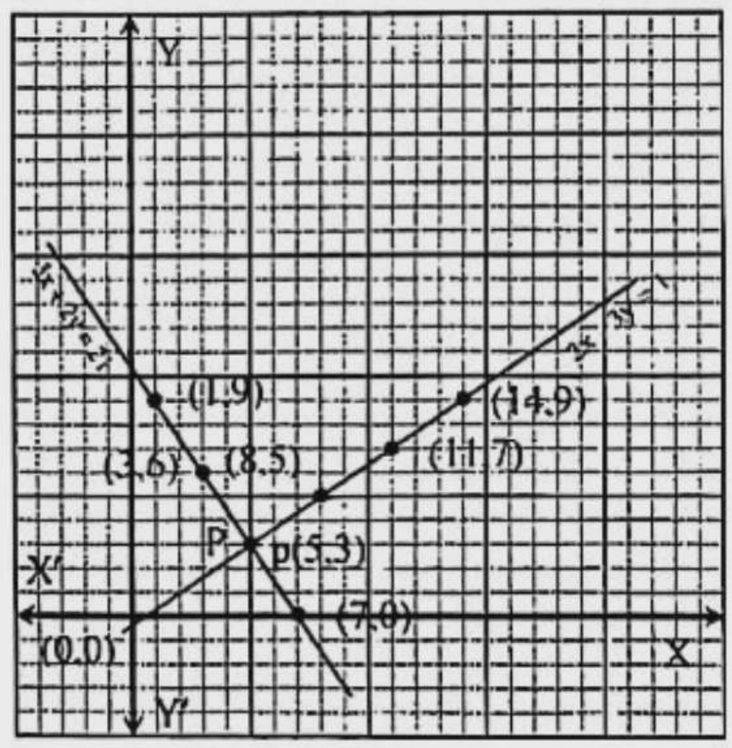
Solution :
Here,
$3x + 2y = 21$ ..... (1)
$2x - 3y = 1$ ..... (2)
For solution, let us find out some points against equation, (1) and (2) for the required graph as under :

For equation (1) : $y = \frac{21 - 3x}{2}$

For equation (2) : $y = \frac{2x - 1}{3}$

For equation (1)		For equation (2)	
x	y	x	y
5	3	5	3
3	6	8	5
1	9	11	7
7	0	14	9

Now, let us plot the above points of the given equations on a graph paper taking X′OX as x-axis and Y′OY as y-axis with the origin at O. Let us also consider the length of one side of the smallest square of the graph as unit. along both the axes.
After plotting and joining the points of the given equations, we have the following graph showing two straight lines. Let, the two straight lines intersect at P. The coordinates of P are found to be (5, 3).



So, the solution of the given equations : (x, y) = (5, 3).

d. $x + 2y = 1$
$x - y = 7$

Solution :
Here,
$x + 2y = 1$ ..... (1)
$x - y = 7$ ..... (2)
For solution, let us find out some points against equations (1) and (2) for the required graph as under :

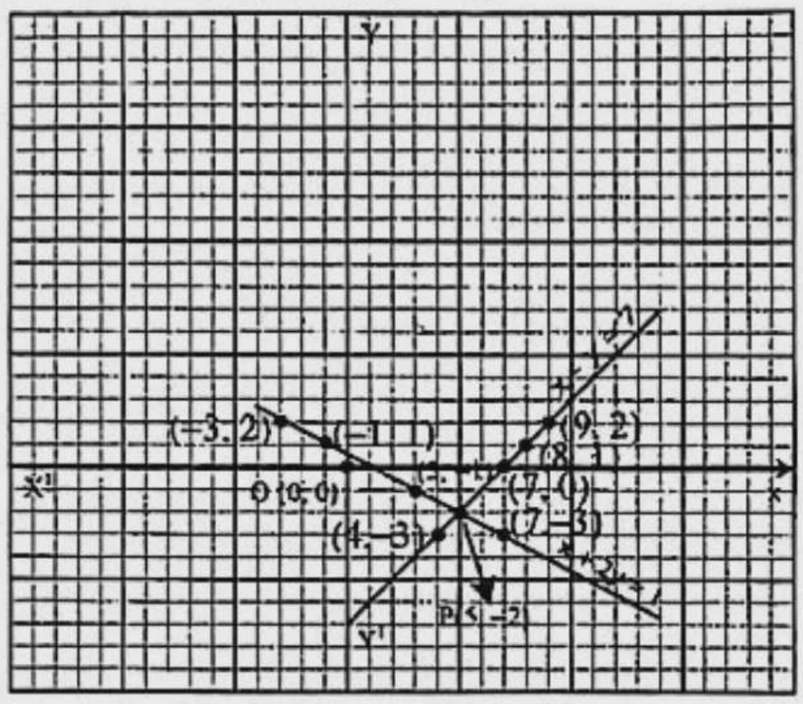
For equation (1) : $x = 1 - 2y$

For equation (2) : $x = y + 7$

For equation (1)		For equation (2)	
x	y	x	y
– 1	1	7	0
– 3	2	8	1
3	– 1	9	2
5	– 2	5	– 2
7	– 3	4	– 3

Now, let us plot the above points of the given equations on a graph paper taking X′OX as x-axis and Y′OY as y-axis with the origin at O. Let us also consider the length of one side of the smallest square of the graph as unit along both the axes.

After plotting and joning the points, we have the following graph showing two straight lines. Let, the two straight lines intersect at P, the co-ordinates of which are (5, – 2).



So the required solution of the given equations, (x, y) = (5, – 2).

e. $x - y = 0$

$x + 2y = -15$

Solution :

Here,

$x - y = 0$ ..... (1)

$x + 2y = -15$ ..... (2)

For solution, let us find out some points against equation (1) and (2) for the required graph as under :

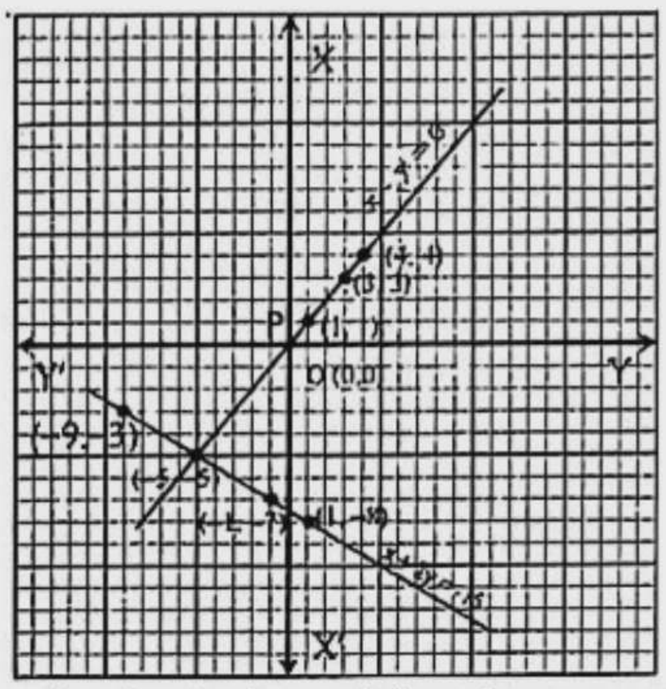
For equation (1) : x = y

For equation (2) : x = – 15 – 2y

For equation (1)		For equation (2)	
x	y	x	y
1	1	1	– 8
4	4	– 9	– 3
– 5	– 5	– 5	– 5
3	3	– 1	– 7

Now let us plot the above points of the given equations on a graph paper taking X′OX as x-axis and Y′OY as y-axis with the origin at O. Let us also consider the length of the smallest square of the graph as unit along both the axes.

After plotting and joining the points, we have the following graph showing two straight lines. Let they intersect at P, the co-ordinates of which are (– 5, – 5).



So, the required solution of the given equations :

(x, y) = (– 5, – 5).

f. $4x + 3y = 11$

$3x - 4y = 2$

Solution :

$4x + 3y = 11$ ..... (1)

$3x - 4y = 2$ ..... (2)

For solution, let us find out some points against the given equations (1) and (2) for the required graph as under :

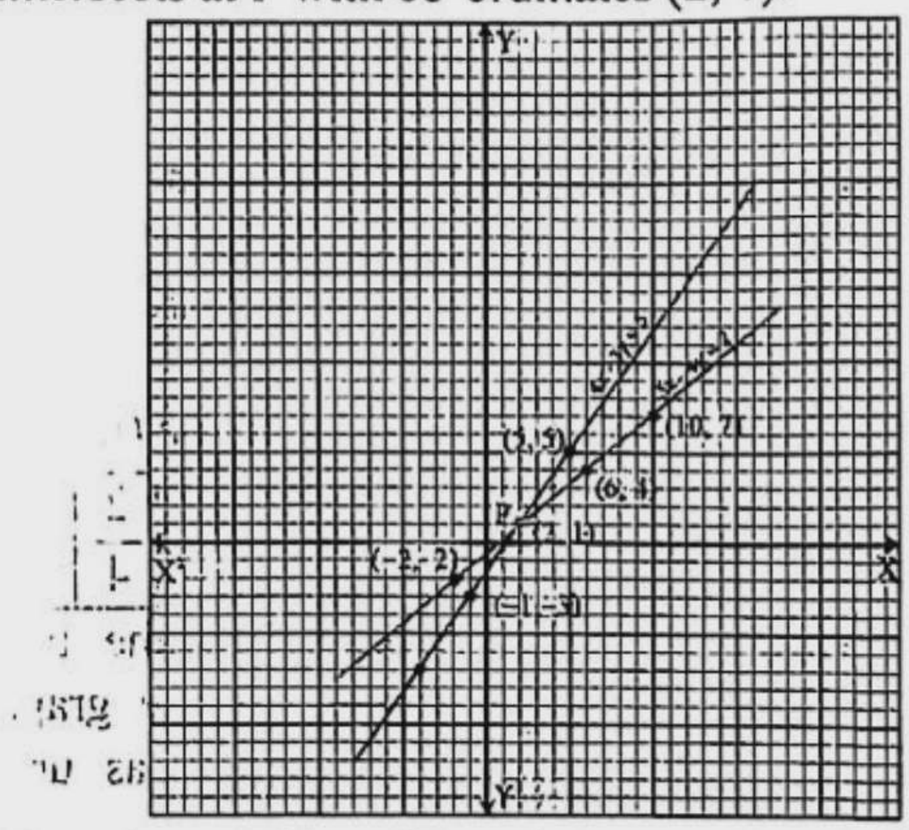
For equation (1): $y = \frac{11 - 4x}{3}$

For equation (2): $y = \frac{3x - 2}{4}$

For equation (1)		For equation (2)	
x	y	x	y
2	1	2	1
5	– 3	6	4
– 4	9	– 2	– 2
– 1	5	10	7

Let us plot the above points of the equations in a graph paper taking X′O X as x-axis and Y′O Y as y-axis with the origin at O. Let us also consider the length of each side of the smallest square of the graph paper as unit along both the axes.

After plotting and joining the points of the given equations, we have the following graph, showing two straight lines. Let the two straight lines intersects at P with co-ordinates (2, 1).



Thus the solution of the given equations is (2, 1).

Creative Questions with Solutions

Ques. 21 If 11 is added to the numerator of a fraction, the value of the fraction becomes 2. Again, if 2 is subtracted from that fraction, the value of the fraction becomes 1.

a. Form the system of equation considering the fraction $\frac{x}{y}$.

b. Find out the value of (x, y) by the method of elimination.

c. Draw the graph and find out the abscissa and the ordinate of the intersecting point.

Solution to Question No. 21 :

a Let, the fraction $\frac{x}{y}$

As per condition, $\frac{x+11}{y} = 2$

or, $x + 11 = 2y$

$\therefore$ $x - 2y = -11$

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

or, $x = y - 2$

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

The required system of equation, $x - 2y = -11$ and $x - y = -2$.

b From (a) above, we have the following related to the stem equations :

$x - 2y + 11 = 0$ .....(i)

$x - y + 2 = 0$ .....(ii)

Now subtracting (ii) from (i), we get,

$-2y + y + 11 - 2 = 0$

or, $-y + 9 = 0$

or, $y = 9$

Putting $y = 9$ in (ii), we get, $x - 9 + 2 = 0$

or, $x - 7 = 0$

or, $x = 7$

$\therefore$ The required solution, $(x, y) = (7, 9)$.

c In order to draw graphs of the equations (i) and (ii), a graph paper of xy-plane is taken. Then the ordered pair of points on (i) and (ii) are found separately as under :

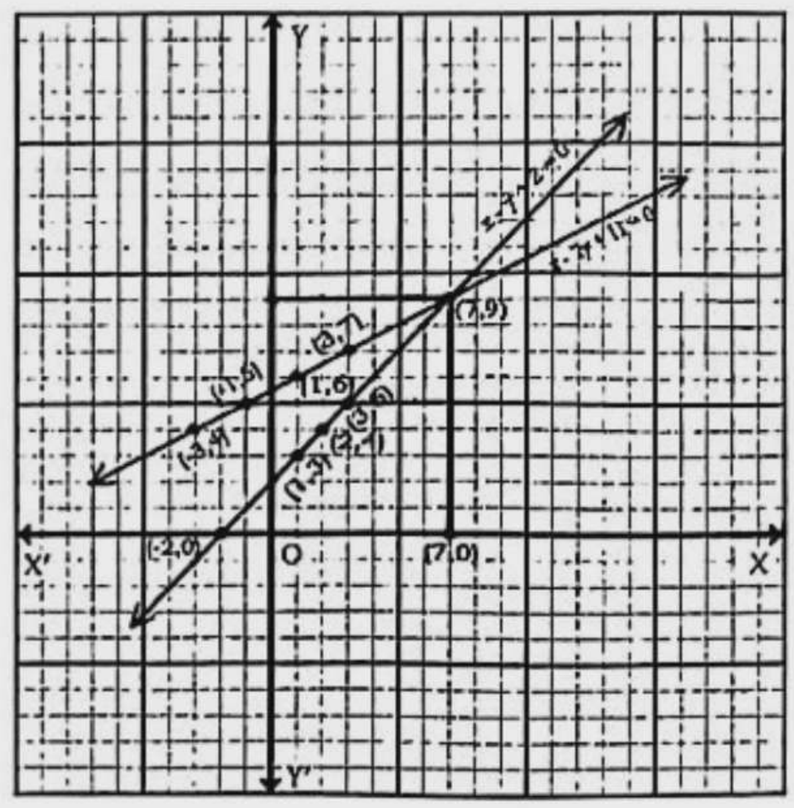
For equation (i) :

x	7	–1	1	–3	3
y	9	5	6	4	7

For equation (ii) :

x	7	–2	1	2	3
y	9	0	3	4	5

The above ordered pair of points for the two equations are subsequently plotted on the graph paper considering 1 (one) small square as unit along x-axis and y-axis as under :



From the graph above, it is obvious that (7, 9) is the point of intersection of the two lines representing the above mentioned equations. Again the abscissa of that point of intersection is 7 and the ordinate is 9.

$\therefore$ The required abscissa and ordinate of the point of intersection of the two simultaneous equations are 7 and 9.

Ques. 22 The length of a rectangular garden is 5 m more than 2 times of its breadth and the perimeter is 40 m.

a. Form two equations by considering its length x m and breadth y m in the light of the information above.

b. Solve the equation by elimination method.

c. Solve the system of equations with the help of the graph.

Solution to Question No. 22 :

a According to the 1st condition,

$x = 2y + 5$ ..... (i)

Again, according to the 2nd condition,

$2(x + y) = 40$ .....(ii)

So, (i) and (ii) are the required simultaneous equations based on the given information.

b From (a) above, we get the following two simultaneous equation :

$x = 2y + 5$ ..... (i)

$2(x + y) = 4$..... (ii)

From (i), we get $x - 2y = 5$ ..... (iii)

From (ii), we also have, $2x + 2y = 40$

or, $x + y = 20$ ..... (iv)

Subtracting (iv) from (iii) we have,

$-3y = -15 \Rightarrow y = 5$

Putting the value of y in (iv), we get,

$x = 20 - 05 \Rightarrow x = 15$

$\therefore$ The required solution of the simultaneous equations, $(x, y) = (15, 5)$

c Here we have two simultaneous equations as under :

$x - 2y = 5 \Rightarrow y = \frac{x-5}{2}$ .....(A)

$x + y = 20 \Rightarrow y = 20 - x$ .....(B)

Now in order to draw graphs of the equations (A) and (B), the following ordered pair of points are found :

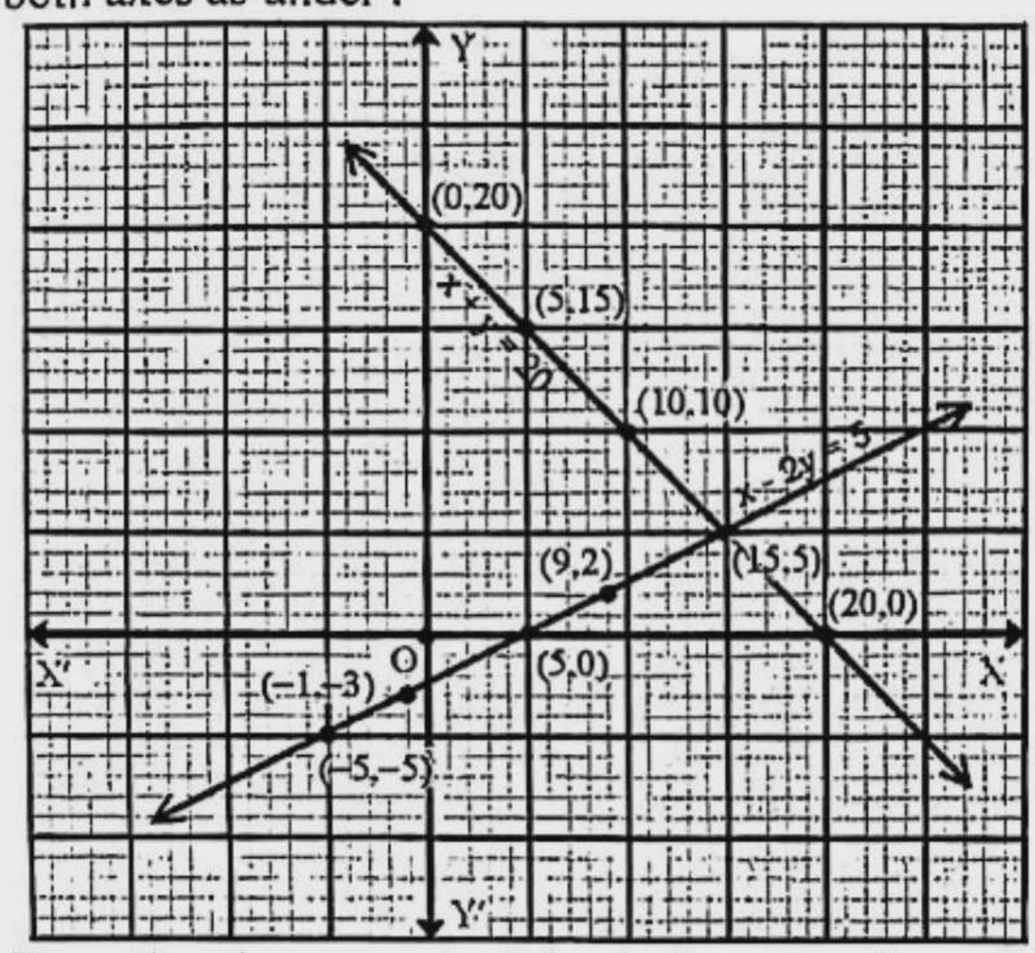
For equation (A) :

x	15	–1	–5	5	9
y	5	–3	–5	0	2

For equation (B) :

x	15	5	10	0	20
y	5	15	10	20	0

Now a graph paper of xy-plane is taken. The ordered pair of points for both (A) and (B) are plotted individually on the graph paper considering 1 small square of the graph paper as unit along both axes as under :



From the above graph, it is obvious that the point of intersection of the two lines representing equations (a) and (b) is (15, 5).

∴ The required solution of the two simultaneous equations, (x, y) = (15, 5).

Ques. 23 $7x - 3y = 31$ and $9x - 5y = 41$ are two equations.

a. Find out which equation is satisfied by the co-ordinate (4, – 1)?

b. Find out (x, y) by elimination method.

c. Solve the equation with the help of the graph.

Solution to Question No. 23 :

a Here we have,

$7x - 3y = 31$

or, $7 \times 4 - 3 \times -1 = 31$, putting $x = 4, y = -1$

or, $28 + 3 = 31$

So, (4, –1) satisfies $7x - 3y = 31$.

Again, $9x - 5y = 41$

or, $9 \times 4 - 5 \times -1 = 41$, putting $x = 4, y = -1$

or, $36 + 5 = 41$

So, (4, –1) also satisfies $9x - 5y = 41$.

∴ (4, –1) satisfies both the equations.

b The given equations are–

$7x - 3y = 31 \Rightarrow 3y = 7x - 31 \Rightarrow y = \frac{7x-31}{3}$.....(i)

Again, $9x - 5y = 41$

$\Rightarrow 9x - \frac{35x - 155}{3} = 41$,

putting $y = \frac{7x-31}{3}$ from (i)

$\Rightarrow 27x - 35x + 155 = 41 \times 3$

$\Rightarrow -8x = -155 + 123$

$\Rightarrow -8x = -32$

$\Rightarrow x = 4$, dividing both sides by – 8

Now putting the value of x in (1), we get,

$y = \frac{28-31}{3}$ or, $y = \frac{-3}{3}$ or, $y = -1$

∴ The required solution, (x, y) = (4, –1).

c Here given two equations are as under :

$7x - 3y = 31$ .....(i)

$9x - 5y = 41$ .....(ii)

In order to draw graphs of the above two equations, the following ordered pair of points for both of them are found individually as under :

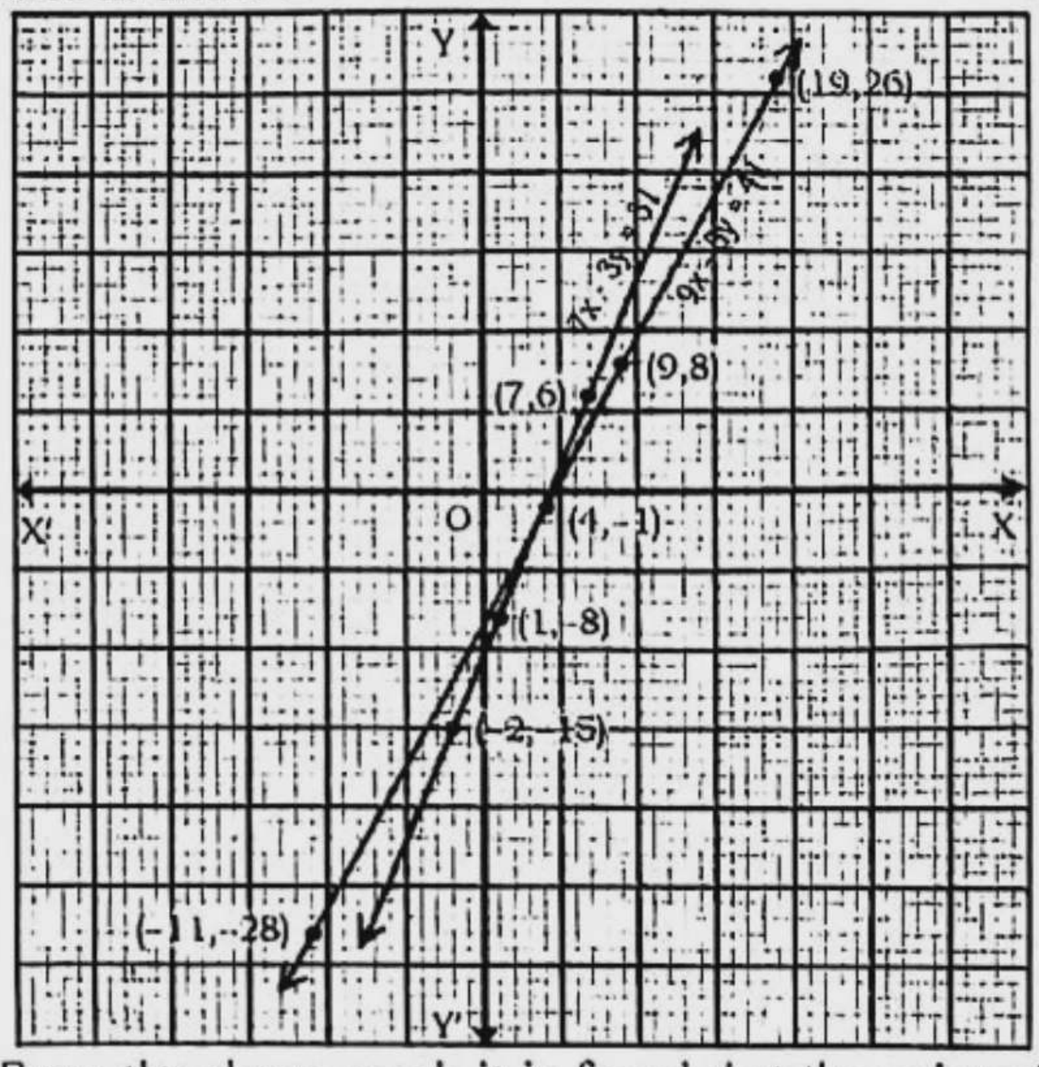
For equation (i) :

x	4	1	–2	7
y	–1	–8	–15	6

For equation (ii) :

x	4	9	–11	19
y	–1	8	–28	26

Then a graph paper of xy-plane is taken. The above ordered pair of points for (i) and (ii) are subsequently plotted on the graph paper considering 1 small square as unit along both the axes as under :



From the above graph it is found that the point of intersection of the two lines representing equations (i) and (ii) is (4, –1).

∴ The required solution of the above simultaneous equations is (4, –1).

Multiple Choice Q/A — Designed as per topic

6.3 Formation and solution to simultaneous equations of real life problems

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Answer the questions 1 to 3 according to the following data :

Anik and Ayesha have x and y oranges respectively. Anik has 2 more oranges than that of Ayesha.

1. **Which of the following equations is correct after the above expression?** *(Easy)*
   ⓐ $x + 2 = y$ ⓑ $x = y + 2$
   ⓑ ⓒ $x + y = 2$ ⓓ $x + y + 2 = 0$

2. **If Ayesha has 1 orange, how many oranges have they all together?** *(Medium)*
   ⓓ ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

3. **If the cost of 1 orange is Tk. 5, what is the total cost of their oranges when Ayesha has 1 orange?** *(Hard)*
   ⓐ Tk. 4 ⓑ Tk. 5
   ⓓ ⓒ Tk. 15 ⓓ Tk. 20

4. **What is the number whose ones place is 'a' and tens place is 'b'?** *(Hard)* *[DB '18]*
   ⓐ $a + 10b$ ⓑ $b + 10a$
   ⓐ ⓒ $a + b$ ⓓ ab

5. **If the sum and subtraction of the numerator and the denominator of a proper fraction are 10 and 4 respectively, what is the fraction?** *(Hard)* *[RB '18]*
   ⓑ ⓐ $\frac{2}{7}$ ⓑ $\frac{3}{7}$ ⓒ $\frac{5}{7}$ ⓓ $\frac{7}{3}$

6. **If $x - 2y = 0$ and $x + y = 6$ then, which one is the solution of the two equations?** *(Medium)* *[CB '18]*
   ⓐ $(4, -2)$ ⓑ $(4, 2)$
   ⓑ ⓒ $(-4, 2)$ ⓓ $(5, 1)$

7. **If the unit place digit is x and ten's place digit is y of a two digits number. What is the number?** *(Hard)* *[SB '18]*
   ⓐ $10x - y$ ⓑ $x + 10y$
   ⓑ ⓒ $x - 10y$ ⓓ $10x + y$

8. **If the perimeter of a square ABCD is 'a' unit, then what is the area of it in sq. unit?** *(Hard)* *[CtgB '17]*
   ⓓ ⓐ $\frac{a^2}{2}$ ⓑ $\frac{a^2}{4}$ ⓒ $\frac{a^2}{8}$ ⓓ $\frac{a^2}{16}$

9. **The perimeter of a parallelogram is 20 cm. If the ratio of the two adjacent sides is 3 : 2, what is the length of the larger side in cm?** *(Hard)* *[BB '17]*
   ⓓ ⓐ 2 ⓑ 3 ⓒ 4 ⓓ 6

10. **What is the distance of x-axis from the point (x_1, y_1)?** *(Easy)* *[DB '16]*
    ⓐ $x_1 + y_1$ ⓑ $\sqrt{x_1 + y_1}$
    ⓓ ⓒ x_1 ⓓ y_1

11. **Sum of two numbers is 14 and difference of them is 2. What are the two numbers?** *(Hard)* *[DB '16]*
    ⓑ ⓐ (7, 7) ⓑ (8, 6) ⓒ (16, 2) ⓓ (9, 5)

12. **In a two digits number the digit of unit and tens place are x and y respectively. What is the number?** *(Hard)* *[DB '16]*
    ⓓ ⓐ xy ⓑ yx ⓒ $10x + y$ ⓓ $10y + x$

13. **How many variables are there of the equation $2x - 3y = 4$?** *(Medium)* *[RB '16]*
    ⓑ ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

P(3, 4) is a point on XY plane.

14. **The sum of two numbers is 36 and their ratio is 5 : 4. Which is the greater number?** *(Hard)* *[JB '16]*
    ⓐ ⓐ 20 ⓑ 16 ⓒ 14 ⓓ 10

15. **The length of a rectangular house is 4 meter more than the breadth and the perimeter is 32 metre. What is the length of the house in metre?** *(Hard)* *[CB' 15]*
    ⓐ 6 ⓑ 8
    ⓒ ⓒ 10 ⓓ 12

16. **The present age of mother is 4 times of the sum of her two daughters ages. After 5 years the mother's age is two times of the sum of two daughters ages. What is the present age of mother?** *(Hard)* *[Ctg.B' 15]*
    ⓐ 15 years ⓑ 35 years
    ⓓ ⓒ 60 years ⓓ 30 years

17. **If 12 is added to the four times of a number, it will be 20. What is the number?** *(Medium)* *[SB' 15]*
    ⓒ ⓐ 5 ⓑ 3 ⓒ 2 ⓓ 1

18. **If unit place digit is x and tens's place digit is y of two digits number, what is the number?** *(Medium)* *[Rajuk Uttara Model College, Dhaka]*
    ⓐ $10x - y$ ⓑ $x + 10y$
    ⓑ ⓒ $x - 10y$ ⓓ $10x + y$

19. **Which point will satisfy the equation, $4x + 3y = 11$?** *(Hard)* *[Viqarunnisa Noon School and College, Dhaka]*
    ⓐ $(1, -5)$ ⓑ $(-1, 5)$
    ⓑ ⓒ $(-1, -5)$ ⓓ $(1, 5)$

20. **If the ages of the father and the son are 65 years and 25 years respectively, then —.** *[BB '17]*
    i. 5 years ago the ratio of their ages was 3 : 1
    ii. 15 years ago the sum of their ages was 75 years
    iii. after 15 years father's age will be doubled that of son's

    Which one is correct? *(Medium)*
    ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

21. **If the ages of father and the son are 65 years and 25 years respectively, then —** *[Rajuk Uttara Model College, Dhaka]*
i. 5 years ago ratio of their ages was 3 : 1
ii. 15 years ago the sum of their ages was 75 years
iii. After 15 years father's age will be doubled of that of son's.
Which one is correct? *(Hard)*
ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Answer the question No. 22 and 23 according to the following statement :
Area of a rectangular garden is 576 sq. metres and its length is 36 m.

22. **What is the peremeter of the garden in metre?** *(Medium)* *[DB '17]*
ⓑ ⓐ 64 ⓑ 104 ⓒ 144 ⓓ 288

23. **What is the diagonal of the garden in metre?** *(Hard)* *[DB '17]*
ⓐ 7.21 (Approx.) ⓑ 10.2 (Approx.)
ⓓ ⓒ 24.3 (Approx.) ⓓ 39.4 (Approx.)

Answer the questions from 24 to 26 in respect of the above information :
The present age of father is 5 years more than two times of the present age of son and the total present age is 80 years of father and son. *[JB '16]*

24. **What is the present age of father, when the present age of son is x year?** *(Easy)*
ⓐ x(2x + 5) ⓑ x(2x – 5)
ⓓ ⓒ 2x – 5 ⓓ 2x + 5

25. **What is the present age of son in year?** *(Medium)*
ⓐ ⓐ 25 ⓑ 35 ⓒ 55 ⓓ 75

26. **What will be the ratio of the ages of father and son after 5 years?** *(Hard)*
ⓐ 5 : 11 ⓑ 11 : 5
ⓒ ⓒ 2 : 1 ⓓ 1 : 2

According to the following information, answer the questions No. 27 and 28 :
The sum of two numbers is 40 and difference is 20.

27. **What is the greater number?** *(Easy)* *[RB' 15]*
ⓓ ⓐ 15 ⓑ 20 ⓒ 25 ⓓ 30

28. **How many times is the greater number tham the smaller number?** *(Medium)* *[RB' 15]*
ⓐ ⓐ $\frac{1}{3}$ ⓑ $\frac{1}{4}$ ⓒ $\frac{1}{5}$ ⓓ $\frac{1}{6}$

Answer to the questions No. 29 and 30 in the light of the information given below :
Half of the difference between the numbers x and y is 4 and the sum is 22. Here x > y. *[Viqarunnisa Noon School and College, Dhaka]*

29. **Which is the first number?** *(Easy)*
ⓐ 13 ⓑ 9
ⓐ ⓒ 15 ⓓ 11

30. **Which is the 2nd number?** *(Medium)*
ⓐ 15 ⓑ 9
ⓓ ⓒ 11 ⓓ 7

6.4 Graphical solution of simple simultaneous equtions
▸ Textbook Page 114

31. **When each equation in the system has a different graph, they are called independent equations. Now which system of equations is not independent?**
ⓐ x + 2y = 5 and 3x – 2y + 6 = 0
ⓑ 2x = 5 and 3x – 2y + 1 = 0
ⓒ x – y = 5 and x – 2y + 1 = 0
ⓓ ⓓ x – y = 1 and 2x – 2y – 2 = 0

32. **When each equation in the system has the same graph, they are called dependent equations. Now which system of equations is not dependent?** *(Easy)*
ⓐ x + 2y = 5 and x + 2y – 5 = 0
ⓑ 2x = 5 and 2x – 5 = 0
ⓒ x – y = 5 and x – 2y + 1 = 0
ⓒ ⓓ x – y = 1 and 2x – 2y – 2 = 0

33. **In which quadrant the point (– 5, 5) will be?** *(Easy)* *[DB '19]*
ⓑ ⓐ First ⓑ Second ⓒ Third ⓓ Fourth

34. **Which point lies on x-axis?** *(Easy)* *[DB '19]*
ⓐ (0, – 4) ⓑ (– 4, 0)
ⓑ ⓒ (0, 3) ⓓ (3, – 1)

35. **Which one is situated in the x-axis?** *(Easy)* *[RB '19]*
ⓐ (– 5, 5) ⓑ (3, – 3)
ⓓ ⓒ (0, 4) ⓓ (2, 0)

36. **Which point satisfies the equation 7x – 3y = 31?** *(Medium)* *[RB '19]*
ⓐ (3, – 3) ⓑ (4, –1)
ⓑ ⓒ (4, 1) ⓓ (3, 3)

37. **Where the point (– 2, 0) is situated?** *(Medium)* *[JB '19]*
ⓐ 1st quadrant ⓑ 2nd quadrant
ⓒ ⓒ On the x-axis ⓓ On the y-axis

38. **In which quadrant (– 3, – 2) is located?** *(Easy)* *[CtgB '19]*
ⓐ 4th ⓑ 3rd
ⓑ ⓒ 2nd ⓓ 1st

39. **Which one of the following point lies on 7x – 3y = 5?** *(Medium)* *[SB '19]*
ⓐ (3, 2) ⓑ (2, 3)
ⓑ ⓒ (– 3, 2) ⓓ (– 2, 3)

40. **In which quadrant (– 3,2) point will be?** *(Easy)* *[SB '19]*
ⓐ First ⓑ Second
ⓑ ⓒ Third ⓓ Fourth

41. **In which quadrant the point (– 1, 2) will be?** *(Medium)* *[BB '19]*
ⓐ First ⓑ Second
ⓑ ⓒ Third ⓓ Fourth

42. **In which quadrant the point (2a, – 5) where a > 0 will be?** *(Hard)* *[MB '19]*
ⓐ First ⓑ Second
ⓓ ⓒ Third ⓓ Fourth

43. **Which one of the following denotes the equation for the straight line?** *(Hard)* *[MB '19]*
ⓐ $x^2 + 2y + 5 = 0$ ⓑ $x + 2y^2 + 5 = 0$
ⓒ ⓒ $x + 2y + 5 = 0$ ⓓ $x + \frac{1}{y} + 5 = 0$

44. **In which quadrant the point (6, – 3) is situated?** *(Medium)* *[CB '18]*
ⓓ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

45. **In which quadrant the point (– 3, 3) is situated?** *(Medium)* *[CtgB '18]*
ⓑ ⓐ First ⓑ Second ⓒ Third ⓓ Fourth

46. **Which point of the following is situated on y-axis?** *(Medium)* *[SB '18]*
ⓐ (0, 3) ⓑ (3, 0)
ⓐ ⓒ (– 3, 3) ⓓ (3, – 3)

47. **In which quadrant the point (– 5, 3) will be?** *(Medium)* *[BB '18]*
ⓑ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

48. **Where the point (2, – 3) is situated?** *(Medium)* *[DjB '18]*
ⓐ on the x-axis ⓑ 2nd quadrant
ⓓ ⓒ on the y-axis ⓓ 4th quadrant

49. **Which one of the following points lies on x-axis?** *(Medium)* *[DB '17]*
ⓐ (3, 3) ⓑ (–3, 5)
ⓓ ⓒ (0, 4) ⓓ (4, 0)

50. **In which quadrant the point (–2, 3) will be?** *(Medium)* *[RB '17]*
ⓐ 1st quadrant ⓑ 2nd quadrant
ⓑ ⓒ 3rd quadrant ⓓ 4th quadrant

51. **How long unit is the point (4, 5) situated from x-axis?** *(Medium)* *[CtgB '17]*
ⓒ ⓐ 1 ⓑ 4 ⓒ 5 ⓓ 9

52. **In which quadrant is the point (4, – 3) situated?** *(Medium)* *[CtgB '17]*
ⓓ ⓐ First ⓑ Second ⓒ Third ⓓ Fourth

53. **In which quadrant the point of (3, –5) is situated?** *(Medium)* *[SB '17]*
ⓓ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

54. **In which quadrant the point A (–3, 4) located?** *(Medium)* *[DjB '17]*
ⓑ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

55. **In which quadrant does the point $\left(-3, \frac{1}{2}\right)$ lie?** *(Medium)* *[DB '16]*
ⓑ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

56. **Where the point (– 5, 0) is located on graph?** *(Medium)* *[RB '16]*
ⓐ In 1st quadrant ⓑ In 2nd quadrant
ⓒ ⓒ On x-axis ⓓ On y-axis

57. **In which quadrant the point $\left(3, \frac{1}{2}\right)$ is situated?** *(Medium)* *[CB '16]*
ⓐ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

58. **The present age of brother and sister are 40 years and 30 years respectively; what was the ratio of their age before 10 years?** *(Medium)* *[CtgB '16]*
ⓐ ⓐ 3 : 2 ⓑ 2 : 3 ⓒ 4 : 3 ⓓ 5 : 4

59. **Which one of the following points lie on y-axis?** *(Medium)* *[CtgB '16]*
ⓐ (– 3, 3) ⓑ (– 2, 3)
ⓒ ⓒ (0, 5) ⓓ (5, 0)

60. **In which quadrant the point (– 2, 9) is located in the graph?** *(Medium)* *[SB '16]*
ⓑ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

61. **In the graph, the point (3, – 10) remains in which quarter?** *(Medium)* *[DjB '16]*
ⓐ 1st ⓑ 2nd
ⓓ ⓒ 3rd ⓓ 4th

62. **Father's age is 4 times of his son's age. Before 4 years total ages of father and son was 52 years. What is the present age of father?** *(Medium)* *[DjB '16]*
ⓒ ⓐ 32 ⓑ 38 ⓒ 48 ⓓ 52

63. **In which quadrant the point (4, – 3) is located on graph?** *[DB' 15]*
ⓐ 1st quadrant ⓑ 2nd quadrant
ⓓ ⓒ 3rd quadrant ⓓ 4th quadrant

64. **What is the distance of the point (4, 3) from y-axis?** *(Medium)* *[CB' 15]*
ⓒ ⓐ 1 ⓑ 3 ⓒ 4 ⓓ 7

65. **In which quadrant the point (0, 3) is located on graph?** *(Medium)* *[Ctg.B' 15]*
ⓐ On y-axis ⓑ In x-axis
ⓐ ⓒ In 1st quadrant ⓓ In 2nd quadrant

66. **How many unit of distance is the point (5, 6) from x-axis?** *(Medium)* *[SB' 15]*
ⓓ ⓐ 1 ⓑ 4 ⓒ 5 ⓓ 6

67. **In which quadrant the point (- 3, – 5) will be?** *(Medium)* *[Ideal School & College, Dhaka]*
ⓒ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

68. **The co-ordinate (– 4, 1) is in which quadrant?** *(Medium)* *[Viqarunnisa Noon School and College, Dhaka]*
ⓑ ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th

69. **Read attentively the following mathematical sentences :**
i. $x - 3y = 4$ represents a straight line.
ii. $4x = 5$ represents a straight line parallel to x- axis.
iii. $x = a$ and $y = b$ intersect at the point (a, b).
What is/are the correct answer/answers after the above statements? *(Medium)*
ⓐ i & ii ⓑ i & iii
ⓑ ⓒ ii & iii ⓓ i, ii & iii

70. i. $x - y - 4 = 0$ and $3x - 3y - 10 = 0$ are consistent and independent
ii. A system of equations can be solved by graphical method
iii. $x + y = 5$ represents a straight line which intersects x-axis at (5, 0) and y-axis at (0,5)
What is/are the correct answer/answers after the above statements? *(Medium)*
d ⓐ i & ii ⓑ i & iii ⓒ i, ii & iii ⓓ ii & iii

71. i. The co-ordinates of three points namely (– 1, 5), (0, 3) and (3, – 3) lying on the line $2x + y = 3$
ii. The statement, $y = 2x - 4$ is true for the adjacent table of co-ordinates

x	0	2	4
y	– 4	0	4

iii. The sum of square of two numbers and the difference of square of the same numbers can be denoted by $x^2 + y^2 = 5$ and $x^2 - y^2 = 3$ respectively
What is/are the correct answer/answers after the above statements? *(Hard)*
ⓐ i, ii & iii ⓑ i & iii
a ⓒ ii & iii ⓓ i & ii

72. **For the graph of the equation $3x - 2y = 6$—** *[DjB '19]*
i. the point (2, 0) lies on the x-axis
ii. the point (0, – 3) lies on the y-axis
iii. the point (2, – 3) lies on the graph of the equation
Which one is correct? *(Hard)*
a ⓐ i & ii ⓑ ii & iii ⓒ i & iii ⓓ i, ii & iii

73. **The points on the graph of the equation $2x - y = 3$ is —.** *[JB '18]*
i. (2, 1)
ii. (3, 3)
iii. (7, 11)
Which one of the following is correct? *(Medium)*
d ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

74. **The point on the graph of the equation $x + 3y = 4$—** *[RB '17]*
i. (1, 1)
ii. (–2, 2)
iii. (2, 3)
Which one is correct? *(Medium)*
a ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

75. **If the graph of two simultaneous simple equations are parallel —.** *[SB' 15]*
i. they have no intersecting points
ii. their simultaneous solutions are innumerous
iii. they have no solution
Which one of the following is true? *(Easy)*
b ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Answer the questions No. 76 and 77 based on following information :
$x + 2y = 1, x - y = 7.$ *[CB '19]*

76. **What is the abscissa of the system of equation?** *(Medium)*
a ⓐ 5 ⓑ 2 ⓒ – 2 ⓓ – 5

77. **In which quadrant does the root of the equation exist?** *(Hard)*
ⓐ First ⓑ Second
d ⓒ Third ⓓ Fourth

Short Q/A — Designed as per topic

6.3 Formation and solution to simultaneous equations of real life problems ▸ Textbook Page 110

Question 1. If the sum of two numbers is 130 and the difference is 20, find the two numbers.

Solution : Let the numbers be x and y, Where $x > y$
According to the question, $x + y = 130$ .....(i)
and $x - y = 20$.....(ii)
Adding (i) and (ii), we get–
$x + y + x - y = 130 + 20$
or, $2x = 150$
$\therefore x = \frac{150}{2} = 75$
Substituting the value of x in (i), we get–
$75 + y = 130$
or, $y = 130 - 75 = 55$
Required numbers are 75 and 55.

Question 2. If the sum of the numerator and denominator of a proper fraction is 15 and the difference is 1, find the fraction.

Solution : Let the proper fraction be $= \frac{x}{y}$, where $x < y$
According to the question, $x + y = 15$.....(i)
and $y - x = 1$.....(ii)
Adding (i) and (ii), we get–
$x + y + y - x = 15 + 1$
or, $2y = 16$
or, $y = \frac{16}{2} = 8$
Substituting the value of x in (i), we get–
$x + 8 = 15$
or, $x = 15 - 8 = 7$
Required fraction $= \frac{7}{8}$

Question 3. If the sum of two numbers is 150 and one is four times the other, find the two numbers.

Solution : Let one number be = x, then the other number = 4x

According to the question,

$x + 4x = 150$

or, $5x = 150$

$\therefore x = \frac{150}{5} = 30$

$\therefore$ One number = 30

And the other number = $4x = 4 \times 30 = 120$

Required numbers are 30 and 120

Question 4. If three times the first of two numbers is added to twice the second, the sum is 42. Again, if the second is subtracted from twice the first, the difference is 7. Form two equations by considering the first number as x and the second number as y.

Solution : Let the first number be x and the second number be y

Since three times x added to twice y is 42

$\therefore 3x + 2y = 42$

Again, if y is subtracted from twice x, the difference is 7.

$\therefore 2x - y = 7$

Required equations : $3x + 2y = 42$ and $2x - y = 7$

Question 5. The length of a rectangular field is 10 meters more than the width. If the perimeter is 120, find the length.

Solution : Let width = x meters

Then length = (x + 10) meters.

$\therefore$ Perimeter of the rectangular field = $2(x + 10 + x)$ meters

$= 2(2x + 10)$ m

According to the question, $2(2x + 10) = 120$

or, $2x + 10 = \frac{120}{2}$

or, $2x + 10 = 60$

or, $2x = 60 - 10 = 50$

$\therefore x = \frac{50}{2} = 25$

$\therefore$ Length = $x + 10 = 25 + 10 = 35$ meters

Required length is 35 meters.

Question 6. The length of a room is three times its width, if the area of the room is 147 square meters, what is the width?

Solution : Let the width of the room be x meters

Then the length of the room = 3x meters

$\therefore$ Area of the room = $3x \times x = 3x^2$ square meters

According to the question, $3x^2 = 147$

or, $x^2 = \frac{147}{3}$

or, $x^2 = 49$

$\therefore x = \sqrt{49} = 7$

$\therefore$ Width = 7 meters

Question 7. The perimeter of a rectangular garden is 50 cm and the ratio of length to width is 3:2, what is the length in cm?

Solution : Let x be the common ratio.

That is, Length = 3x cm and Width = 2x cm

$\therefore$ Perimeter $= 2(3x + 2x)$ cm

According to the question, $2(3x + 2x) = 50$

or, $3x + 2x = \frac{50}{2}$

or, $5x = 25$

or, $x = \frac{25}{5}$

$\therefore x = 5$

Length = $3x = 3 \times 5 = 15$ cm.

Question 8. A student bought 5 pens and 2 notebooks from a shop for 80 taka. The price of 3 pens is 4 taka more than the price of 1 notebook. Form the equations by considering the price of a notebook as x and the price of a pen as y taka.

Solution : Given, the price of a notebook is x taka and the price of a pen is y taka.

The price of 5 pens and 2 notebooks = $(5 \times y + 2 \times x)$ taka

$= 2x + 5y$ taka

According to the 1st condition, $2x + 5y = 80$ .....(i)

According to the 2nd condition, $3y = x + 4$

$\therefore x - 3y = -4$.....(ii)

Required equations: $2x + 5y = 80$ and $x - 3y = -4$.

6.4 Graphical solution of simple simultaneous equations

▸ Textbook Page 114

Question 9. Find the coordinates of three points on the graph of the equation $9x - 7y = 13$.

Solution : Given equation,

$9x - 7y = 13$

or, $9x - 13 = 7y$

$\therefore y = \frac{9x - 13}{7}$

Find the value of y for different values of x :

Required three points : (x, y) = (3, 2), (– 4, – 7), (10, 11)

Question 10. How far is the point (4,0) from the origin?

Solution : Point (4, (0) is located on the x-axis. We know that the distance of any point on the x-axis from the origin is equal to the value of the abscissa of the point.

Here, abscissa = 4.

$\therefore$ Distance from origin to given point = 4 units.

Question 11. Verify that the point (9, 6) satisfies the equation $\frac{x}{3}+\frac{y}{2}=6$

Solution : Given equation, $\frac{x}{3}+\frac{y}{2}=6$

The abscissa of the point (9, 6), x = 9 and ordinate, y = 6

$$\text{LHS} = \frac{x}{3}+\frac{y}{2}$$
$$= \frac{9}{3}+\frac{6}{2}$$
$$= 3+3$$
$$= 6 = \text{R.H.S}$$

∴ Point (9, 6) satisfies the given equation. (Verified)

Question 12. If a = 3, verify that (2, 5) is a solution of the equation ax – y = 1.

Solution : Given equation, ax – y = 1

If a = 3, then 3x – y = 1.....(i)

At point (2,5) ,the abscissa x = 2 and ordinate y = 5

LHS = 3x – y = 3 × 2 – 5 = 6 – 5 = 1 = RHS

∴ If a = 3, (2, 5) is a solution of the equation ax – y = 1. (Verified)

Question 13. Determine which of the equations x + 5y = 17 and 7x – 4y = 2 is satisfied by the point (– 3, 4).

Solution : Given equations,

x + 5y = 17.....(i)

7x – 4y = 2 .....(ii)

The abscissa of the point (– 3, 4), x = –3 and ordinate, y = 4

Left side of equation (i) = x + 5y
= – 3 + 5 × 4
= – 3 + 20 = 17
= R.H.S

Left side of equation (ii) = 7x – 4y
= 7 × (– 3) – 4 × 4
= 21 – 16 = 5
≠ Right Hand Side

That is, the point (– 3, 4) satisfies the equation x + 5y = 17.

Question 14. 9x – 7y = 21 and 5x – 3y = 9 are two linear equations. Determine which equation is satisfied by the point ((0, – 3).

Solution : Given equations ,

9x – 7y = 21.....(i)

x – 3y = 9.....(ii)

The abscissa of the point (0, – 3), x = 0 and ordinate, y = – 3

Left side of equation (i) = 9x – 7y
= 9 × 0 – 7 × (– 3)
= 0 + 21 = 21
= Right Hand Side

Left side of equation (ii) = 5x – 3y
= 5 × 0 – 3 × (– 3)
= 0 + 9 = 9
= Right Hand Side

That is, the point (0, – 3) satisfies both equations.

Creative Q/A — Designed as per learning outcomes

Ques. 01 3x – y = 5 and 3x – 2y = 4.

a. Now explain whether the system of equations is consistent or not. Find their number of solutions. 2

b. Solve the system of equations by using the method of cross-multiplication and find (x, y). 4

c. Solve the system of equations by graphical method and verify the solution obtained in question 'b'. 4

Solution to Question No. 01 :

a Given that, 3x – y = 5 and 3x – 2y = 4.

Comparing the system of equations with $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ we get,

$\frac{3}{3} \neq \frac{-1}{-2}$ i.e. $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

∴ The system of equations is consistent and since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ so it has a unique solution.

b The equations are 3x – y = 5 and 3x – 2y = 4

i.e. 3x – y – 5 = 0 ..... (A)

and 3x – 2y – 4 = 0 ..... (B)

Using the method of cross-multiplication we get from (A) and (B),

$$\frac{x}{(-1)\times(-4)-(-5)\times(-2)}$$
$$=\frac{y}{(-5)\times(3)-(3)\times(-4)}$$
$$=\frac{1}{(3)\times(-2)-(-1)\times(3)}$$

or, $\frac{x}{4-10}=\frac{y}{-15+12}=\frac{1}{-6+3}$

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

∴ x = 2 and y = 1

∴ The required solution (x, y) = (2, 1).

c Given that, 3x – y = 5 ... ... (i)

and 3x – 2y = 4 ... ... (ii)

From the first equation we get, y = 3x – 5

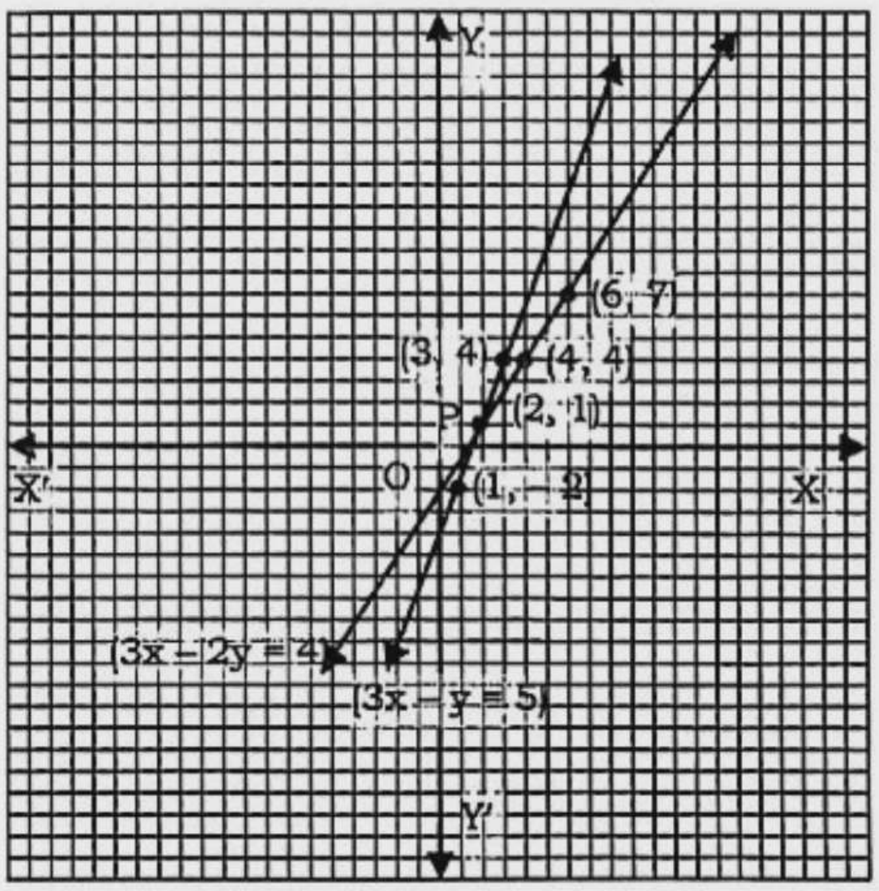
Let us determine the coordinates of three points, (1, – 2), (2, 1) and (3, 4) for the equation (i) as under :

x	1	2	3
y	– 2	1	4

From second equation we get, $3x - 2y = 4$ i.e. $y = \frac{3x-4}{2}$.

Let us determine the coordinates of three points (2, 1), (4, 4) and (6, 7) for the equation (ii) as under :

x	2	4	6
y	1	4	7



Taking the length of the side of a small square as unit, let us plot the points (1, – 2), (2, 1) and (3, 4) on the graph for the first equation and join them. The graph is a straight line. Similarly, by plotting the points (2, 1), (4, 4) and (6, 7) of the second equation, we also get a straight line. Suppose, these two straight lines intersect at the point P. It is seen from the graph that the abscissa and the ordinate of the point P are 2 and 1 respectively.

∴ The required point of intersection i.e. solution of the system is (2, 1).

Verification : From `b', we have got the solution (2, 1) of the given system of equations. Again, from the graph we have got the point of intersection (2, 1) of the system of equations, which are the same. Hence, the derived solution is correct.

Ques. 02 $\frac{x}{3} + \frac{y}{2} = 1$ and $x - 3y = 3$ are two simple equations.

a. Find which equation is satisfied by the point $\left(4, -\frac{2}{3}\right)$. 2

b. Solve the equations by the substitution method. 4

c. Solve with the help of graphs. 4

● *Dhaka Board 2019*

Solution to Question No. 02 :

a Putting $x = 4$ and $y = -\frac{2}{3}$ in the 1st equation, we get,

$$\frac{4}{3} + \frac{\frac{-2}{3}}{2} = 1$$

or, $\frac{4}{3} - \frac{2}{3} \times \frac{1}{2} = 1$

or, $\frac{4}{3} - \frac{1}{3} = 1$

or, $\frac{4-1}{3} = 1$

or, $\frac{3}{3} = 1$

or, $1 = 1$

∴ The point $\left(4, -\frac{2}{3}\right)$ satisfies the equation $\frac{x}{3} + \frac{y}{2} = 1$.

Again, putting $x = 4$ and $y = -\frac{2}{3}$ in the 2nd equation, we get,

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

or, $4 + 3.\frac{2}{3} = 3$

or, $4 + 2 = 3$

or, $6 = 3$

∴ The point $\left(4, -\frac{2}{3}\right)$ does not satisfy the equation $x - 3y = 3$.

So, the equation $\frac{x}{3} + \frac{y}{2} = 1$ is satisfied by the point $\left(4, -\frac{2}{3}\right)$.

b The given equations are :

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

and $x - 3y = 3$ ..... (ii)

From equation (ii) we get,

$x - 3y = 3$

or, $x = 3 + 3y$ ..... (iii)

Now, putting the value of x from equation (iii) in the equation (i), we get,

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

or, $\frac{6+6y+3y}{6} = 1$

or, $6 + 9y = 6$

or, $9y = 6 - 6$

or, $9y = 0$

∴ $y = 0$

Putting the value of y in equation (iii), we get,

$x = 3 + 3.0$

or, $x = 3$

∴ Required solution of the given equations is $(x, y) = (3, 0)$.

c Here, we have

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

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

or, $\frac{y}{2}=\frac{3-x}{3}$

or, $y=\frac{6-2x}{3}$ ..... (i)

Again, $x-3y=3$

or, $x-3=3y$

or, $\frac{x-3}{3}=y$

$\therefore y=\frac{x-3}{3}$ ..... (ii)

Now, for the equation (i), table-1 for the points (x, y) are made below :

Table–1

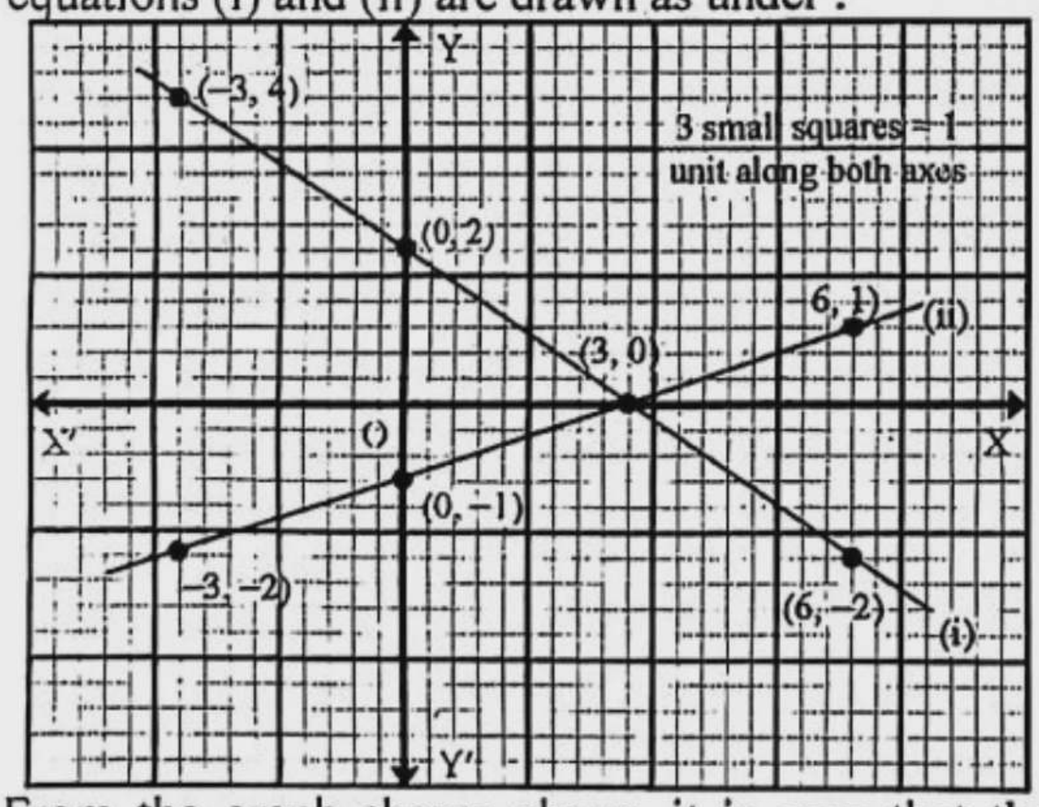
x	– 3	0	3	6
y	4	2	0	– 2

Again, for the equation (ii), table–2 is made for (x, y) as under :

Table–2

x	– 3	0	3	6
y	– 2	– 1	0	1

Now, points of both table–1 and table–2 are plotted on a graph paper of xy-plane considering 3 small squares as a unit. Thus the graph of equations (i) and (ii) are drawn as under :



From the graph shown above, it is seen that the two graphs mutually meet at point (3, 0).

So, the required solution of the given two equations is (x, y) = (3, 0).

Ques. 03 $3x-4y=0$ and $2x-3y=-1$ are two simple equations.

a. The sum of two numbers is 210 and smaller number is half of larger number. Find out the smaller number. 2

b. Solve the equations using the method of elimination. 4

c. Draw the graph of the equations and find the abscissa and ordinate of the point of intersection. 4

• *Rajshahi Board 2019*

Solution to Question No. 03 :

a Let, larger number = a

and smaller number = b

By the condition, we get,

$a+b=210$ ..... (i)

and $b=\frac{a}{2}$ ..... (ii)

From equation (ii), we get,

$b=\frac{a}{2}$

or, $2b=a$

$\therefore a=2b$

Now, putting the value of a in equation (i), we get,

$2b+b=210$

or, $3b=210$

or, $b=70$

$\therefore$ Determined smaller number is 70.

b The given equations are

$3x-4y=0$ ..... (i)

and $2x-3y=-1$ ..... (ii)

Now, multiplying equation (i) by 3 and equation (ii) by 4 we get

$9x-12y=0$

$8x-12y=-4$

(–) (+) (+)

$x=4$ [By subtracting]

$\therefore x=4$

putting the value of x in equation (i) we get

$3.4-4y=0$

or, $12-4y=0$

or, $-4y=-12$

or, $y=\frac{-12}{-4}$

$\therefore y=3$

$\therefore$ Required solution is (x, y) = (4, 3)

c The given equations are

$3x-4y=0$ ..... (i)

and $2x-3y=-1$ ..... (ii)

From equation (i) we get,

$3x-4y=0$

or, $-4y=-3x$

or, $y=\frac{-3x}{-4}$

$\therefore y=\frac{3x}{4}$

We contruct the table below from the values of y for different values of x :

x	– 8	– 4	4	8
y	– 6	– 3	3	6

From equation (ii) we get,

$2x - 3y = -1$

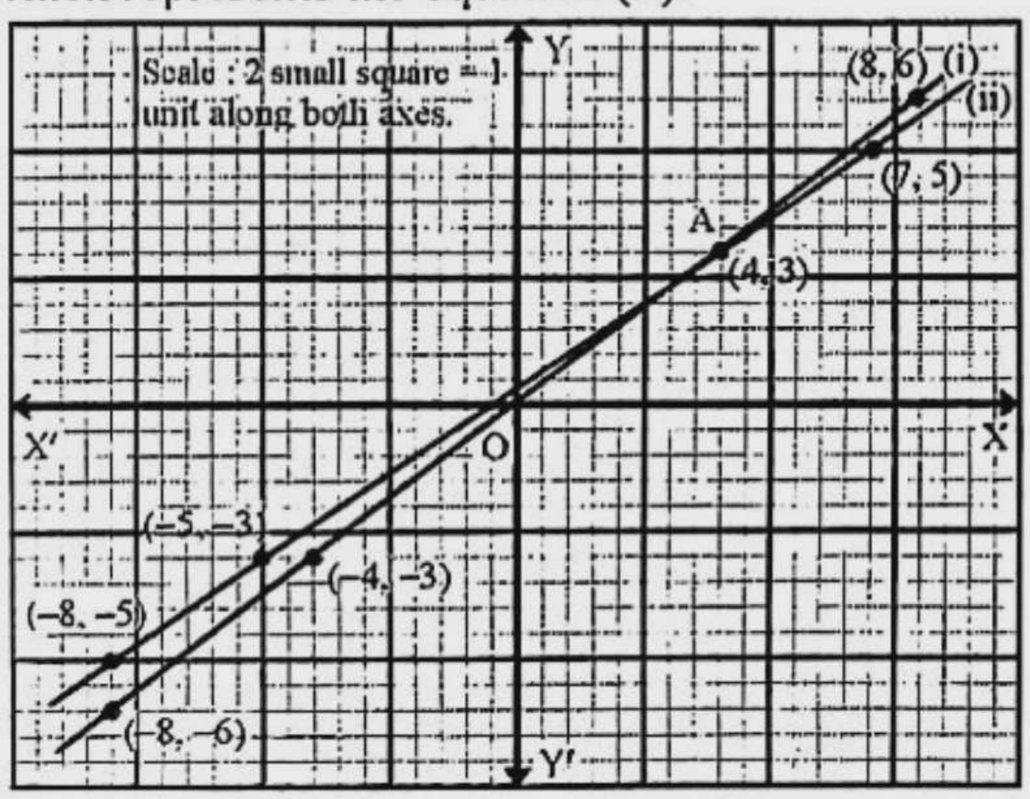
Or, $2x + 1 = 3y$

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

We again construct the table below from the values of y for different values of x :

x	– 8	– 5	4	7
y	– 5	– 3	3	5

Let XOX′ and YOY′ be x-axis and y-axis respectively with O as the origin. Let the length of two sides of the smallest square of both axes be chosen as a unit. We put the points of table–1 (–8, – 6), (– 4, – 3), (4, 3) and (8, 6) on the graph paper. Adding the points and extending the line in both directions, we get the graph of the equation (i). Again, we put the points of table–2 (– 8, – 5), (– 5, – 3), (4, 3) and (7, 5) on the graph paper. Joining the points, we get the graph of the straight line which represents the equation (ii).



The second stgraight line intersects the previous one at the point A. A is the common point of both the straight lines. Both the equations are satisfied by coordinates of A. From the graph, we see that the abscissa of A is 4 and the ordinate of A is 3. Therefore, the abscissa and ordinate of the point of intersection of the equations are 4 and 3.

Ques. 04 5 years ago the ratio of the ages of father and a son was 4 : 1 and after 15 years that will be 2 : 1.

a. Resolve into factors of $36 - 12p + p^2$. 2

b. Determine the present age of father and son. 4

c. Making the simple simultaneous equations from the stem, determine the abscissa and ordinate using the help of graph. 4

• *Cumilla Board 2019*

Solution to Question No. 04 :

a Given, expression : $36 - 12p + p^2$

$= 6^2 - 2.6.p + p^2$

$= (6 - p^2)$

$= (6 - p)\ (6 - p)$ **(Ans.)**

b Let, present age of father = x years

and present age of son = y years

Now,

5 years ago, age of father = (x – 5) years

and age of son = (y – 5) years

and After 15 years, age of father = (x + 15) years

and age of son = (y + 15) years

According to 1st condition,

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

or, $x - 5 = 4(y - 5)$

or, $x - 5 = 4y - 20$

$\therefore\ x - 4y + 15 = 0$ ..... (i)

According to 2nd condition,

$\frac{x+15}{y+15} = \frac{2}{1}$

or, $x + 15 = 2(y + 15)$

or, $x + 15 = 2y + 30$

or, $x - 2y - 15 = 0$ ..... (ii)

Now, equation (ii) is multiplied by 2 then subtracted from equation (i) we get,

$x - 4y + 15 = 0$

$2x - 4y - 30 = 0$

(–) (+) (+)

$-x + 45 = 0$

or, $-x = -45.$

$\therefore\ x = 45$

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

$45 - 4y + 15 = 0$

or, $-4y + 60 = 0$

or, $-4y = -60$

or, $y = \frac{-60}{-4}$

$\therefore\ y = 15$

Therefore, father's present age = 45 years and son's present age = 15 years **(Ans.)**

c From 'b' we get

$x - 4y + 15 = 0$ ..... (i)

$x - 2y - 15 = 0$ ..... (ii)

From (i) we get,

$y = \frac{x+15}{4}$

For different values of x we get different values of y

x	– 15	20	45
y	0	8.75	15

From (ii) we get,

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

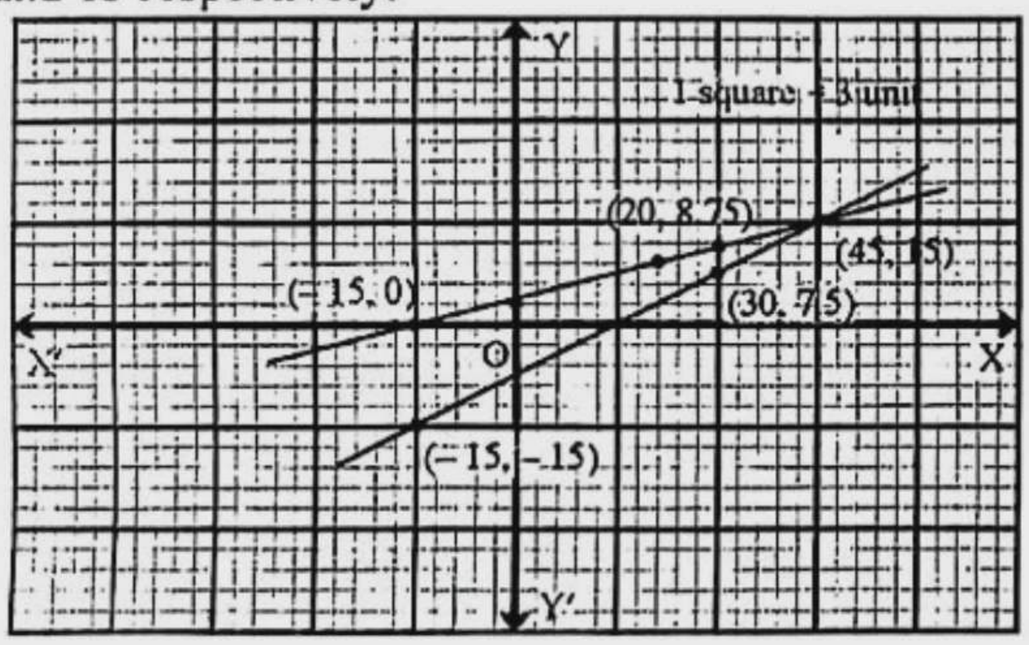
For different values of x we get different values of y.

x	30	– 15	45
y	7.5	– 15	15

Let, XOX′ and YOY′ be the x-axis and the y-axis respectively and O be the origin. Let 3 smallest squares of both axes to be considered a unit. We put the points obtained from table–1 on the graph paper. Joining the points and extending the line in both directions, we get the graph of straight line represented by the equation (i).

Again, we put the points obtained from table–2 on the graph paper. Joining the points and extending the line in both directions, we get the graph of straight line represented by the equation (ii). This straight line intersects the previous on at the point P. P is the common point of both straight lines, the abscissa of P is 45 and ordinate is 15.

Therefore, determined abscissa and ordinate are 45 and 15 respectively.



Ques. 05 Of two numbers the sum of thrice of the first and one-third of the second is 19. Again, the difference of the double of the second number from one-third of the first is – 4.

a. Form two equations with the variable x and y according to stem. 2
b. Find two numbers. 4
c. Express that two equations with the help of graph. 4

• *Chattogram Board 2019*

Solution to Question No. 05 :

a Let us suppose,
the 1st number = x
and the 2nd number = y
As per 1st condition :

$$3x + \frac{y}{3} = 19 \text{ ..... (i)}$$

As per 2nd condition :

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

Therefore, equations (i) and (ii) are the required equations with the variable x and y according to stem.

b From (a) above, we have the following equations :

$$3x + \frac{y}{3} = 19 \text{ ..... (i)}$$

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

Multiplying equation (i) by 6 and then adding with equation (ii), we get,

$$18x + 2y + \frac{x}{3} - 2y = 114 - 4$$

or, $18x + \frac{x}{3} = 110$

or, $\frac{54x + x}{3} = 110$

or, $55x = 330$

or, $x = \frac{330}{55}$

$\therefore x = 6$

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

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

or, $2 - 2y = -4$

or, $-2y = -4 - 2$

or, $-2y = -6$

or, $2y = 6$

or, $y = \frac{6}{2}$

$\therefore y = 3$

$\therefore$ The required numbers, (x, y) = (6, 3).

c From (a) above, we have the following equations :

$$3x + \frac{y}{3} = 19 \text{ ..... (i)}$$

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

Now, from equation (i), we get,

$$3x + \frac{y}{3} = 19$$

or, $\frac{y}{3} = 19 - 3x$ or, $y = 57 - 9x$ ..... (iii)

And from equation (ii), we get,

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

or, $\frac{x}{3} + 4 = 2y$

or, $\frac{x+12}{3} = 2y$ or, $y = \frac{x+12}{6}$ ..... (iv)

Now, for the equation (iii), table– 1 is made for (x, y) as below :

Table–1

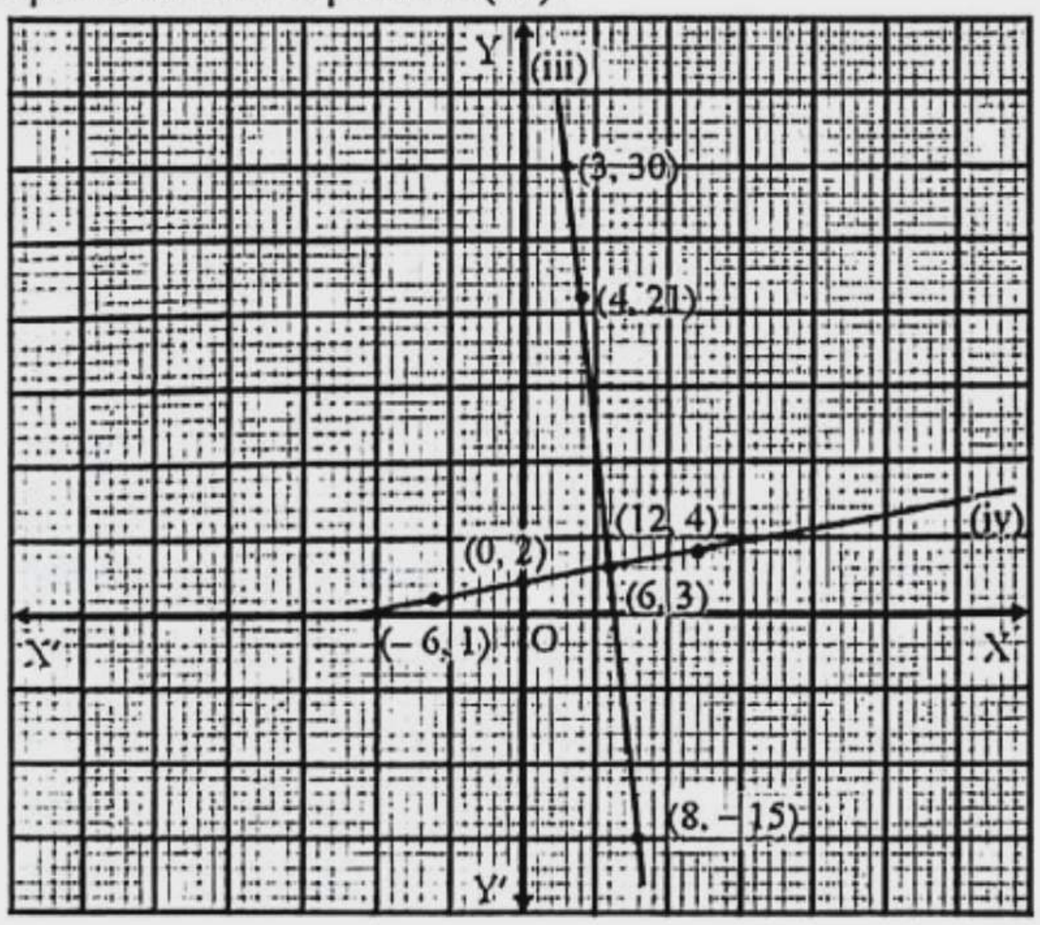
x	8	6	4	3
y	–15	3	21	30

Again, for the equation (iv), table–2 is made for (x, y) as below :

Table–2

x	– 6	0	6	12
y	1	2	3	4

Let, XOX′ and YOY′ be x-axis and y-axis respectively with O as the origin. Let the length of a side of the smallest square of both axes be chosen as a unit. We put the points of table–1 (8, – 15), (6, 3), (4, 21) and (3,30) on the graph paper. Adding the points and extending the line in both directions, we get the graph of the equation (iii). Again, we put the points of table–2 (– 6, 1), (0, 2), (6, 3) and (12, 4) on the graph paper. Joining the points, we get the graph of the straight line which represents the equation (iv).



Ques. 06 $7x + 3y = 27$ and $5x - 2y = 11$ are two simple equations.

a. Verify which equation is satisfied by the co-ordinate (0, 9). 2

b. Find out (x, y) by elimination method. 4

c. Solve the equation with the help of the graph. 4

• *Barishal Board 2019*

Solution to Question No. 06 :

a Here we have,

$7x + 3y = 27$

or, $7 \times 0 + 3 \times 9 = 27$ putting $x = 0, y = 9$

or, $0 + 27 = 27$

So, (0, 9) satisfies the equation $7x + 3y = 27$

Again, $5x - 2y = 11$

or, $5 \times 0 - 2 \times 9 = 11$ putting $x = 0, y = 9$

or, $0 - 18 = 11$

or, $-18 = 11$

So, (0, 9) does not satisfy $5x - 2y = 11$

b Given, $7x + 3y = 27$ ..... (i)

$5x - 2y = 11$ ..... (ii)

Now, multiplying (i) by 2 and multiplying (ii) by 3, we get,

$14x + 6y = 54$

$15x - 6y = 33$ [Adding]

$29x = 87$

or, $x = \frac{87}{29}$

$\therefore x = 3$

Substituting the value of x in (i), We get,

$7.3 + 3y = 27$

or, $3y = 27 - 21$

or, $3y = 6$

or, $y = \frac{6}{3}$

$\therefore y = 2$

$\therefore$ Required solution : $(x, y) = (3, 2)$

c Given,

$7x + 3y = 27$ ..... (i)

and $5x - 2y = 11$ ..... (ii)

From (i) we get,

$y = \frac{27 - 7x}{3}$

For different values of x, we get different values of y.

x	0	3	– 3
y	9	2	16

From (ii) we get,

$y = \frac{5x - 11}{2}$

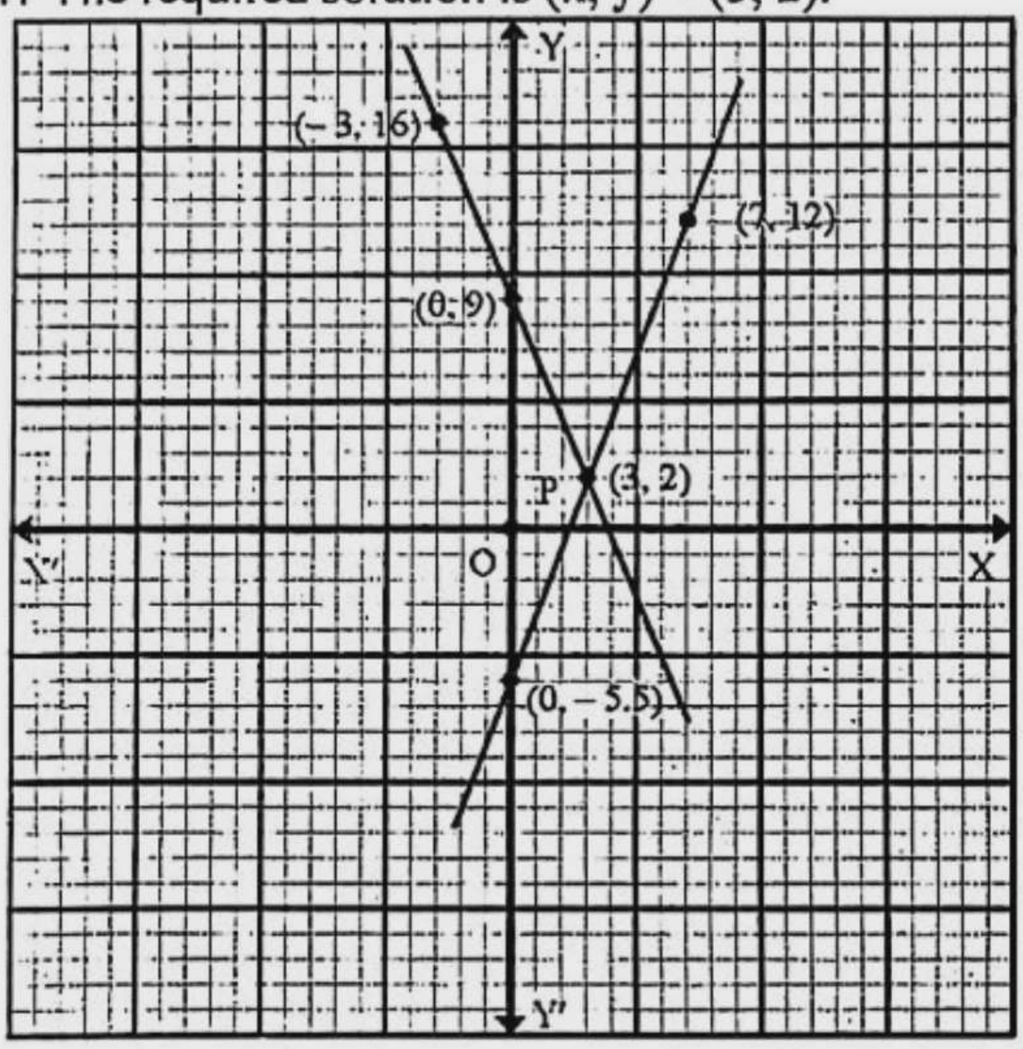
For different values of x, we get different values of y.

x	0	3	7
y	– 5.5	2	12

Let, XOX′ and YOY′ be the x-axis and the y-axis respectively and O be the origin. Let 1 smallest squares of both axes to be considered a unit. We put the points obtained from table-1 on the graph paper. Joining the points and extending the line in both directions, we get the graph of straight line represented by the equation (i).

Again, we put the points obtained from table-2 on the graph paper. Joining the points and extending the line in both directions, we get the graph of straight line represented by the equation (ii). This straight line intersects the previous one at the point P.P is the common point of both straight lines, the abscissa of P is 3 and ordiante is 2.

∴ The required solution is (x, y) = (3, 2).



Ques. 07 $2x - 3y = 12$, $x + 5y = -7$ are two simple equations.

a. If the sum and the difference of two numbers are 110 and 50 respectively, find the two numbers. 2

b. Find out (x, y) by elimination method. 4

c. Solve the equation with the help of graph. 4

• *Mymensingh Board 2019*

Solution to Question No. 07 :

a Let, one number = a

and another number = b; where a > b

According to question,

$a + b = 110$ ..... (i)

and $a - b = 50$ ..... (ii)

Adding the equations (i) and (ii) we get,

$2a = 160$

∴ $a = 80$

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

$80 + b = 110$

or, $b = 110 - 80$

∴ $b = 30$

∴ The required numbers are 80 and 30 **(Ans.)**

b The given equations are

$2x - 3y = 12$ ..... (i)

$x + 5y = -7$ ..... (ii)

Mutiplying equation (i) by 5 and equation (ii) by 3 we get,

$10x - 15y = 60$ ..... (iii)

$3x + 15y = -21$ ..... (iv)

$13x = 39$ [Adding]

or, $x = \frac{39}{13}$

∴ $x = 3$

Now, putting the value of x in equation (ii), we get,

$3 + 5y = -7$

or, $5y = -7 - 3$

or, $y = \frac{-10}{5}$

∴ $y = -2$

∴ Required solution : (x, y) = (3, – 2).

c Given, equations are

$2x - 3y = 12$ ..... (i)

and $x + 5y = -7$ ..... (ii)

From equation (i) we get,

$2x - 3y = 12$

or, $y = \frac{2x - 12}{3}$

We construct the table below from the values of y for different values of x :

x	– 3	0	3	6
y	– 6	– 4	– 2	0

Table-1

From equation (ii) we get,

$x + 5y = -7$

or, $y = \frac{-7 - x}{5}$

We again construct the table below from the values of y for the different values of x :

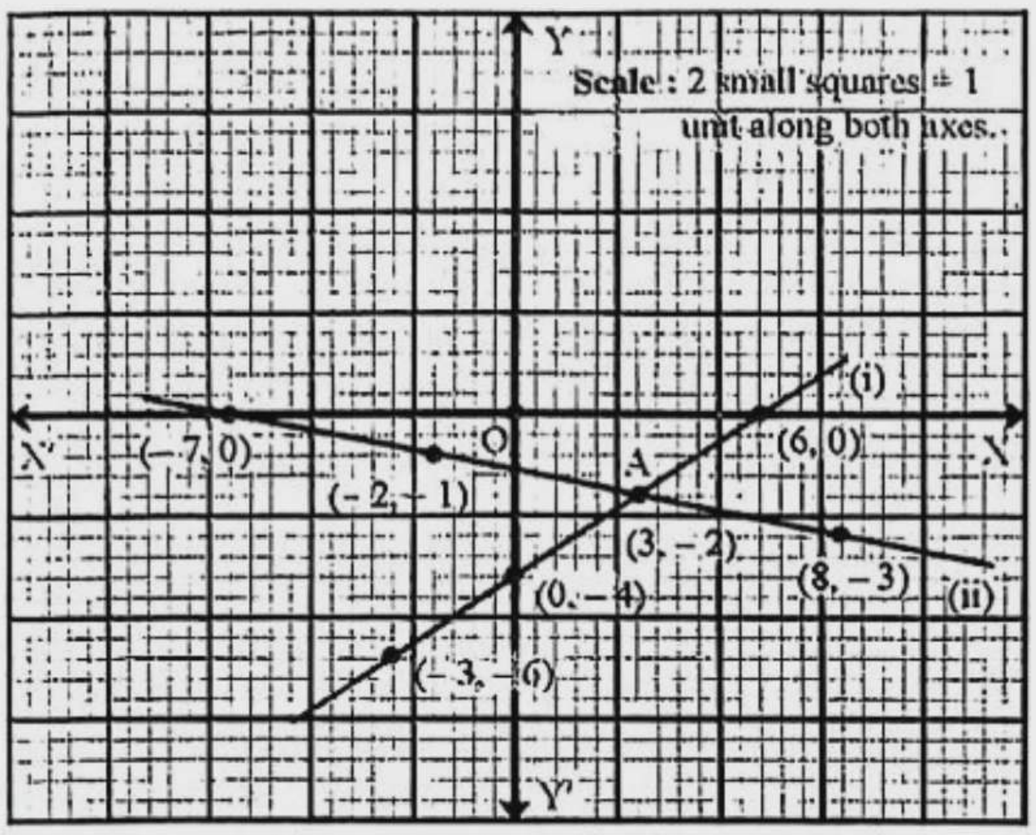
x	– 7	– 2	3	8
y	0	– 1	– 2	– 3

Table-2

Let XOX′ and YOY′ be x-axis and y-axis respectively with O as the origin. Let, the length of two sides of the smallest square of both axes be chasen as a unit. We put the points of table-1 (– 3, – 6), (0, – 4), (3, – 2) and (6, 0) on the graph paper. Adding the points and extending the line in both directions, we get the graph of the equation (i).

Again, we put the points of table-2 (– 7, 0), (– 2, – 1), (3, – 2) and (8, – 3) on the graph paper. Joining the points, we get the graph of the straight line which represents the equation (ii).

This straight line intersects the previous one at the point A. A is the common point of both the straight lines.



Both the equations are satisfied by co-ordinates of A. From the graph, we see that the abscissa of A is 3 and the ordinate of A is – 2.

Therefore, the required solution is (x, y) = (3, – 2).

Ques. 08 $9x - 7y = 13$ and $5x - 3y = 9$ are two equations.

a. Determine which equation is satisfied by the point (0, – 3) 2

b. Solve the equation by the elimination method. 4

c. Draw the graph and find out the abscissa and the ordinate of the intersect point. 4

• *Dhaka Board 2018*

Solution to Question No. 08 :

a Putting x = 0, y = – 3 in $9x - 7y = 13$, we get, $0 - 7(-3) = 13$ or, $21 = 13$ which is impossible.

So, (0, – 3) does not satisfies $9x - 7y = 13$.

Again, putting x = 0, y = – 3 in $5x - 3y = 9$, we get, $0 - 3 \times -3 = 9$ or, $9 = 9$, which is true.

∴ (0, – 3) satisfies $5x - 3y = 9$.

b Given equations are—

$9x - 07y = 13 \Rightarrow y = \frac{9x - 13}{7}$ .....(i) and

$5x - 3y = 9 \Rightarrow 5x - 3 \times \frac{9x - 13}{7} = 9$, putting for y from (i).

$\Rightarrow 5x - \frac{27x - 39}{7} = 9$

$\Rightarrow 35x - 27x + 39 = 63$, pultiplying by 7.

$\Rightarrow 8x = 63 - 39$

$\Rightarrow x = \frac{24}{8}$

$\Rightarrow x = 3$

Now, putting x = 3 in (i), we get, $y = \frac{9 \times 3 - 13}{7}$

$= \frac{14}{7} = 2$

∴ The required solution : (x, y) = (3, 2).

c Here, $9x - 7y = 13 \Rightarrow y = \frac{9x - 13}{7}$ .....(i) and

$5x - 3y = 9 \Rightarrow y = \frac{5x - 9}{3}$ .....(ii)

Now, to solve the equations (i) and (ii) by using graphs, two tables of some points (x, y) against both the equations (i) and (ii) are made below :

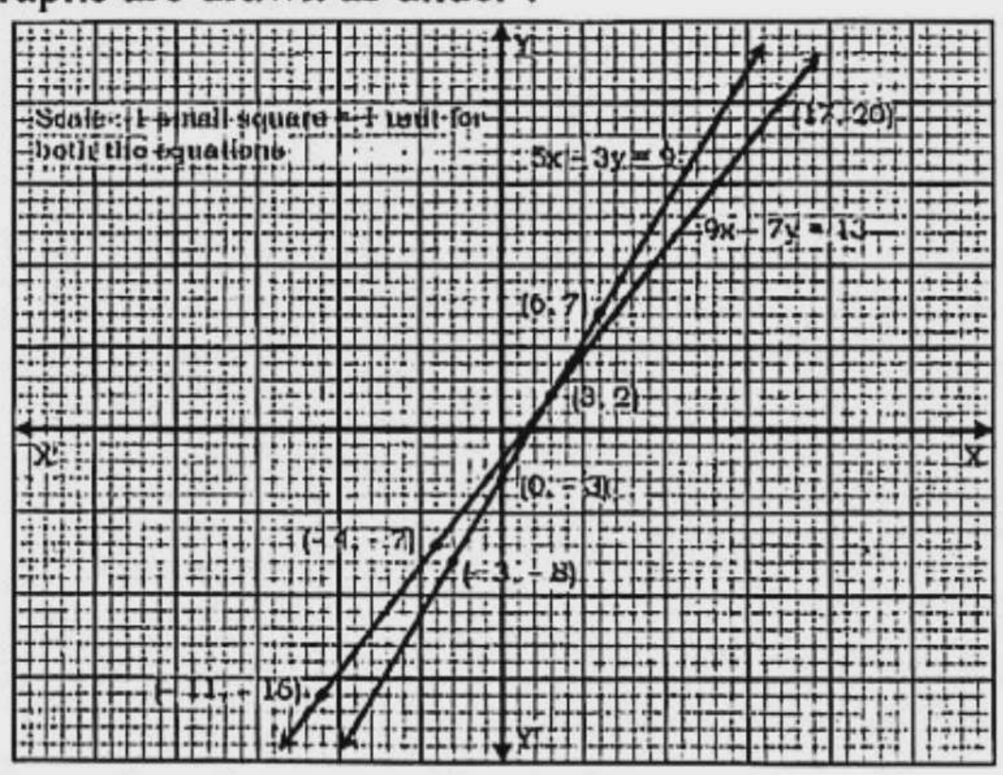
Table–1 (against equation (i))

x	3	– 4	– 11	17
y	2	– 7	– 16	20

Table–1 (against equation (ii))

x	0	3	6	– 3
y	– 3	2	7	– 8

Then points on equation (i) and equation (2) which are showen in table–1 and table–2 respectively are plotted on a graph paper of xy – plane and two graphs are drawn as under :



From the above graphs, it is seen that the two graphs against the given two equation mutually intersect at point (3, 2).

The solution of the given two equation is (x, y) = (3, 2).

Ques. 09 $ax - y = 1$ and $x + ay = 8$ are two simple equations.

a. Justify a solution of $ax - y = 1$ is (2, 5) if a = 3. 2

b. Solve the pair of equations. 4

c. Solve the pair of equations with the help of graph when a = 2. 4

• *Rajshahi Board 2018*

Solution to Question No. 09 :

a The given equation is $ax - y = 1$

or, $2a - 5 = 1$

or, $2a = 6$

or, $a = 3$

That is, if a = 3, (2, 5) is a solution of $ax - y = 1$ **(Justified)**

b Here, $ax - y = 1 \Rightarrow y = ax - 1$.....(i) and
$x + ay = 8 \Rightarrow x + a(ax - 1) = 8$, putting for y from (i)

$$\Rightarrow x + a^2x - a = 8$$
$$\Rightarrow (a^2 + 1)x = 8 + a$$
$$\Rightarrow x = \frac{a+8}{a^2+1}$$

Now, putting $x = \frac{a+8}{a^2+1}$ in (i), we get,

$$y = a\left(\frac{a+8}{a^2+1}\right) - 1$$
$$= \frac{a^2 + 8a - a^2 - 1}{a^2+1}$$
$$= \frac{8a-1}{a^2+1}.$$

$\therefore$ The required solution : $(x, y) = \left(\frac{8+a}{a^2+1}, \frac{8a-1}{a^2+1}\right)$

c We have,
$ax - y = 1 \Rightarrow 2x - y = 1$ when $a = 2$
$\Rightarrow y = 2x - 1$.....(i) and
$x + ay = 8 \Rightarrow 2y = 8 - x$, when $a = 2$
$\Rightarrow y = \frac{8-x}{2}$ .....(ii)

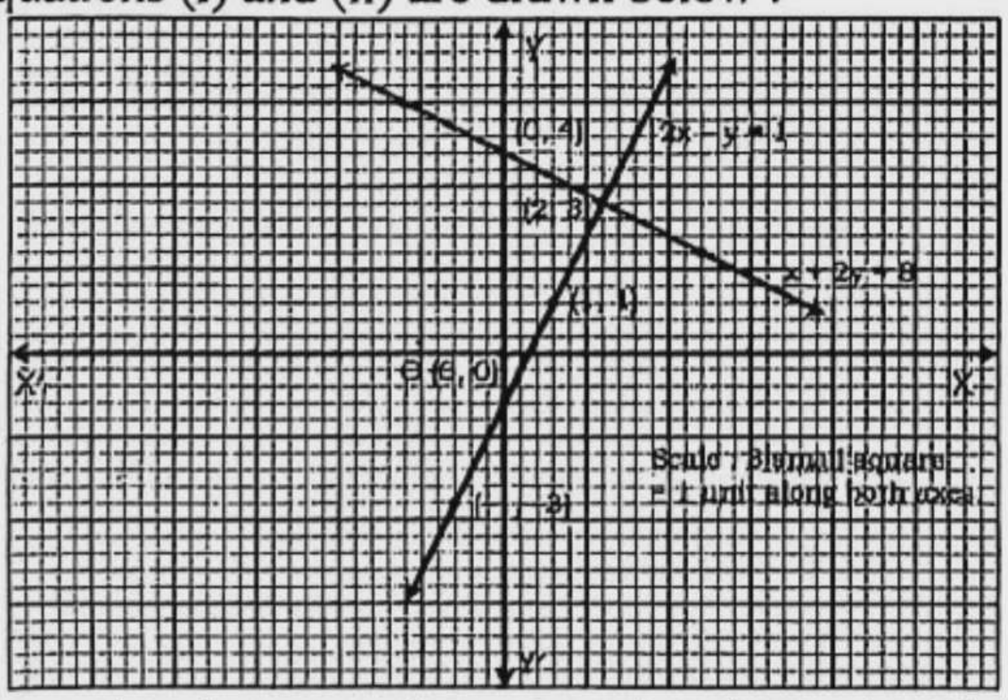
For equation (i), table– (i)

x	0	1	2	– 1
y	– 1	1	3	– 3

For equation (ii), table– (ii)

x	0	2	4	– 2
y	4	3	2	5

Now, plotting points of table (i) and table (ii), on a graph paper, two graphs of lines representing equations (i) and (ii) are drawn below :



From the above graph, we see that the two straight line mutually intersect at point (2, 3)
$\therefore$ The required solution is $(x, y) = (2, 3)$.

Ques. 10 $2x + 4y = 4$ and $3x - 5y = 6$ are simple simultaneous equations.
a. Which equation is satisfied by the co-ordinate (4, – 1)? 2
b. Solve two equations. 4
c. Solve two equations with the help of the graph. 4

● *Jashore Board 2018*

Solution to Question No. 10 :

a Putting $x = 4$ and $y = -1$ in the 1st equation, we get, $2 \times 4 + 4 \times -1 = 4$. That is, the 1st equation is satisfied by the point (4, – 1).
Again, putting $x = 4$, $y = -1$ in the 2nd equation, we get, $3 \times 4 - 5 \times -1 = 17 \neq 6$. That is, the 2nd equation is not satisfied by the point (4, – 1).
Thus, $2x + 4y = 4$ is the required equation to satisfy by (4, – 1).

b Here given two equations,
$2x + 4y = 4$
$\Rightarrow 6x + 12y = 12$ ..... (i) and
$3x - 5y = 6$
$\Rightarrow 6x - 10y = 12$ ..... (2)
Now, subtracting (2) from (1), we get,
$22y = 0 \Rightarrow y = 0$
Putting $y = 0$ in (1), we get, $x = 2$
$\therefore$ The required solution : $(x, y) = (2, 0)$.

c Here we have,
$2x + 4y = 4 \Rightarrow 4y = 4 - 2x \Rightarrow y = \frac{4-2x}{4}$ ..... (i)
Again, $3x - 5y = 6 \Rightarrow 5y = 3x - 6$
$\Rightarrow y = \frac{3x-6}{5}$ ..... (ii)

Now, for the equation (i), a table for the points (x, y) are made below :

Table- 1

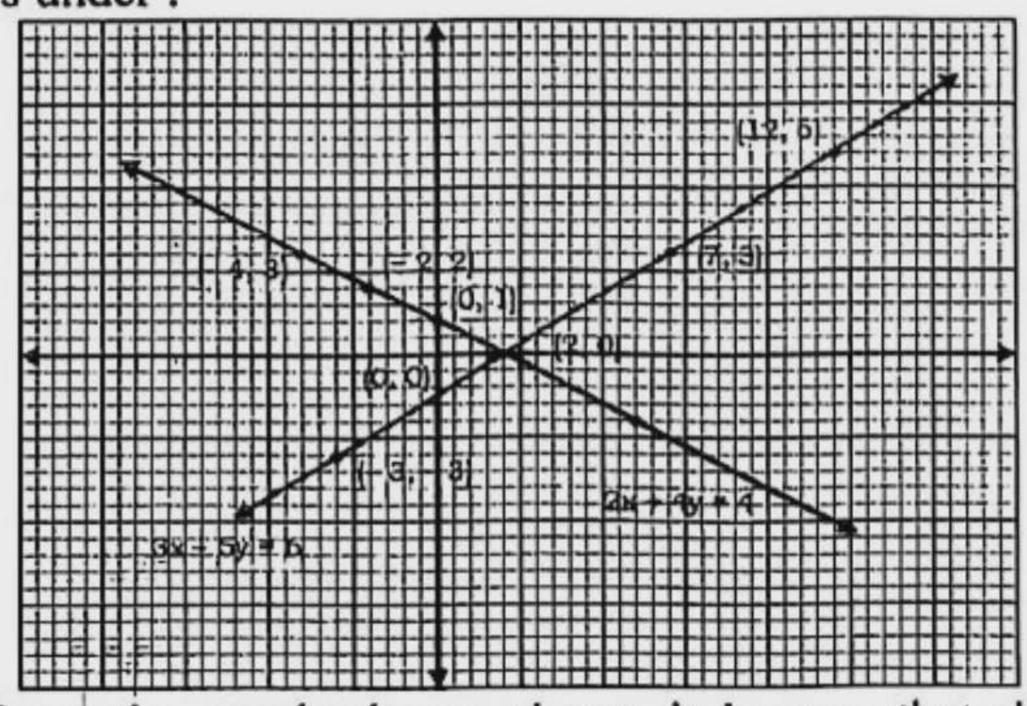
x	0	2	– 2	– 4
y	1	0	2	3

Again, for the equation (ii), table- 2 is made for (x, y) as under :

Table- 2

x	2	7	12	– 3
y	0	3	6	– 3

Now, points in both table- 1 and table- 2 are plotted on a graph paper of xy-plane and the required graph for equations (i) and (ii) are drawn as under :



From the graph shown above, it is seen that the two graphs mutually meet at point (2, 0).
So, the solution of the given two equation is $(x, y) = (2, 0)$.

Ques. 11 (i) $7x + 3y = 10$ and $5x - 2y = 3$ are two simple equations and .
(ii) $4x - y = 7$ and $2x + y = 5$ are another two simple equations.
a. If the sum and difference of two numbers are 120 and 10 respectively, find the two numbers. 2
b. Solve the equations by using substitution method from (i). 4
c. Draw the graph of the equation from (ii). 4

• *Chattogram Board 2018*

Solution to Question No. 11 :

a Let the two numbers are x and y.
∴ According to the given information,
$x + y = 120$ ..... (1) and
$x - y = 10$ ..... (2)
Adding (1) and (2), we get,
$2x = 130 \Rightarrow x = 65$
Putting $x = 65$ in (1), we get,
$65 + y = 120 \Rightarrow y = 55$
∴ The desired two numbers are 65 and 55.

b From (i) we get,
$7x + 3y = 10 \Rightarrow 3y = 10 - 7x$
$\Rightarrow y = \frac{10 - 7x}{3}$ ..... (1)
And $5x - 2y = 3 \Rightarrow 2y = 5x - 3$
$\Rightarrow y = \frac{5x - 3}{2}$ ..... (2)
Now, putting the value of y from (2) in (1) we get,
$\frac{5x - 3}{2} = \frac{10 - 7x}{3}$
or, $15x - 9 = 20 - 14x$, by cross – multiplication.
or, $29x = 29$
or, $x = 1$
Now, putting $x = 1$ in (2) we get,
$y = \frac{5 - 3}{2}$ or, $y = 1$, So, solution : $(x, y) = (1, 1)$

c Equations from (ii) are,
$4x - y = 7 \Rightarrow y = 4x - 7$ ..... (1) and
$2x + y = 5 \Rightarrow y = 5 - 2x$ ..... (2)
Now, two individual tables of ordered pair (x, y) one against equation (1) and the other against equation (2) are made below :

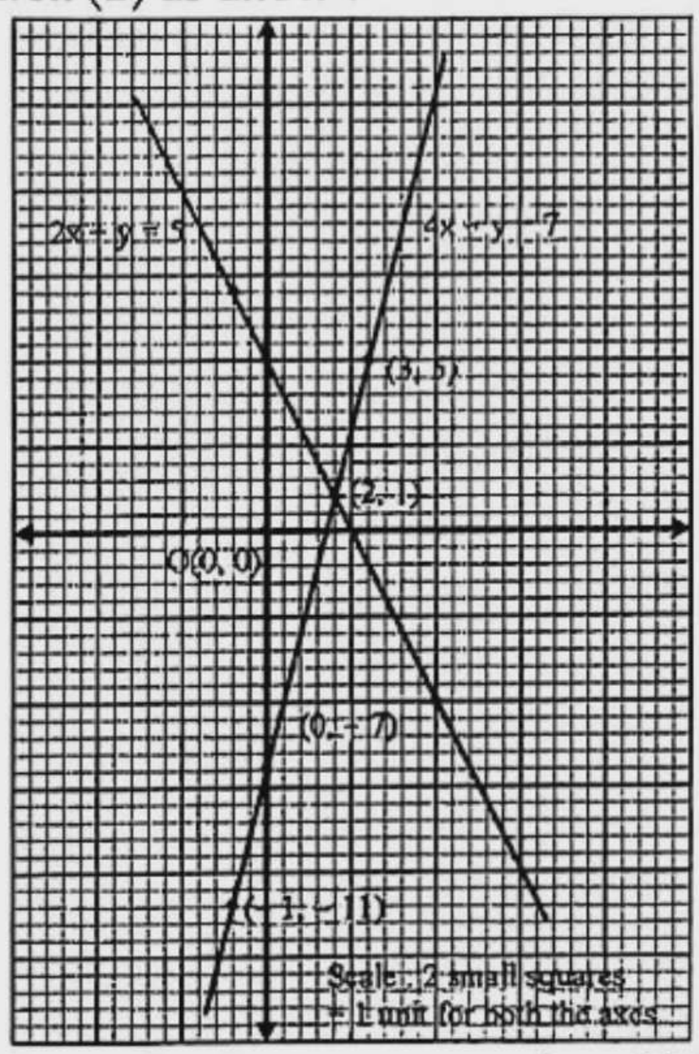
Table-1 (For equation-1)

x	0	2	3	–1
y	–7	1	5	–1

Table-2 (For equation-2)

x	0	2	–1	5
y	5	1	7	–5

Then ordered pair of points from table-1 are plotted on a graph paper and are joined to draw the graph for equation (1). Similarly, ordered pair of points from table-2 are also plotted on the same graph paper and are joined to draw the graph for the equation (2) as under :



Thus we have the above two graphs which are the desired graphs.

Ques. 12 $3x - 4y = 0$ and $2x - 3y = -1$ are two simple equations.
a. If the sum and difference of two numbers are 60 and 10 respectively. Find the two numbers. 2
b. Solve the two equations using elimination method. 4
c. Solve the equations with the help of graphs. 4

• *Sylhet Board 2018*

Solution to Question No. 12 :

a Let, the desired two numbers are x and y.
Now, according to the given information,
$x + y = 60$.....(1) and
$x - y = 10$ .....(2)
Adding (1) and (2), $2x = 70$ or, $x = 35$.
Again, subtracting (2) from (1), $2y = 50$ or, $y = 25$
∴ The two numbers are 35 and 25.

b Here, we have,
$3x - 4y = 0$.....(1) and
$2x - 3y = -1$ .....(2)
Now, multiplying (1) by 2 and (2) by 3, we get,
$6x - 8y = 0$.....(3)
$6x - 9y = -3$ .....(4)
Subtracting (4) from (3), $y = +3$.
Putting $y = 3$ in (1), we get,
$3x - 12 = 0$ or, $x = \frac{12}{3}$ or, $x = 4$
∴ The solution of the two equation, $(x, y) = (4, 3)$.

c $3x - 4y = 0 \Rightarrow y = \frac{3}{4}x$.....(1) and

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

Now, in order to draw graphs of straight lines representing equations (1) and (2), two individual tables of points under (x, y) are made below :

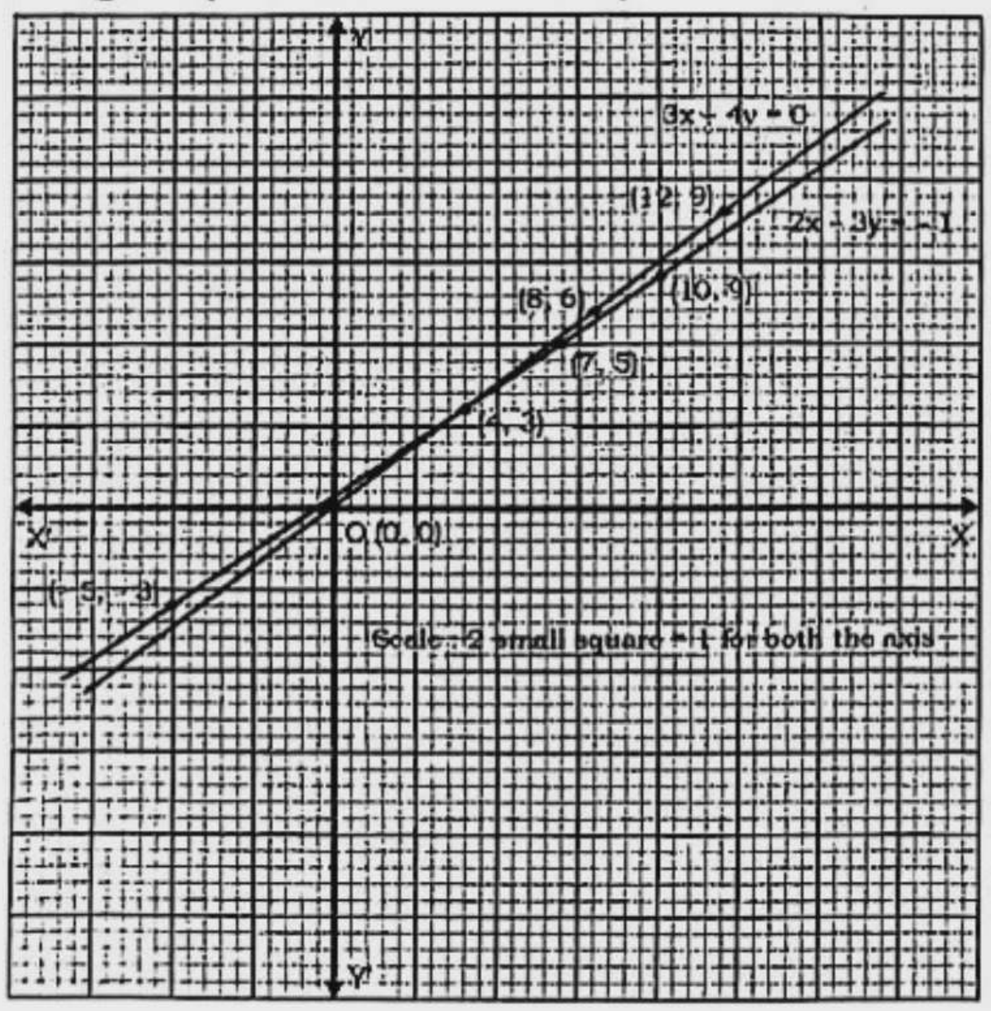
Table – 1 (For equation (1)

x	0	4	8	12
y	0	3	6	9

Table – 2 (For equation (2)

x	4	7	10	– 5
y	3	5	7	– 3

Then the points in table–1 and table–2 are separately plotted on a graph paper of xy-plane and thus two separation straight lines are obtained by joining the points of individual points as under :



From the above graphs, it is seen that the two lines mutually meet at point (4, 3) thus the solution of equations, (x, y) = (4, 3) based on the graphs.

Ques. 13 If 3 is added with the numerator of a fraction, it will be 1. Again, if 2 is added with the denominator, it will be $\frac{1}{2}$.

a. Establish the system of equation considering the fraction $\frac{x}{y}$. 2

b. Find the fraction. 4

c. Solve the equation with the help of the graph. 4

• *Dhaka Board 2017*

Solution to Question No. 13 :

a Here the given fraction is $\frac{x}{y}$.

Now according to the 1st condition, $\frac{x+3}{y} = 1$

or, $x + 3 = y$

or, $x - y + 3 = 0$ .....(1)

Again, based on the 2nd condition,

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

or, $2x = y + 2$

or, $2x - y - 2 = 0$ .....(2)

The equations (1) and (2) are the required system of equations.

b From (a) above, we get,

$x - y + 3 = 0$ .....(1) and

$2x - y - 2 = 0$.....(2)

Subtracting (2) from (1),

$-x + 5 = 0$

or, $x = 5$

Now putting x = 5 in (1), we get,

$5 - y + 3 = 0$

or, $8 - y = 0$

or, $y = 8$.

$\therefore$ The fraction is $\frac{x}{y} = \frac{5}{8}$, putting the value of x, y.

c From (a), (b) above, we have,

$x - y + 3 = 0$

or, $y = x + 3$ .....(1)

Now the following table is made taking values of y for different values of x for equation (1) :

Table-1

x	– 1	1	– 2	2	0	– 3	3	5
y	2	4	1	5	3	0	6	8

Again, we have, $2x - y - 2 = 0$

or, $y = 2x - 2$ .....(ii)

Another table is made below for equation (ii) taking values of y against different values of x :

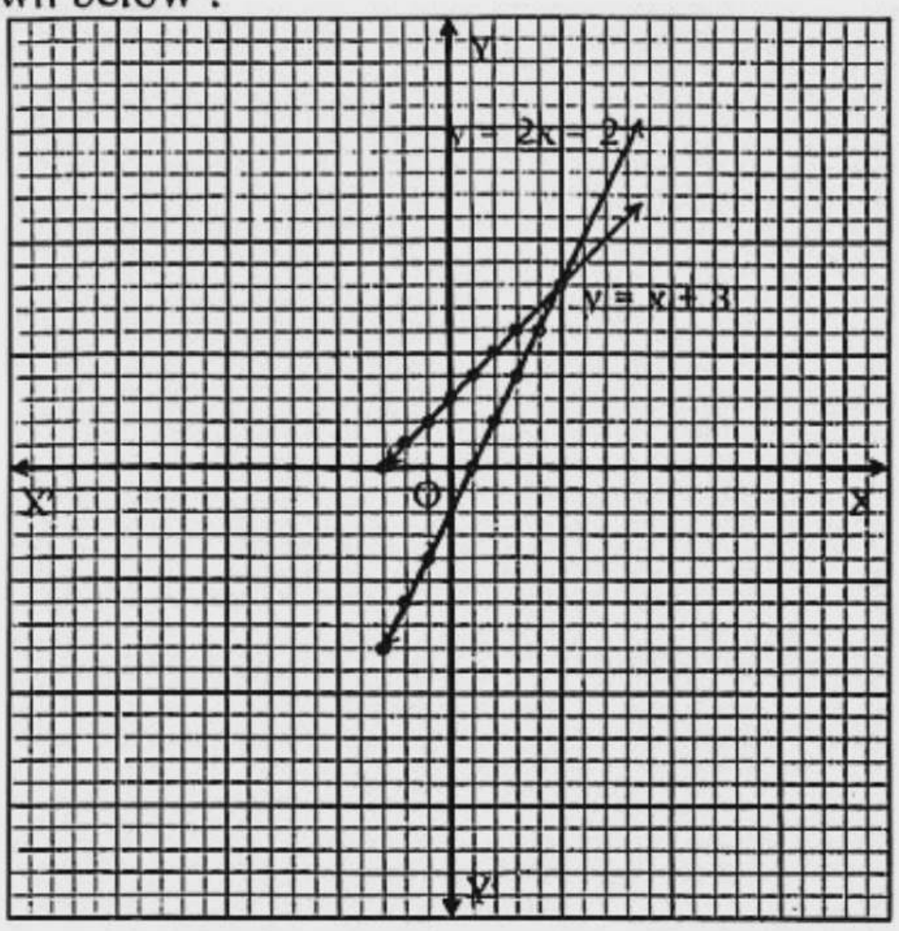
Table-2

x	– 1	1	– 2	2	3	4	5	–3
y	–4	0	–6	2	4	6	8	–8

Then a graph paper of xy – plane is taken. From table (1), ordered pairs for (x, y) and from table (2), ordered pairs for (x, y) are plotted separately on the graph paper. Thus two straight lines one for equation. (1) and the other equation (2) are obtained from the graph, it is found that the two straight lines mutually intersect at the point where (x, y) is (5, 8).

Mathematics

∴ The solution of the system of equation (1) and (2) is (x, y) = (5, 8). The graph in this connection is shown below :



Ques. 14 The length of a rectangular garden is 5 m less than three times of its breadth and the peremeter of the garden is 30 metre.

a. Establish two equations by considering its length 'x' metre and breadth 'y' metre according to the above information. 2

b. Determine the length and breadth of the rectangular garden solving by the equations using the method of substitution. 4

c. Solve the equations with the help of the graph. 4

• *Rajshahi Board 2017*

Solution to Question No. 14 :

a Here length of the rectangular garden = x m and breadth of the rectangular garden = y m.

Now according to the 1st condition,

$x = 3y - 5$ .....(i)

Again, perimeter of the garden = 2 (x + y) m.

Now according to the 2nd condition,

$2(x + y) = 30$ .....(ii)

Thus two equation (i) and (ii) are the desired equations.

b From (a) above we get,

$x = 3y - 5$ .....(1) and

$2(x + y) = 30 \Rightarrow x + y = 15 \Rightarrow x = 15 - y$ .....(2)

From (1) and (2), we can have,

$3y - 5 = 15 - y$, putting $x = 3y - 5$ in (2) from (1).

or, $4y = 20$ or, $y = 5$.

Putting $y = 5$ in (1), we get, $x = 10$

∴ Length = 10 m and breadth = 5 m.

c Based on the given information,

we have the following two equations :

$x = 3y - 5$ .....(1) and $x = 15 - y$.....(2)

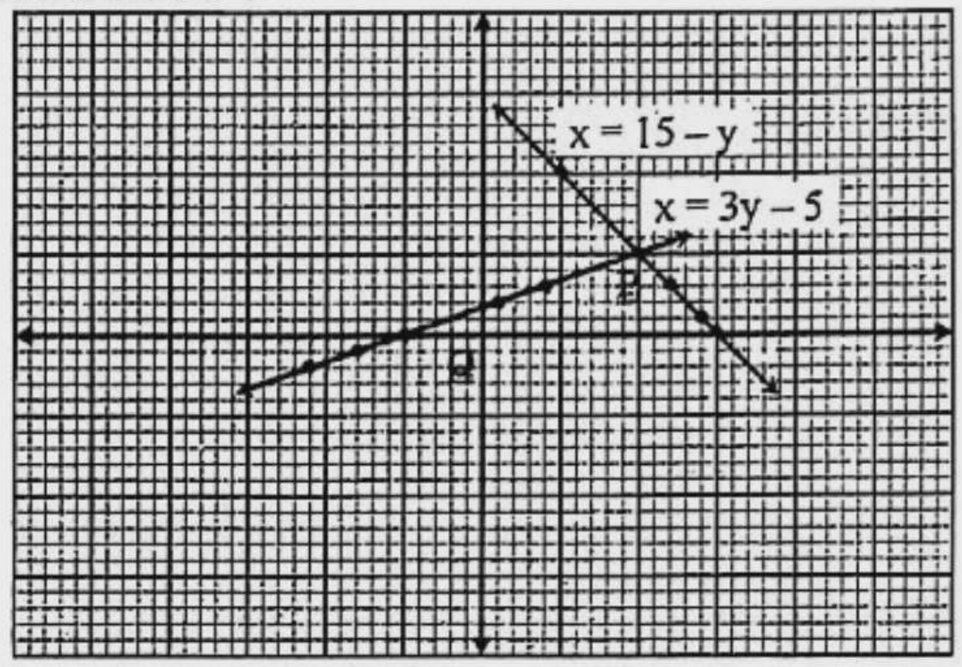
Now, a table is made below for values of y for different values of x for equation (1) :

x	– 5	1	4	– 8	– 11	10
y	0	2	3	– 1	– 2	5

Again, another table is made below for values of y for some values of x for equation (2) :

x	15	10	12	14	5
y	0	5	3	1	10

For both the equations, the ordered pairs of values of (x, y) are plotted in a graph paper of xy – plane. By joining the points obtained from ordered pairs, two straight lines are formed in the graph paper as shown below :



From the graph it is seen that the two lines mutually intersect at point P(10, 5).

∴ The solution of the equation is (x, y) = (10, 5).

Ques. 15 $7a - 3b = 31$, $9a - 5b = 41$.

a. Which equation is satisfied by the point (4, –1)? 2

b. Find out (a, b) by elimination method. 4

c. Evaluate (a, b) by solving the equations with the help of the graph. 4

• *Comilla Board 2017*

Solution to Question No. 15 :

a Putting a = 4 and b = – 1 in the 1st equation, we get,

$7 \times 4 - 3 \times -1 = 31$

or, $28 + 3 = 31$

or, $31 = 31$

∴ The point (4, – 1) satisfies the equation $7a - 3b = 31$.

Again, putting a = 4, b = – 1 in the 2nd equation, we get,

$9a - 5b = 41$

or, $9 \times 4 - 5 \times -1 = 41$

or, $36 + 5 = 41$

or, $41 = 41$

∴ The equation $9a - 5b = 41$ is also satisfied by (4, – 1).

b Given that,

$7a - 3b = 31$ ..... (1) and

$9a - 5b = 41$ ..... (2)

Now multiplying (1) by 9 and (2) by 7, we get,

$63a - 27b = 279$ ..... (3)

$63a - 35b = 287$ ..... (4)

Subtracting (4) from (3), we get,

$8b = -8$ or, $b = -1$

Putting b = – 1 in (1), we get,

$7a + 3 = 31$ or, $7a = 28$ or, $a = 4$

∴ (a, b) = (4, – 1).

c Here we have,

$7a - 3b = 31$

or, $3b = (7a - 31)$

or, $b = \frac{7a - 31}{3}$ ..... (1)

Now a table of order pair (a, b) for equation (1) is made below :

a	1	4	7	10	– 2
b	– 8	– 1	6	13	– 15

Table- 1

Again, we have,

$9a - 5b = 41$

or, $5b = 9a - 41$

or, $b = \frac{9a - 41}{5}$ ..... (2)

A table of ordered pair (a, b) for equation (2) is made below :

a	4	– 1	9	– 6	– 11
b	– 1	– 10	8	– 19	– 28

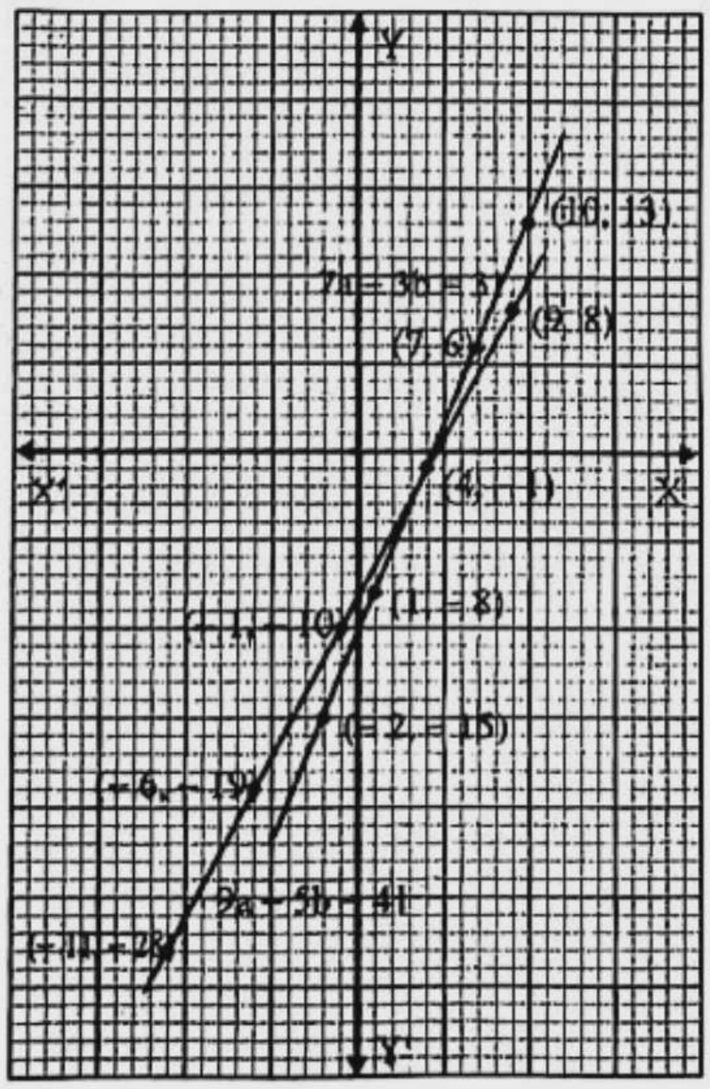
Table- 2

Then a graph paper of xy-plane is taken. The ordered pairs (a, b) for both table- 1 and table- 2 are plotted in the graph paper separately. So, that values of 'a' are plotted along x-axis and values of 'b' are plotted along y-axis.

Thus two separate straight lines are obtain and found that they mutually intersect at (4, – 1).

∴ The solution of the two given equation is :

(a, b) = (4, – 1) by drawing graph and the graph drawn is shown below :



Ques. 16 If 8 is added to the sum of the number with two digits, the sum becomes the three times the digit of ten place. But if 27 is subtracted from the number, the digits are intercharged.

a. From two equations in the light of the stem taking x as the unit place and y as the ten place of the number. 2

b. Find the number by solving the pair of equations following the method of substitution. 4

c. Solve the pair of equations by graphical method. 4

● *Barisal Board 2017*

Solution to Question No. 16 :

a Here the digit of unit place = x and

the digit of tens place = y

Now according to the 1st condition,

$(x + y) + 8 = 3y$ ..... (1)

Again, according to the 2nd condition,

$10y + x - 27 = 10x + y$ ..... (2)

b From (a) above we have two equations in x and y based on the given information as under :

$x + y + 8 = 3y \Rightarrow x = 2y - 8$ ..... (1)

$10y + x - 27 = 10x + y \Rightarrow 9y - 9x = 27$ ..... (2)

Now substituting $x = 2y - 8$ in equation (2),

$9y - 9(2y - 8) = 27$

or, $9y - 18y + 72 = 27$

or, $-9y = -45$

or, $y = 5$

Again, putting $y = 5$ in (1), we get,

$x = 2 \times 5 - 8 = 10 - 8 = 2$

∴ The required solution, (x, y) = (2, 5).

c From (a) and (b) above, we have the following algebraic equation :

$x = 2y - 8 \Rightarrow y = \frac{x + 8}{2}$ ..... (1) and

$9y = 9x + 27 \Rightarrow y = x + 3$ ..... (2)

Now two separate tables of values of y for some values of x against equations (1) and (2) as under :

For equation (1) :

x	0	– 8	2	4	– 2
y	4	0	5	6	3

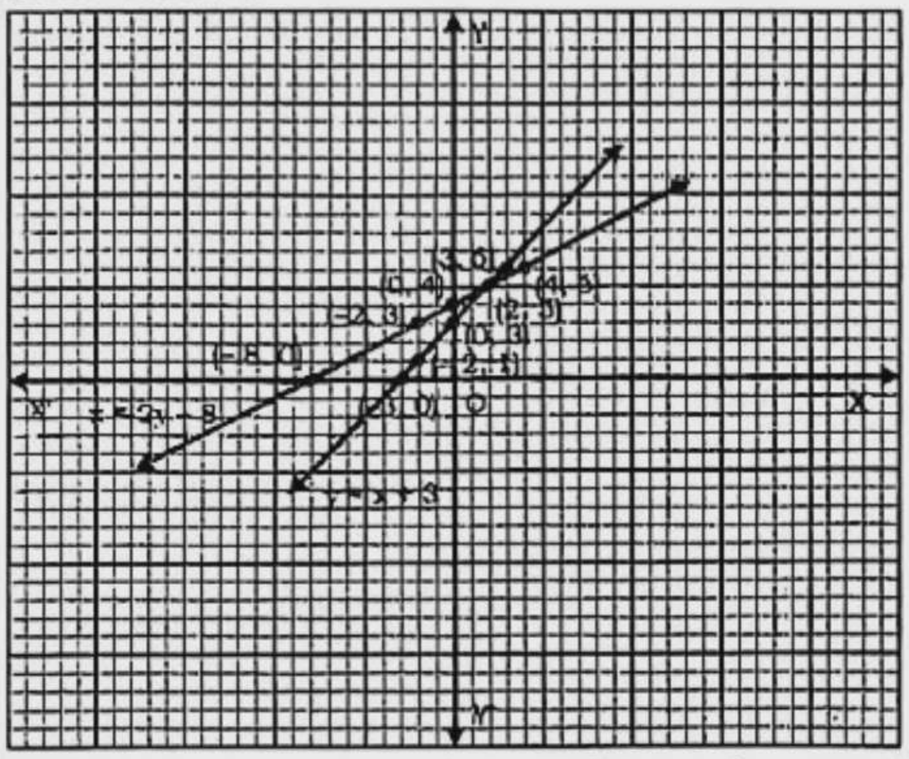
Table-1

For equation (2) :

x	0	– 3	2	– 2	3
y	3	0	5	1	6

Table-2

Then a graph paper of xy plane is taken and the values of ordered pairs (x, y) for both the tables are plotted in graph paper and two straight lines are found as under :



According to the graph shown above, the two lines representing the two equations mutually intersect at (2, 5).

So, the solution, (x, y) = (2, 5)

Ques. 17 $9x - 7y = 13$ and $5x - 3y = 9$ are two simple equations.

a. Which equation is satisfied by (0, – 3)? 2

b. Solve the both equations using the method of elimination. 4

c. Solve the both equations with the he of graphs. 4

• *Dinajpur Board 2017*

Solution to Question No. 17 :

a 1st equation, $9x - 7y = 13$

$\Rightarrow$ $9.0 - 7.(-3) = 13$, putting $x = 0, y = -3$

$\Rightarrow$ $0 + 21 = 13$, which is impossible

$\therefore$ $9x - 7y = 13$ is not satisfied by (0, – 3).

Again, 2nd equation, $5x - 3y = 9$

$\Rightarrow$ $5.0 - 3.(-3) = 9$, putting $x = 0, y = -3$

$\Rightarrow$ $0 + 9 = 9$, which is true.

$\therefore$ $5x - 3y = 9$ is satisfied by (0, – 3).

b Here given the following equations :

$9x - 7y = 13$ ..... (1) and

$5x - 3y = 9$ ..... (2)

Multiplying (1) by 5 and (2) 9, we get,

$45x - 35y = 65$ ..... (3)

$45x - 27y = 81$ ..... (4)

Now subtracting (4) from (3), we get,

$-8y = -16$

or, $y = 2$

Putting $y = 2$ in (1) we get,

$9x - 7 \times 2 = 13$

or, $9x = 13 + 14$ or, $9x = 27$ or, $x = 3$

$\therefore$ The required solution : (x, y) = (3, 2)

c Here, we have,

$9x - 7y = 13 \Rightarrow 7y = 9x - 13$

$\Rightarrow y = \dfrac{9x - 13}{7}$ ..... (1)

And $5x - 3y = 9 \Rightarrow 3y = 5x - 9$

$\Rightarrow y = \dfrac{5x - 9}{3}$ ..... (2)

Now two tables of values of y for some values of x for both the equations (1) and (2) are made below :

For equation : $9x - 7y = 13$

x	3	10	– 4
y	2	11	– 7

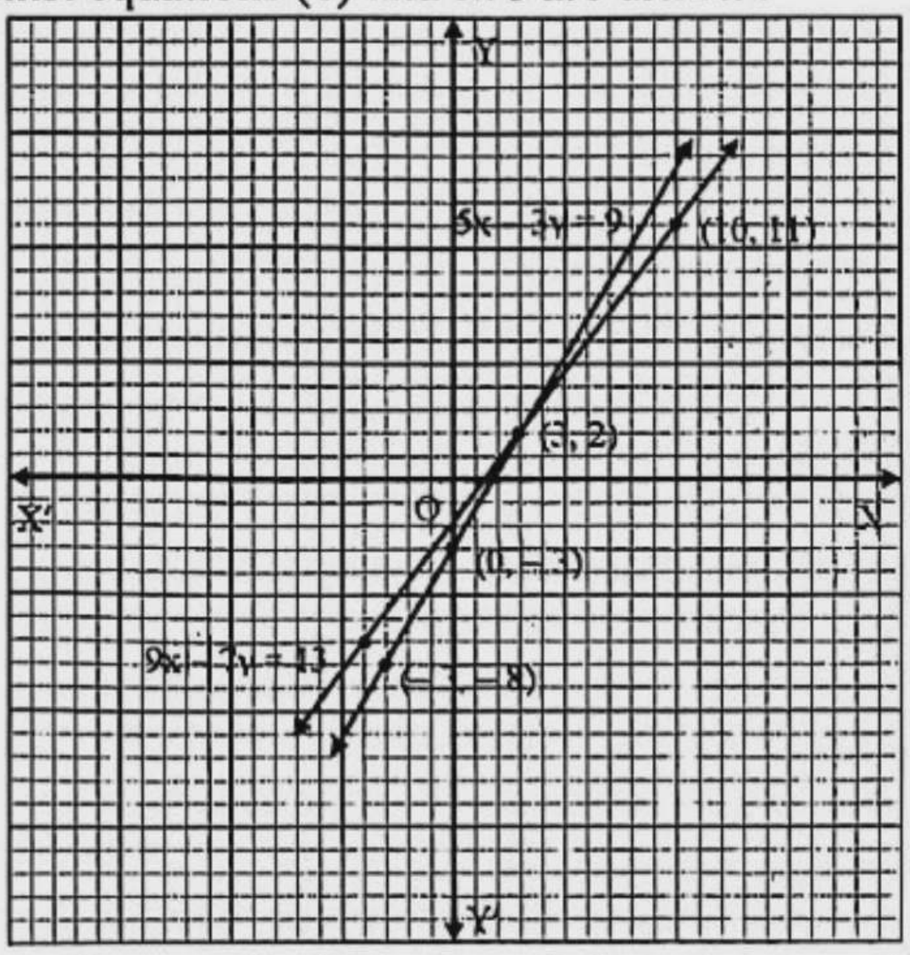
Table-1

For equation : $5x - 3y = 9$

x	3	0	– 3
y	2	– 3	– 8

Table-2

A graph paper of xy-plane is taken. The values of x and y are then plotted along x-axis and y-axis for both the tables considering 1 small square of the graph paper as unit of numbers for both x and y. Thus the following graphs of two straight lines against equations (1) and two are drawn :



From the graph, it is found that the two lines mutually intersect at (3, 2). So, the solution is (3, 2)

Ques. 18 Of two numbers the sum of thrice of the first and one third of the second is 19. Again the difference of the double of the second number from one third of the first is – 4.

a. From two equations with the variable x and y according to stem. 2

b. Find two numbers. 4

c. Find the abscissa and ordinates with the help of graph. 4

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Solution to Question No. 18 :

a Let,

The first number be x

And the second number be y

According to the question,

$3x + \frac{y}{3} = 19$ ---------- (i)

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

b From 'a' we get,

$3x + \frac{y}{3} = 19$ ---------- (i)

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

From equation (i) we get,

$3x + \frac{y}{3} = 19$

or, $\frac{9x + y}{3} = 19$

or, $9x + y = 19 \times 3$

or, $9x + y = 57$ ---------- (iii)

From equation (ii) we get,

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

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

or, $x - 6y = -12$ ---------- (iv)

Multiplying equation (iii) by 6 and adding with (iv) we get,

$$\begin{array}{ll} 54x + 6y & = 342 \\ x - y & = -12 \\ \hline 55x & = 330 \\ \text{or, } x & = \frac{330}{55} \end{array}$$

$\therefore x = 6.$

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

$6 - 6y = -12$

or, $-6y = -12 - 6$

or, $-6y = -18$

or, $y = \frac{-18}{-6}$

$\therefore y = 3$

$\therefore$ The two numbers are 6 and 3. **(Ans.)**

c From 'b' we get,

$9x + y = 57$ ---------- (i)

$x - 6y = -12$ ---------- (ii)

From equation (i) we get,

$9x + y = 57$

$\therefore y = 57 - 9x$

We construct the table below from the values of y for different values of x.

We construct the table below from the values of y for different values of x.

x	−1	0	1	3	7
y	66	57	48	30	−6

Table- 1

From the equation (ii) we get,

$x - 6y = -12$

or, $-6y = -12 - x$

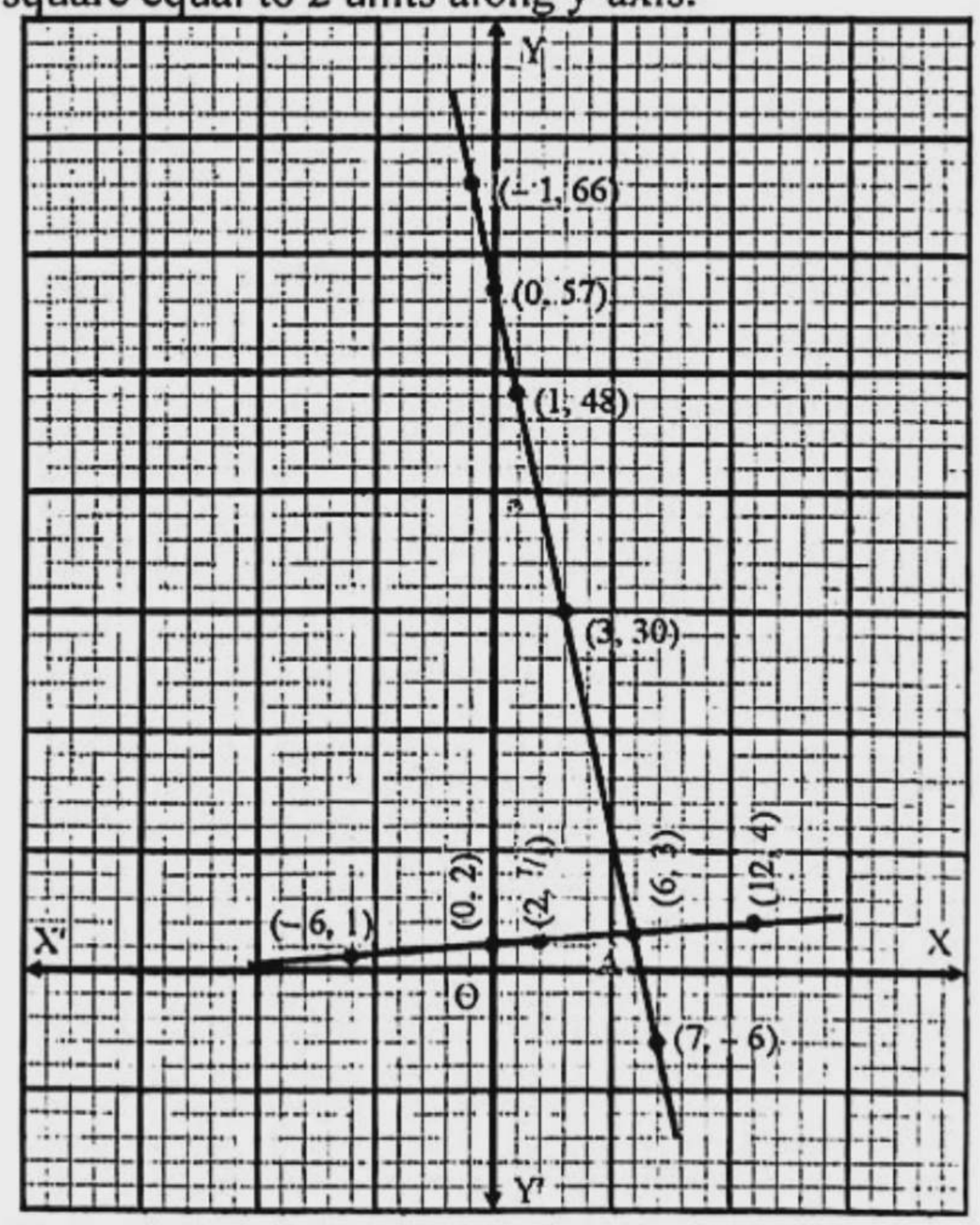
$\therefore y = \frac{x + 12}{6}$

We again construct the table below from the values of y for the different values of x :

x	−6	0	2	6	12
y	1	2	$\frac{7}{3}$	3	4

Table- 2

Let XOX′ and YOY′ are x-axis and y-axis respectively and O is the origin. Let, one small square equal to 1 unit along x-axis and one small square equal to 2 units along y-axis.



We put the points of table-1 (− 1, 66), (0, 57), (1, 48), (4, 21), (7, − 6) on the graph paper. Joining the points and extending the line in both directions, we get the graph of the straight line represented by the equation (i). Again, we put the points table- 2 (− 6, 1), (0, 2), (2, $^7/_3$), (6, 3), (12, 4) on the graph paper. Joining the points, we get the graph of the straight line which represents the equation (ii). This straight line intersects the previous one at the point A. A is the common point of both the straight lines. So, both equations are satisfied by co-ordinates of A. From graph, we see that the abscissa of A is 6 and the ordinate is 3.

Ques. 19 If 11 is added to the numerator of fraction, the value of the fraction becomes 2. Again, If 2 is subtracted from that fraction, the value of the fraction becomes 1.

a. Form the system of equation considering x and y as numerator and denominator respectively. 2

b. Find the value of (x, y) by substitution method. 4

c. Draw the graph and find out the abscissa and ordinate of the intersect point. 4

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Solution to Question No. 19 :

a Given,

Numerator of the fraction = x

Denominator of the fraction = y

According to the question,

$$\frac{x+11}{y}=2$$

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

∴ The required simultaneous equations related to the stem are $\frac{x+11}{y}=2$ and $\frac{x}{y-2}=1$.

b From 'a' we get,

$$\frac{x+11}{y}=2 \text{ ----------(i)}$$

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

From equation (i) we get,

$$\frac{x+11}{y}=2$$

or, $x+11=2y$

∴ $x=2y-11$ ---------(iii)

Putting $x=2y-11$ in equation (ii) we get,

$$\frac{2y-11}{y-2}=1$$

or, $2y-11=y-2$

or, $2y-y=-2+11$

∴ $y=9$

Putting $y=9$ in equation (iii) we get,

$x=2\times 9-11$

or, $x=18-11$

∴ $x=7$

∴ The required solution $(x, y)=(7, 9)$.

c From 'a' we get,

$$\frac{x+11}{y}=2 \text{ ----------(i)}$$

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

From equation (i) we get,

$$\frac{x+11}{y}=2$$

or, $2y=x+11$

∴ $y=\frac{x+11}{2}$ ----------(iii)

From equation (ii) we get,

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

or, $y-2=x$

∴ $y=x+2$ ----------(iv)

Now in order to draw graphs of the equations (iii) and (iv), the following ordered pair of points are found :

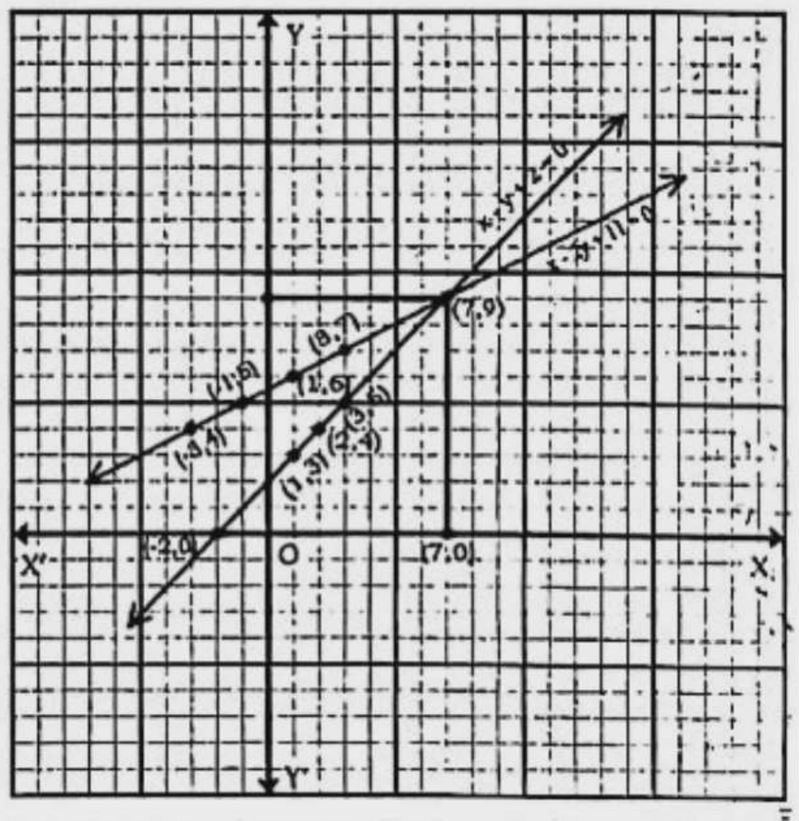
For equation (iii)

x	−1	−3	1	3	7
y	5	4	6	7	9

For equation (iv)

x	−2	−1	2	3	7
y	0	3	4	5	9

Now a graph paper of xy-plane is taken. The above ordered pair of points for the two equations are subsequently plotted on the graph paper considering 1 (one) small square as unit along x-axis and y-axis as under :



From the graph above, it is obvious that (7, 9) is the point of intersection of the two lines representing the above mentioned equations. Again the abscissa of that point of intersection is 7 and the ordinate is 9.

∴ The required abscissa and ordinate of the point of intersection of the two simultaneous equations are 7 and 9.

Appendix

Multiple Choice Q/A — Designed as per topic

1. **What is called the unknown quantity of an equation?** *(Easy)*
   ⓐ Root ⓑ LHS
   ⓒ Variable ⓓ Solution
   ⓒ

2. **How many degree are there in a simple equation?** *(Medium)*
   ⓐ One degree ⓑ Two degree
   ⓒ Three degree ⓓ Four degree
   ⓐ

3. **Equations having the highest degree of the variable 1 is called ——.** *(Easy)*
   ⓐ Simple equation
   ⓑ simple sinaltaneous equation
   ⓒ Quadratic equation
   ⓓ Identity
   ⓐ

4. **How many axioms are there for solving equations?** *(Easy)*
   ⓐ 1 ⓑ 2
   ⓒ 3 ⓓ 4
   ⓓ

5. **Which of the following is a simple equation?** *(Medium)*
   ⓐ $x + 3x = 5$ ⓑ $x^2 + 4 = 0$
   ⓒ $x^2 + 3x = 3$ ⓓ $(a + b)^2 = a^2 + 2ab + b^2$
   ⓐ

6. **How many variables are there in the equation $2x - y + 1 = x + y$?** *(Hard)*
   ⓐ 1 ⓑ 2
   ⓒ 3 ⓓ 4
   ⓑ

7. **What is the root $8(x - 5) = 0$?** *(Medium)*
   ⓐ 5 ⓑ 8
   ⓒ $\frac{5}{8}$ ⓓ $-\frac{8}{5}$
   ⓐ

   ▸▸ **Explanation :** $8(x - 5) = 0$
   or, $x - 5 = \frac{0}{8} = 0$
   or, $x = 5$ [By transposing]
   ∴ The root is 5.

8. **If $\frac{2z - 1}{3} = 5$ then, what is the value of z ?** *(Hard)*
   ⓐ 6 ⓑ 8
   ⓒ 5 ⓓ 3
   ⓑ

   ▸▸ **Explanation :** $\frac{2z - 1}{3} = 5$
   or, $2z - 1 = 15$ [Cross-multiplication]
   or, $2z = 16$ [By transposing]
   or, $\frac{2z}{2} = \frac{16}{2}$ [Dividing by 2]
   ∴ $z = 8$

9. **What is the solution of $2(5 + x) = 16$?** *(Medium)*
   ⓐ 3 ⓑ 4
   ⓒ 5 ⓓ 6
   ⓐ

   ▸▸ **Explanation :** $2(5 + x) = 16$
   or, $10 + 2x = 16$
   or, $2x = 16 - 10$ [By transposing]
   or, $2x = 6$
   or, $\frac{2x}{2} = \frac{6}{2}$ [Dividing by 2]
   or, $x = 3$
   ∴ $x = 3$

10. **To solve an equation —.**
    i. Similar terms with same sign can directly be cancelled.
    ii. Common fuctors can be cancelled directly.
    iii. Any term of any equation is transposed directly from one side to another side by changing its sign.
    Which of the following is correct? *(Easy)*
    ⓐ i & ii ⓑ i & iii
    ⓒ ii & iii ⓓ i, ii & iii
    ⓓ

Short Q/A — Designed as per topic

Question 1. What is meant by the law of transposition and the law of symmetry?
Solution : Law of transposition: The process of directly transferring any term of an equation from one side to the other by changing the sign is called the law of transposition.

Law of symmetry : The process of transferring all the terms on the left side of an equation to the right side and all the terms on the right side to the left side without changing any sign is called the law of symmetry.

Question 2. What is meant by the law of cancellation of addition and the law of cancellation of multiplication?

Solution : Law of cancellation of addition: The process of directly canceling similar terms with the same sign from both sides of an equation is called the law of cancellation of addition.

Law of cancellation of multiplication: The process of directly canceling common factors from both sides of an equation is called the law of cancellation of multiplication.

Question 3. Write down the axioms of solving equations.

Solution : There are four axioms for solving equations. These are as follows:

(1) If the same quantity is added to each of two equal quantities, their sum will also be equal.
(2) If the same quantity is subtracted from each of two equal quantities, their differences will also be equal.
(3) If each of two equal quantities is multiplied by the same quantity, their products will also be equal.
(4) If each of two equal quantities is divided by the same non-zero quantity, their quotients will also be equal.

Question 4. Solve $3x - 5 = 2x + 3$.

Solution : $3x - 5 = 2x + 3$

or, $3x - 2x = 3 + 5$ [By transposition}

$x = 8$

Required solution : $x = 8$

Question 5. Solve $3y + 2 = 8y - 8$.

Solution : $3y + 2 = 8y - 8$

or, $8y - 8 = 3y + 2$ [Law of Symmetry]

or, $8y - 3y = 2 + 8$ [By transposition]

or, $5y = 10$

or, $\frac{5y}{5} = \frac{10}{5}$ [Dividing both sides by 5]

$\therefore y = 2$

Required solution : $y = 2$

Question 6. Solve : $\frac{3x-6}{3} = 7$

Solution : $\frac{3x-6}{3} = 7$

or, $3x - 6 = 7 \times 3$ [By cross multiplication]

or, $3x - 6 = 21$

or, $3x = 21 + 6$ [By transposition]

or, $3x = 27$

or, $\frac{3x}{3} = \frac{27}{3}$ [Dividing both sides by 3]

$\therefore x = 9$

Required solution : $x = 9$

Question 7. If 5 is added to twice a number, the sum is 25. Find the number.

Solution : If the number is x, then twice the number = 2x

According to the question, $2x + 5 = 25$

or, $2x = 25 - 5$ [By transposition]

or, $2x = 20$

or, $\frac{2x}{2} = \frac{20}{2}$ [Dividing both sides by 2]

$\therefore x = 10$

Required number is 10.

Creative Q/A — Designed as per learning outcomes

Ques. 01 (i) $4y - 5 = 2y - 1$

(ii) $\frac{2z}{3} - \frac{z}{6} = -\frac{3}{4}$

a. Solve : $2(5 + x) = 20$ *(Easy)* 2
b. Determine root of equation (ii) *(Medium)* 4
c. Solve equation (i) and verify. *(Hard)* 4

Solution to Question No. 01 :

a $2(5 + x) = 20$

or, $2 \times 5 + 2 \times x = 20$ [Distributive law]

or, $10 + 2x = 20$

or, $2x = 20 - 10$ [By transposing]

or, $2x = 10$

or, $\frac{x}{2} = \frac{10}{2}$ [Dividing by 2]

$\therefore x = 5$

Required solution : $x = 5$.

b From equation (ii), we get,

$\frac{2z}{3} - \frac{z}{6} = -\frac{3}{4}$

or, $\frac{4z - z}{6} = -\frac{3}{4}$ [LCM of denominaton of Left side 3, 6 is 6.]

or, $\frac{3z}{6} = -\frac{3}{4}$

or, $\frac{z}{2} = -\frac{3}{4}$

or, $4 \times z = -3 \times 2$ [Cross multiplication]

or, $2 \times 2z = 2 \times (-3)$

or, $2z = -3$ [Cancelling common factor 2]

or, $\frac{2z}{2} = -\frac{3}{2}$ [Dividing both sides by 2]

$\therefore z = -\frac{3}{2}$

Required solution : $z = -\frac{3}{2}$.

c From, equation (i), we get,

$4y - 5 = 2y - 1$

or, $4y - 2y = -1 + 5$ [By transposing]

or, $2y = 4$

or, $2 \times y = 2 \times 2$

or, $y = 2$ [Cancelling common factor 2]

$\therefore$ Solution : $y = 2$

Verification :

Putting value of y,

LHS $= 4y - 5 = 4 \times 2 - 5 = 8 - 5 = 3$

RHS $= 2y - 1 = 2 \times 2 - 1 = 4 - 1 = 3$

$\therefore$ LHS = RHS

$\therefore$ Required solution $y = 2$.

Ques. 02 (i) The width of a rectangular pond is 3 metre less than its length and perimeter is 26 metre.

(ii) If 25 is subtracted from 5 times of a numbers, the difference will be 225.

a. Express the perimeter of the pond in terms of variable x. *(Easy)* 2

b. Find the length and width of the pond. *(Medium)* 4

c. Find the number from (ii). *(Hard)* 4

Solution to Question No. 02 :

a Let, length of the pond = x m

Therefore, pond width = $(x - 3)$ m

$\therefore$ Perimeter = 2(Length + width)

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

$= 2(2x - 3)$ m

$\therefore$ Perimeter of the pond in terms of variable $= 2(2x - 3)$ m

b Given, perimeter of the pond = 26 m

From 'a' perimeter of the pond $= 2(2x - 3)$ m

According to question, $2(2x - 3) = 26$

or, $\frac{2(2x-3)}{2} = \frac{26}{2}$ [Dividing both sides by 2]

or, $2x - 3 = 13$

or, $2x = 13 + 3$ [By transposing]

or, $2x = 16$

or, $\frac{2x}{2} = \frac{16}{2}$ [Dividing both sides by 2]

$\therefore$ $x = 8$

$\therefore$ Length of the pond = 8 m

Widgth of the pond $= (x - 3)$ m

$= (8 - 3)$ m

$= 5$ m

Required length is 8 metre and width is 5 metre.

Let, The number = x

If 25 is subtracted from 5 times of x,

The differened $= (5 \times x) - 25$

$= 5x - 25$

As per condition, $5x - 25 = 225$

or, $5x = 225 + 25$ [By transposing]

or, $5x = 250$

or, $5 \times x = 5 \times 50$

or, $x = 50$ [Cancelling common factor 5 from both sides]

$\therefore$ $x = 50$

Required number is 50.

Super Suggestions

Super Suggestions with 100% preparatory questions selected by the Master Trainer Panel

Dear learners, important multiple choice, short and creative questions of this chapter selected by Master Trainer Panel for Half-Yearly and Annual Exams are presented below. Learn the answers to the mentioned questions well to ensure 100% preparation.

Question Pattern		7★	5★	3★
MCQs with Answers	Learn each MCQs in this chapter thoroughly.			
Short Q/A	Exercise 6.1	1, 5, 9, 12	3, 6, 10	2, 8, 11
	Exercise 6.2	2, 5, 9, 13	1, 7, 10, 14	4, 8, 12
Creative Q/A	Exercise 6.1	1	2	
	Exercise 6.2	2, 5, 10, 16	1, 7, 12, 17	4, 9, 14, 19
	Appendix	1, 5	2, 6	3, 7

Assessment & Evaluation

A question bank presented in the form of a class test to assess the preparation

Class Test Time : 3 hours **Mathematics** Full marks : 100

Class : Eight

Multiple Choice Questions (Each question carries 1 mark) 1 × 30 = 30

*[N.B. : Answer all the questions. Each question carries **one** mark. Block fully, with a ball-point pen, the circle of the letter that stands for the correct/best answer in the "Answer Sheet" for Multiple Choice Question Type Examination.]*

1. **How many dimension in each of the variables of Simple Simultaneous Equations?**
   ⓐ 1 ⓑ 2 ⓒ 3 ⓓ None
2. **Which point satisfy $2x - 3y = 18$?**
   ⓐ (– 3, 4) ⓑ (– 4, 3) ⓒ (4, – 3) ⓓ (3, – 4)
3. **If $x + y = 5$ and $x - y = 7$ then, (x, y) = ?**
   ⓐ (6, 1) ⓑ (6, – 1) ⓒ (1, 6) ⓓ (– 1, 6)
4. **If $x + 2y = 9$, $2x - y = 3$, which one of the following will be the value of (x, y)?**
   ⓐ (1, 1) ⓑ (2, 2) ⓒ (3, 3) ⓓ (3, 2)
5. **What is the distance of the point A (3, 4) from X axis?**
   ⓐ 3 ⓑ 4 ⓒ 5 ⓓ 7
6. **If $x = 0$ in equation $x + 7y = 14$, which one is the value of y?**
   ⓐ 2 ⓑ 4 ⓒ 0 ⓓ 8
7. **If $x + y = 6$ and $xy = 5$, then—**
   i. $x - y = 4$
   ii. $x^3 - y^3 = 124$
   iii. $x^3 + y^3 = 130$
   Which one is correct?
   ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Using the following information answer the question No. 8 and 9 :

(x + y – z) and (x + y + z) are two algebraic expression.

8. **$x + y = 2$ and $z = 2$, then what is the product of two expressions?**
   ⓐ 9 ⓑ 4 ⓒ 0 ⓓ 1
9. **If $x^2 + y^2 + z^2 = p$ and $xy + yz + zx = q$, then what is the square of 2nd expression?**
   ⓐ $p + 2q$ ⓑ $p^2 + 2q$
   ⓒ $p + 4q^2$ ⓓ $p^2 + q^2$
10. **If $x - 2y = 0$ and $x + y = 6$ then, which one is the solution of the two equations?**
    ⓐ (4, – 2) ⓑ (4, 2) ⓒ (– 4, 2) ⓓ (5, 1)
11. **Sum of two numbers is 14 and difference of them is 2. What are the two numbers?**
    ⓐ (7, 7) ⓑ (8, 6) ⓒ (16, 2) ⓓ (9, 5)
12. **How many variables are there of the equation $2x - 3y = 4$?**
    ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4
13. **The sum of two numbers is 36 and their ratio is 5 : 4. Which is the greater number?**
    ⓐ 20 ⓑ 16 ⓒ 14 ⓓ 10
14. **If 12 is added to the four times of a number, it will be 20. What is the number?**
    ⓐ 5 ⓑ 3 ⓒ 2 ⓓ 1
15. **Which point will satisfy the equation, $4x + 3y = 11$?**
    ⓐ (1, –5) ⓑ (– 1, 5)
    ⓒ (– 1, –5) ⓓ (1, 5)
16. **In which quadrant the point (– 5, 5) will be?**
    ⓐ First ⓑ Second ⓒ Third ⓓ Fourth
17. **Which point lies on x-axis?**
    ⓐ (0, – 4) ⓑ (– 4, 0)
    ⓒ (0, 3) ⓓ (3, – 1)
18. **Which one is situated in the x-axis?**
    ⓐ (– 5, 5) ⓑ (3, – 3) ⓒ (0, 4) ⓓ (2, 0)
19. **Which point satisfies the equation $7x - 3y = 31$?**
    ⓐ (3, – 3) ⓑ (4, –1) ⓒ (4, 1) ⓓ (3, 3)
20. **In which quadrant (– 3, – 2) is located?**
    ⓐ 4th ⓑ 3rd ⓒ 2nd ⓓ 1st
21. **Which one of the following point lies on $7x - 3y = 5$?**
    ⓐ (3, 2) ⓑ (2, 3)
    ⓒ (– 3, 2) ⓓ (– 2, 3)
22. **In which quadrant (– 3,2) point will be?**
    ⓐ First ⓑ Second ⓒ Third ⓓ Fourth
23. **In which quadrant the point (– 1, 2) will be?**
    ⓐ First ⓑ Second ⓒ Third ⓓ Fourth
24. **In which quadrant the point (6, – 3) is situated?**
    ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th
25. **In which quadrant the point (– 5, 3) will be?**
    ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th
26. **Where the point (2, – 3) is situated?**
    ⓐ on the x-axis ⓑ 2nd quadrant
    ⓒ on the y-axis ⓓ 4th quadrant
27. **In which quadrant is the point (4, – 3) situated?**
    ⓐ First ⓑ Second ⓒ Third ⓓ Fourth
28. **In which quadrant the point of (3, –5) is situated?**
    ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th
29. **In which quadrant the point A (–3, 4) located?**
    ⓐ 1st ⓑ 2nd ⓒ 3rd ⓓ 4th
30. **What is called the unknown quantity of an equation?**
    ⓐ Root ⓑ LHS
    ⓒ Variable ⓓ Solution

Short-Answer Question (Each question carries 2 marks)

Answer any 10 of the following questions : $2 \times 10 = 20$

1. What is meant by equation and simple equation?
2. What is the root of a simultaneous equation?
3. Solve by the method of substitution: $x + y = 12$ and $x - y = 6$.
4. Solve by the method of elimination : $2x + y = 10$, $x - 2y = 5$
5. What is the value of x in the system of equations $2x - y = 5$, $x - y = 2$?
6. If the sum of two numbers is 130 and the difference is 20, find the two numbers.
7. If the sum of two numbers is 150 and one is four times the other, find the two numbers.
8. The length of a rectangular field is 10 meters more than the width. If the perimeter is 120, find the length.
9. Find the coordinates of three points on the graph of the equation $9x - 7y = 13$.
10. How far is the point (4,0) from the origin?
11. If a = 3, verify that (2, 5) is a solution of the equation $ax - y = 1$.
12. Determine which of the equations $x + 5y = 17$ and $7x - 4y = 2$ is satisfied by the point (– 3, 4).
13. $9x - 7y = 21$ and $5x - 3y = 9$ are two linear equations. Determine which equation is satisfied by the point ((0, – 3).
14. What is meant by the law of transposition and the law of symmetry?
15. Write down the axioms of solving equations.

Creative Question (Each question carries 10 marks)

Answer any 5 of the following questions : $10 \times 5 = 50$

1. $3x - y = 5$ and $3x - 2y = 4$.
   a. Now explain whether the system of equations is consistent or not. Find their number of solutions. 2
   b. Solve the system of equations by using the method of cross-multiplication and find (x, y). 4
   c. Solve the system of equations by graphical method and verify the solution obtained in question 'b'. 4
2. $\frac{x}{3} + \frac{y}{2} = 1$ and $x - 3y = 3$ are two simple equations.
   a. Find which equation is satisfied by the point $\left(4, -\frac{2}{3}\right)$. 2
   b. Solve the equations by the substitution method. 4
   c. Solve with the help of graphs. 4
3. 5 years ago the ratio of the ages of father and a son was 4 : 1 and after 15 years that will be 2 : 1.
   a. Resolve into factors of $36 - 12p + p^2$. 2
   b. Determine the present age of father and son. 4
   c. Making the simple simultaneous equations from the stem, determine the abscissa and ordinate using the help of graph. 4
4. $7x + 3y = 27$ and $5x - 2y = 11$ are two simple equations.
   a. Verify which equation is satisfied by the co-ordinate (0, 9). 2
   b. Find out (x, y) by elimination method. 4
   c. Solve the equation with the help of the graph. 4
5. $2x + 4y = 4$ and $3x - 5y = 6$ are simple simultaneous equations.
   a. Which equation is satisfied by the co-ordinate (4, – 1)? 2
   b. Solve two equations. 4
   c. Solve two equations with the help of the graph. 4
6. $3x - 4y = 0$ and $2x - 3y = -1$ are two simple equations.
   a. If the sum and difference of two numbers are 60 and 10 respectively. Find the two numbers. 2
   b. Solve the two equations using elimination method. 4
   c. Solve the equations with the help of graphs. 4
7. $7a - 3b = 31$, $9a - 5b = 41$.
   a. Which equation is satisfied by the point (4, –1)? 2
   b. Find out (a, b) by elimination method. 4
   c. Evaluate (a, b) by solving the equations with the help of the graph. 4
8. $9x - 7y = 13$ and $5x - 3y = 9$ are two simple equations.
   a. Which equation is satisfied by (0, – 3)? 2
   b. Solve the both equations using the method of elimination. 4
   c. Solve the both equations with the he of graphs. 4

Answer Sheet ▸ Multiple Choice Questions

1	ⓐ	2	ⓓ	3	ⓑ	4	ⓒ	5	ⓑ	6	ⓐ	7	ⓐ	8	ⓒ	9	ⓐ	10	ⓑ	11	ⓑ	12	ⓑ	13	ⓐ	14	ⓒ	15	ⓑ
16	ⓑ	17	ⓑ	18	ⓓ	19	ⓑ	20	ⓑ	21	ⓑ	22	ⓑ	23	ⓑ	24	ⓓ	25	ⓑ	26	ⓓ	27	ⓓ	28	ⓓ	29	ⓑ	30	ⓒ

Solving Reference ▸ Short-Answer Questions

1 ▸ See Page 192; Ques. 02
2 ▸ See Page 192; Ques. 03
3 ▸ See Page 192; Ques. 06
4 ▸ See Page 193; Ques. 08
5 ▸ See Page 193; Ques. 12
6 ▸ See Page 206; Ques. 01
7 ▸ See Page 207; Ques. 03
8 ▸ See Page 207; Ques. 05
9 ▸ See Page 207; Ques. 09
10 ▸ See Page 207; Ques. 10
11 ▸ See Page 208; Ques. 12
12 ▸ See Page 208; Ques. 13
13 ▸ See Page 208; Ques. 14
14 ▸ See Page 224; Ques. 01
15 ▸ See Page 225; Ques. 03

Solving Reference ▸ Creative Questions

1 ▸ See Page 208; Ques. 01
2 ▸ See Page 209; Ques. 02
3 ▸ See Page 211; Ques. 04
4 ▸ See Page 213; Ques. 06
5 ▸ See Page 216; Ques. 10
6 ▸ See Page 217; Ques. 12
7 ▸ See Page 219; Ques. 15
8 ▸ See Page 221; Ques. 17