AEP STUDY CIRCLE
IIT-NEET-CBSE
ACCENTS EDUCATIONAL PROMOTERS

23 YEARS OF LEGACY

REVISION MODULE CHEMISTRY

LINEAR EQ.

CBSE-X

LINEAR EQUATIONS
IN TWO VARIABLES

"Elevate your mastery of mathematics with our targeted Revision Module focusing on Linear Equations for CBSE Class 10. This concise and comprehensive resource is designed to reinforce key concepts, problem-solving techniques, and real-world applications, ensuring proficiency in this fundamental mathematical topic."

www.aepstudycircle.com

Prepare for CBSE Class 10th success with confidence in Linear Equations. Order our Revision Module now to embark on a streamlined review journey and reinforce your knowledge in this crucial mathematical topic. Study, revise, and excel in understanding and solving linear equations!

NEET IIT-JEE CBSE

OFFLINE-ONLINE LEARNING ACADEMY

The Success Destination

+91-9939586130
+91-7739650505

2ND FLOOR, SATKOUDI COMPLEX, THANA CHOWK, RAMGARH - 829122-JH

LINEAR EQUATIONS
CBSE-X
REVISION MODULE CHEMISTRY

Conceptual Review: Immerse yourself in a focused review of linear equations, revisiting foundational concepts such as coefficients, variables, and constants. Strengthen your understanding of the principles governing linear relationships.

Solving Techniques: Master the art of solving linear equations through various methods—substitution, elimination, and the graphical method. Our revision module guides you through step-by-step procedures, enhancing your problem-solving skills.

Problem-solving Practice: Hone your problem-solving skills with a variety of practice questions. Covering a spectrum of difficulty levels, our revision module provides targeted exercises to reinforce your understanding and boost confidence.

Graphical Representation: Explore the graphical representation of linear equations. Visual aids, diagrams, and illustrations make abstract concepts visually tangible, aiding in better understanding and retention.

Systems of Linear Equations: Delve into systems of linear equations and their solutions. Understand how simultaneous equations model scenarios where multiple variables interact, preparing you for more complex problem-solving challenges.

Exam-oriented Approach: Tailored to align with the CBSE examination pattern, our revision module ensures you are well-prepared for questions related to linear equations in the Class 10th board exams. Boost your confidence with targeted, exam-focused content.

Online Accessibility: Access your revision module anytime, anywhere. Our digital platform offers the flexibility needed for efficient and personalized learning, allowing you to tailor your study schedule for optimal results.

HELPLINE : +91-9939586130 // +91-7739650505
2ND FLOOR, SATKOUDI COMPLEX, THANA CHOWK, RAMGARH - 829122-JH

LINEAR EQUATIONS
CBSE-X
REVISION MODULE CHEMISTRY

Basic Concepts

- **Equation:** An algebraic expression with 'equal to' (=) sign is called the equation. It is an algebraic expression of equality.

  For example: $2x = 3,\ 2x + 3 = 0,\ 2x + 3y = 5$ etc.

- **Linear Equation:** If the greatest exponent of the variables(s) in an equation is one, the equation is said to be a linear equation.

  For example: $2x + 5 = 0,\ 3x - 7y = 8$ etc.

- **Linear Equation in One Variable:** An equation of the form $ax + b = 0$, where a, b are real numbers and $a \neq 0$ is called linear equation in one variable.

  For example: $2x + 5 = 0$

- **Linear Equation in Two Variables:** An equation of the form $ax + by + c = 0$, where a, b and c are real numbers where $a, b \neq 0$ is called **linear equation** in two variables.

  For example: $2x - 5y + 7 = 0$

- **Solution of an Equation:** That value/values of variable/variables used in equation, which make(s) two sides of equation equal *i.e.*, satisfy the equation, is called solution of the equation.

  For example:

  (*i*) $x = 2$ is the solution of equation $2x - 3 = 1$, because when we put $x = 2$ in $2x - 3 = 1$, we get

  $$2 \times 2 - 3 = 1 \Rightarrow 4 - 3 = 1 \Rightarrow 1 = 1$$

  (*ii*) $x = 2, y = 3$ is the solution of the equation $5x - 2y = 4$ because when we put $x = 2, y = 3$ in $5x - 2y = 4$, we get

  $$5 \times 2 - 2 \times 3 = 4 \Rightarrow 10 - 6 = 4 \Rightarrow 4 = 4$$

- **Pair of Linear Equation in Two Variables:** Two linear equations of the form $ax + by + c = 0$ taken together form a pair of linear equations in two variables.

  For example: $2x + 3y + 5 = 0$

  $x + 2y + 7 = 0$

- **Solution of Pair of Linear equation in Two Variables:** The values of x and y satisfying each one of the given pair of linear equations is called their solution.

  For example: The solution of pair of linear equations

  $2x + 3y = 8$

  and $5x + 2y = 9$ is $x = 1, y = 2$

  because, $2 \times 1 + 3 \times 2 = 8$

  and $5 \times 1 + 2 \times 2 = 9$

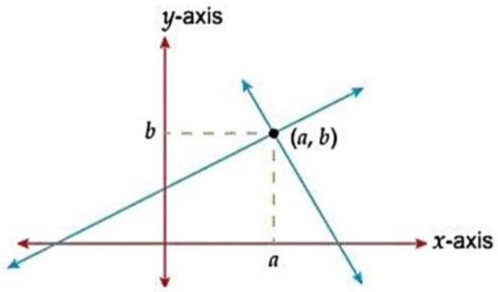
❒ **Method to Find Solution of Pair of Linear Equations:** There are two methods:

(*i*) Graphical Method (*ii*) Algebraic Method

(*i*) **Graphical Method:** The graph of both linear equations are drawn, which are obviously straight lines.

Case I: If the lines intersect at a point then the coordinate of intersecting point gives the unique solution of pair of linear equations. In this case pair of linear equations is consistent.

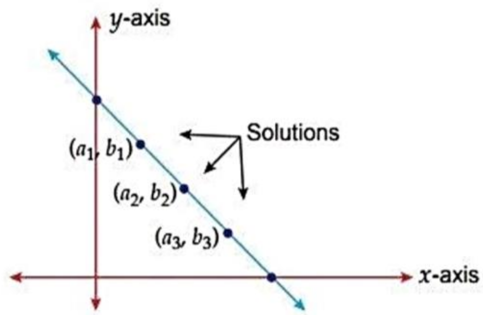
For example:



$x = a,\ y = b$ is solution.

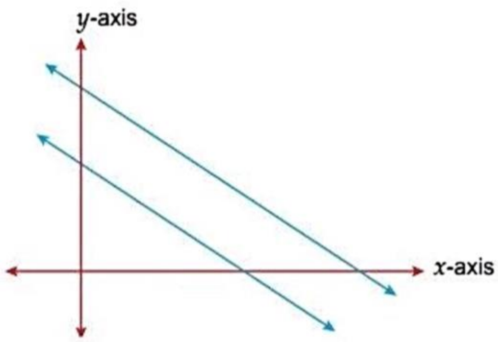
Case II: If the lines coincide, then there are infinitely many solutions *i.e.* co-ordinate of each point on the line being a solution. The pair of equations is also consistent.

For example:



Case III: If the lines are parallel, then the pair of equations has no solution because they are not intersecting any where. In this case pair of linear equations is inconsistent.

For example:



(*ii*) **Algebraic Method:** There are two algebraic methods to find solution of pair of linear equations.

(*a*) Substitution Method

(*b*) Elimination Method

(*a*) **Substitution Method:** In this method we follow the given algorithm:

Step I: Obtain given pair of equations and denote both as (*i*) and (*ii*) respectively.

$$a_1x + b_1y + c_1 = 0 \quad ...(i)$$

$$a_2x + b_2y + c_2 = 0 \quad ...(ii)$$

Step II: Find the value of one variable, say y, from either of the two equations, say (*i*) in terms of other variable x.

Step III: Substitute the value of y obtained in step II, in other equation (*ii*) to obtain an equation in one variable x.

Step IV: Solve the equation obtained in step III and obtain the value of x.

Step V: Putting the value of x in the equation obtained in step II and find the value of y.

The value of x and y obtained in step IV and step V is the solution of given pair of linear equations.

For example: Given equations are

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

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

From equation (*i*)

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

Putting the value of y in (*ii*), we get

$$x - (14 - x) = 4 \quad \Rightarrow \quad x - 14 + x = 4$$

$$\Rightarrow \quad 2x = 4 + 14 \quad \Rightarrow \quad 2x = 18$$

$$\Rightarrow \quad x = 9$$

Putting the value of $x = 9$ in (*iii*), we get

$$y = 14 - 9 \quad \Rightarrow \quad y = 5$$

Hence, solution of given pair or system of linear equations (*i*) and (*ii*) is

$$x = 9, y = 5.$$

(*b*) **Elimination Method:** In this method we follow following algorithm:

Step I: Obtain the given pair of equations.

Step II: Multiply the equations by suitable numbers so that numerical value of co-efficient of one variable in both equations become equal.

Step III: Add or subtract the equations obtained in step II accordingly as the terms having same co-efficient are of opposite or of same sign. It will eliminate one variable.

Step IV: By solving find the value of remaining one variable.

Step V: Put the value of one variable obtained in step IV in any one equation of given system and find the value of other variable by solving.

The value of both variables obtained in step IV and step V is the solution of given pair (system) of equations.

For example: Given equations are

$$x + y = 5 \quad ...(i)$$

$$2x - 3y = 4 \quad ...(ii)$$

Multiply (*i*) by 3, we get

$$3x + 3y = 15 \quad ...(iii)$$

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

$$5x = 19 \quad \Rightarrow \quad x = \frac{19}{5}$$

Putting $x = \frac{19}{5}$ in (*i*), we have

$$\frac{19}{5} + y = 5$$

$$\Rightarrow \quad y = 5 - \frac{19}{5} = \frac{25-19}{5} = \frac{6}{5}$$

Hence $x = \frac{19}{5}, y = \frac{6}{5}$ is the required solution.

Important Facts/Tips:

(*i*) A system (pair) of equations

$$a_1x + b_1y + c_1 = 0$$

and $$a_2x + b_2y + c_2 = 0$$

have unique solution or represent intersecting lines if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

For example: $2x + 3y + 5 = 0$ and $3x + 2y - 7 = 0$

have unique solution or represent intersecting lines in graph.

(*ii*) A system (pair) of equations

$$a_1x + b_1y + c_1 = 0$$

and $$a_2x + b_2y + c_2 = 0$$

have infinitely many solutions or represent coincident lines if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

For example: $2x + 3y - 5 = 0$ and $4x + 6y - 10 = 0$

have infinitely many solutions or represent coincident lines in graph.

(*iii*) A system (pair) of equations

$$a_1x + b_1y + c_1 = 0$$

and $$a_2x + b_2y + c_2 = 0$$

have no solution or represent parallel lines if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

For example: $2x + 5y + 7 = 0$ and $4x + 10y + 11 = 0$

have no solution or represent parallel lines in graph.

(*iv*) A system of linear equations is said to be consistent if it has at least one solution *i.e.* has a unique solution or infinitely many solutions.

(*v*) A system of linear equations is said to be inconsistent if it has no solution.

(*vi*) The coordinate of each point on a line satisfies its equation.

For example: Point (2, 3) lie on line $2x + 3y = 13$

because $2 \times 2 + 3 \times 3 = 13$

(*vii*) In pair of equations if we find out value of one variable in terms of other variable from one of the equations and substitute it in other equation then if variable term cancels out, we have two situations.

(*a*) LHS = RHS $\Rightarrow$ Pair of equations have infinitely many solutions.

For example: $2x + 3y = 9$ ...(*i*)

$4x + 6y = 18$ ...(*ii*)

From (*i*) $y = \frac{9-2x}{3}$

Putting in (*ii*), we get

$$4x + \frac{6(9-2x)}{3} = 18$$

$\Rightarrow \quad 4x + 2(9 - 2x) = 18 \quad \Rightarrow \quad 4x + 18 - 4x = 18$

$\Rightarrow \quad 18 = 18$

Hence, pair of equations has infinitely many solutions.

(*b*) LHS ≠ RHS $\Rightarrow$ Pair of equations have no solution.

For example: $x + 2y = 4$ ...(*i*)

$2x + 4y = 12$ ...(*ii*)

From (*i*) $y = \frac{4-x}{2}$

Putting in (*ii*), we get

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

$\Rightarrow \quad 2x + 2(4 - x) = 12 \quad \Rightarrow \quad 2x + 8 - 2x = 12 \quad \Rightarrow \quad 8 = 12$

But $8 \neq 12$

Hence, pair of equations does not have any solution.

Selected NCERT Questions

1. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the lines representing the pair of linear equations

$6x - 3y + 10 = 0$

$2x - y + 9 = 0$

intersects at a point are parallel or coincident.

Sol. We have, $6x - 3y + 10 = 0$ ...(*i*)

$2x - y + 9 = 0$ ...(*ii*)

Here, $a_1 = 6,\ b_1 = -3,\ c_1 = 10$

$a_2 = 2,\ b_2 = -1,\ c_2 = 9$

and $\frac{a_1}{a_2} = \frac{6}{2} = 3, \quad \frac{b_1}{b_2} = \frac{-3}{-1} = 3, \quad \frac{c_1}{c_2} = \frac{10}{9}$

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

So, equations (*i*) and (*ii*) represent parallel lines.

2. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the pair of linear equations

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

$2x + 3y = 12$, is consistent or inconsistent.

Sol. We have, $\frac{4}{3}x + 2y - 8 = 0$ ...(*i*)

$2x + 3y - 12 = 0$ ...(*ii*)

Here, $a_1 = \frac{4}{3},\ b_1 = 2,\ c_1 = -8$

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

Thus, $\frac{a_1}{a_2} = \frac{4}{3 \times 2} = \frac{2}{3};\ \frac{b_1}{b_2} = \frac{2}{3};\ \frac{c_1}{c_2} = \frac{-8}{-12} = \frac{2}{3}$

Since $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, so equations (*i*) and (*ii*) represent coincident lines.

Hence, the pair of linear equations is consistent with infinitely many solutions.

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

Sol. Let length and width of rectangular garden be x and y respectively.

$\therefore$ From question

$$x = y + 4 \Rightarrow x - y = 4 \quad ...(i)$$

and $$\frac{1}{2}\{2x + 2y\} = 36 \Rightarrow x + y = 36 \quad ...(ii)$$

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

$$x - y = 4$$
$$x + y = 36$$
$$2x = 40 \Rightarrow x = 20$$

$\therefore$ $y = 20 - 4 = 16$

Hence, dimensions are 20 m, 16 m.

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

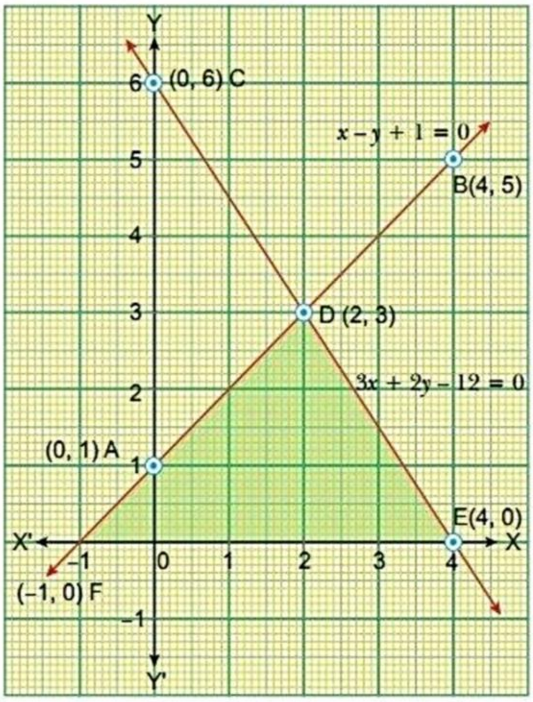
Sol. Pair of linear equations are

$$x - y + 1 = 0 \quad ...(i)$$

x	0	4	2
$y = x + 1$	1	5	3
Points	A	B	D

$$3x + 2y - 12 = 0 \quad ...(ii)$$

x	0	2	4
$y = \frac{12 - 3x}{2}$	6	3	0
Points	C	D	E



Plot the point $A(0, 1)$, $B(4, 5)$ and join them to get a line AB. Similarly, plot the points $C(0, 6)$, $D(2, 3)$ and join them to form a line CD.

Clearly, the two lines intersect each other at the point $D(2, 3)$. Hence, $x = 2$ and $y = 3$ is the solution of the given pair of equations. The line CD cuts the x-axis at the point $E(4, 0)$ and the line AB cuts the x-axis at the point $F(-1, 0)$. Hence, the coordinates of the vertices of the triangle are $D(2, 3)$, $E(4, 0)$ and $F(-1, 0)$.

5. A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator. If 3 is added to both the numerator and the denominator, it becomes $\frac{5}{6}$. Find the fraction.

Sol. Let required fraction be $\frac{x}{y}$.

According to question

$$\frac{x+2}{y+2} = \frac{9}{11} \Rightarrow 11x + 22 = 9y + 18 \Rightarrow 11x - 9y = -4$$

and $$\frac{x+3}{y+3} = \frac{5}{6} \Rightarrow 6x + 18 = 5y + 15 \Rightarrow 6x - 5y = -3$$

Now, we have a pair of linear equations

$$11x - 9y = -4 \quad ...(i)$$
$$6x - 5y = -3 \quad ...(ii)$$

Multiplying (*i*) by 5 and (*ii*) by 9, we get

$$55x - 45y = -20 \quad ...(iii)$$
$$54x - 45y = -27 \quad ...(iv)$$

Subtracting (*iv*) from (*iii*), we get

$$55x - 45y - (54x - 45y) = -20 - (-27)$$
$$\Rightarrow \quad 55x - 45y - 54x + 45y = -20 + 27 \Rightarrow x = 7$$

Putting $x = 7$ in (*i*), we have

$$11 \times 7 - 9y = -4 \Rightarrow 9y = 77 + 4$$
$$\Rightarrow \quad 9y = 81 \Rightarrow y = 9$$

Hence, required fraction is $\frac{7}{9}$.

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

Sol. Let the present age of Nuri and Sonu be x and y years respectively.

According to question $x - 5 = 3(y - 5)$

$$\Rightarrow \quad x - 5 = 3y - 15$$
$$\Rightarrow \quad x - 3y = -10 \quad ...(i)$$

and $$x + 10 = 2(y + 10)$$
$$\Rightarrow \quad x + 10 = 2y + 20$$
$$\Rightarrow \quad x - 2y = 10 \quad ...(ii)$$

From equation (*i*), we get

$$x = 3y - 10 \quad ...(iii)$$

Putting it in (*ii*), we have,

$$3y - 10 - 2y = 10$$
$$\Rightarrow \quad y = 10 + 10 \Rightarrow y = 20$$

Now, from (*iii*)

$$x = 3 \times 20 - 10 \Rightarrow x = 60 - 10 \Rightarrow x = 50$$

Therefore, present age of Nuri is 50 years and of Sonu is 20 years.

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

Sol. Let the digit at tens and unit place of the two digit number be x and y respectively.

Therefore required two digit number $= 10x + y$

According to question

$$x + y = 9 \qquad ...(i)$$

and $9(10x + y) = 2(10y + x) \Rightarrow 90x + 9y = 20y + 2x$

$\Rightarrow 90x + 9y - 20y - 2x = 0 \Rightarrow 88x - 11y = 0$

$\Rightarrow 8x - y = 0 \qquad ...(ii)$

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

$$x + y + 8x - y = 9 + 0 \Rightarrow 9x = 9 \Rightarrow x = 1$$

Putting $x = 1$ in (*i*), we get

$$1 + y = 9 \Rightarrow y = 8$$

Hence, required number = $10 \times 1 + 8 = 18$

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

Sol. Let the fixed charge be ₹x and the cost of food per day be ₹y.

Therefore, according to question,

$$x + 20y = 1000 \qquad ...(i)$$
$$x + 26y = 1180 \qquad ...(ii)$$

Now, subtracting equation (*ii*) from (*i*), we have

$$\begin{array}{rcl} x + 20y &=& 1000 \\ x + 26y &=& 1180 \\ - \quad - & & - \\ \hline -6y &=& -180 \end{array}$$

$$y = \frac{-180}{-6} = 30$$

Putting the value of y in equation (*i*), we have

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

$\Rightarrow x + 600 = 1000$

$\Rightarrow x = 1000 - 600 = 400$

Hence, fixed charge is ₹400 and cost of food per day is ₹30.

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

Sol. Let x be the numerator and y be the denominator of the fraction.

$\therefore$ Fraction = $\frac{x}{y}$

Now, according to question

$$\frac{x-1}{y} = \frac{1}{3} \Rightarrow 3x - 3 = y \Rightarrow 3x - y = 3 \qquad ...(i)$$

Also, $\frac{x}{y+8} = \frac{1}{4} \Rightarrow 4x = y + 8 \Rightarrow 4x - y = 8 \qquad ...(ii)$

Subtracting (*ii*) from (*i*) we get

$$\begin{array}{rcl} 3x - y &=& 3 \\ -4x \mp y &=& -8 \\ \hline -x &=& -5 \end{array} \Rightarrow x = 5$$

Putting $x = 5$ in equation (*i*), we get

$$3 \times 5 - y = 3 \Rightarrow 15 - 3 = y \Rightarrow y = 12$$

$\therefore$ Fraction $= \dfrac{x}{y} = \dfrac{5}{12}$

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

Sol. Let x be the number of questions of right answer and y be the number of questions of wrong answer.

$\therefore$ According to question,

$$3x - y = 40 \quad \ldots (i)$$

and $$4x - 2y = 50$$

or $$2x - y = 25 \quad \ldots (ii)$$

Subtracting (*ii*) from (*i*), we have

$$\begin{array}{r} 3x - y = 40 \\ 2x - y = 25 \\ - \quad + \quad - \\ \hline x = 15 \end{array}$$

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

$$3 \times 15 - y = 40 \Rightarrow 45 - y = 40$$

$\therefore$ $y = 45 - 40 = 5$

Hence, total number of questions is $x + y$ *i.e.*, $5 + 15 = 20$.

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

Sol. Let the length and breadth of a rectangle be x and y respectively.

Then area of the rectangle $= xy$

According to question, we have

$$(x - 5)(y + 3) = xy - 9 \Rightarrow xy + 3x - 5y - 15 = xy - 9$$

$$\Rightarrow 3x - 5y = 15 - 9 = 6 \Rightarrow 3x - 5y = 6 \quad \ldots (i)$$

Again, we have

$$(x + 3)(y + 2) = xy + 67 \Rightarrow xy + 2x + 3y + 6 = xy + 67$$

$$\Rightarrow 2x + 3y = 67 - 6 = 61 \Rightarrow 2x + 3y = 61 \quad \ldots (ii)$$

Now, from equation (*i*), we express the value of x in terms of y as

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

Substituting the value of x in equation (*ii*), we have

$$2 \times \left(\frac{6 + 5y}{3}\right) + 3y = 61 \Rightarrow \frac{12 + 10y + 9y}{3} = 61$$

$$\Rightarrow 19y = 183 - 12 = 171 \Rightarrow y = \frac{171}{19} = 9$$

Putting the value of y in equation (*i*), we have

$$3x - 5 \times 9 = 6 \Rightarrow 3x = 6 + 45 = 51$$

$\therefore \quad x = \frac{51}{3} = 17$

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

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

Sol. Let actual speed of the train be x km/h and actual time taken be y hours.

Then, distance covered = speed × time = xy km ... (i)

Case I: When speed is $(x + 10)$ km/h, then time taken is $(y - 2)$ hours

$\therefore$ Distance covered = $(x + 10)(y - 2)$

$\Rightarrow \quad xy = (x + 10)(y - 2)$ [From (i)]

$\Rightarrow \quad xy = xy - 2x + 10y - 20$

$\Rightarrow \quad 2x - 10y = -20$

$\Rightarrow \quad x - 5y = -10$ ...(ii)

Case II: When speed is $(x - 10)$ km/h, then time taken is $(y + 3)$ hours.

$\therefore$ Distance covered = $(x - 10)(y + 3)$

$\Rightarrow \quad xy = (x - 10)(y + 3)$ [From (i)]

$\Rightarrow \quad xy = xy + 3x - 10y - 30$

$\Rightarrow \quad 3x - 10y = 30$ ...(iii)

Multiplying equation (ii) by 2 and subtracting it from (iii), we get

$$\begin{array}{r} 3x - 10y = 30 \\ 2x - 10y = -20 \\ - \quad + \qquad + \\ \hline x \qquad = 50 \end{array}$$

Putting $x = 50$ in equation (ii), we get

$50 - 5y = -10$

$\Rightarrow \quad 50 + 10 = 5y$

$\Rightarrow \quad y = 12$

$\therefore$ Distance covered by the train = xy km = 50 × 12 km = 600 km

13. Solve the following linear equations:

$152x - 378y = -74$ and $-378x + 152y = -604$ [*Competency Based Question*]

Sol. We have, $152x - 378y = -74$ ...(i)

$-378x + 152y = -604$ ...(ii)

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

$$\begin{array}{r} 152x - 378y = -74 \\ -378x + 152y = -604 \\ \hline -226x - 226y = -678 \end{array}$$

$\Rightarrow \quad -226(x + y) = -678$

$\Rightarrow \quad x + y = \frac{-678}{-226}$

$\Rightarrow \quad x + y = 3$ ...(iii)

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

$$\begin{array}{r} 152x - 378y = -74 \\ -378x + 152y = -604 \\ + \quad\; - \quad\;\; + \\ \hline 530x - 530y = 530 \end{array}$$

$\Rightarrow \qquad x - y = 1 \qquad \ldots(iv)$

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

$$\begin{array}{r} x + y = 3 \\ x - y = 1 \\ \hline 2x = 4 \end{array} \qquad \Rightarrow \qquad x = 2$$

Putting the value of x in (*iii*), we get

$$2 + y = 3 \qquad \Rightarrow \qquad y = 1$$

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

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

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

Sol. We have, $\frac{x}{2} + \frac{2y}{3} = -1 \Rightarrow \frac{3x + 4y}{6} = -1$

$\therefore \qquad 3x + 4y = -6 \qquad \ldots(i)$

and $\qquad x - \frac{y}{3} = 3 \Rightarrow \frac{3x - y}{3} = 3$

$\therefore \qquad 3x - y = 9 \qquad \ldots(ii)$

By elimination method:

Subtracting (*ii*) from (*i*), we have

$$5y = -15 \quad \text{or} \quad y = -\frac{15}{5} = -3$$

Putting the value of y in equation (*i*), we have

$$3x + 4 \times (-3) = -6 \qquad \Rightarrow \qquad 3x - 12 = -6$$

$\therefore \qquad 3x = -6 + 12 \quad \Rightarrow \quad 3x = 6$

$\therefore \qquad x = \frac{6}{3} = 2$

Hence, solution is $x = 2, y = -3$.

By substitution method:

Expressing x in terms of y from equation (*i*), we have

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

Substituting the value of x in equation (*ii*), we have

$$3 \times \left(\frac{-6 - 4y}{3}\right) - y = 9 \quad \Rightarrow \quad -6 - 4y - y = 9 \quad \Rightarrow \quad -6 - 5y = 9$$

$\therefore \qquad -5y = 9 + 6 = 15$

$$y = \frac{15}{-5} = -3$$

Putting the value of y in equation (i), we have

$$3x + 4 \times (-3) = -6 \quad \Rightarrow \quad 3x - 12 = -6$$

$$\therefore \quad 3x = 12 - 6 = 6 \qquad \therefore \quad x = \frac{6}{3} = 2$$

Hence, the required solution is $x = 2, y = -3$.

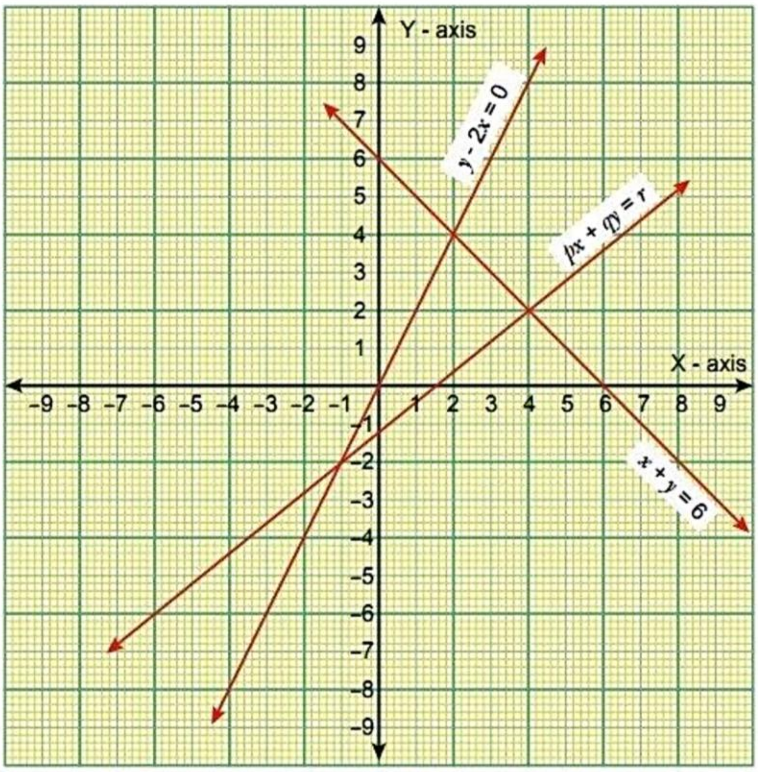
Multiple Choice Questions

Choose and write the correct option in the following questions.

1. Graphically, the pair of equations [*NCERT Exemplar*]
$6x - 3y + 10 = 0$; $2x - y + 9 = 0$ represents two lines which are

(a) intersecting at exactly one point
(b) intersecting at exactly two points
(c) coincident
(d) parallel

2. Shown below are the graphs of the lines $y - 2x = 0$, $x + y = 6$ and $px + qy = r$.



Which of these is the solution for the pair of equations $x + y = 6$ and $px + qy = r$?
[*CBSE Question Bank*]

(a) $x = 2, y = 4$
(b) $x = 4, y = 2$
(c) $x = 3, y = 2$
(d) We cannot say for sure as the values of p and q are not known.

3. The value of k for which the system of equations $2x + ky = 12$, $x + 3y - 4 = 0$ are inconsistent is

(a) $\frac{21}{4}$ (b) $\frac{1}{6}$ (c) 6 (d) $\frac{4}{21}$

4. If the lines given by $3x + 2ky = 2$ and $2x + 5y + 1 = 0$ are parallel, then value of k is
[*NCERT Exemplar*]

(a) $\frac{-5}{4}$ (b) $\frac{2}{5}$ (c) $\frac{15}{4}$ (d) $\frac{3}{2}$

5. **If $2x - 3y = 7$ and $(a + b)x - (a + b - 3)y = 4a + b$ represent coincident lines, then a and b satisfy the equation**

(*a*) $a + 5b = 0$ (*b*) $5a + b = 0$ (*c*) $a - 5b = 0$ (*d*) $5a - b = 0$

6. **The value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$ has no solution, is** **[*CBSE* 2020(30/1/1)]**

(*a*) -2 (*b*) $\neq 2$ (*c*) 3 (*d*) 2

7. **The pair of equations $x + 2y + 5 = 0$ and $-3x - 6y + 1 = 0$ have** **[*NCERT Exemplar*]**

(*a*) unique solution (*b*) exactly two solutions
(*c*) infinitely many solutions (*d*) no solution

8. **Consider the equations shown:**

$$ax + by = ab \text{ and } 2ax + 3by = 3b$$

Which of these is the value of y in terms of a? **[*Competency Based Question*]**

(*a*) $y = 5 - 3a$ (*b*) $y = 3 - 2a$ (*c*) $y = 9a - 35$ (*d*) $y = 2ab - 3b$

9. **The pair of linear equations $y = 0$ and $y = -6$ has** **[*CBSE* 2020(30/4/1)]**

(*a*) unique solution (*b*) no solution
(*c*) infinitely many solutions (*d*) only solution (0, 0)

10. **The value of k, for which the pair of linear equations $kx + y = k^2$ and $x + ky = 1$ have infinitely many solution is** **[*CBSE* 2020(30/4/1)]**

(*a*) ± 1 (*b*) 1 (*c*) -1 (*d*) 2

11. **Consider the equations shown** **[*CBSE Question Bank*]**

$$4x + 3y = 41; \quad x + 3y = 26$$

Which of these is the correct way of solving the given pair of equations?

(*a*) $4x + x + 3y - 3y = 41 - 26$ (*b*) $4x + 3y + 3y = 41 - 26$
(*c*) $4x - x + 3y - 3y = 41 - 26$ (*d*) $4(x + 3y) + 3y = 41$

12. **Gunjan has only ₹ 1 and ₹ 2 coins with her. If the total number of coins that she has is 50 and the amount of money with her is ₹ 75, then the number of ₹ 1 and ₹ 2 coins are respectively** **[*Competency Based Question*]**

(*a*) 25 and 25 (*b*) 15 and 35 (*c*) 35 and 15 (*d*) 35 and 20

13. **The sum of the digits of a two-digits number is 9. If 27 is added to it, the digits of number get reversed. The number is** **[*NCERT Exemplar*]**

(*a*) 27 (*b*) 72 (*c*) 63 (*d*) 36

14. **Shipra gave a note of ₹2,000 for a pair of jeans worth ₹500. She was returned 11 notes in denominations of ₹200 and ₹100. Which pair of equations can be used to find the number of ₹200 notes as x, and the number of ₹100 notes as y? How many notes of ₹200 did she get?** **[*CBSE Question Bank*]**

(*a*) $x + y = 11$ and $200x + 100y = 1500$; 4 (*b*) $x = y + 11$ and $200x + 100y = 2000$; 4
(*c*) $x + y = 15$ and $200x + 100y = 1800$; 10 (*d*) $x + y = 15$ and $100x + 200y = 1800$; 12

15. **The father's age is six times his son's age. Four years hence, the age of the father will be four times his son. The present ages (in years) of the son and the father are, respectively** **[*NCERT Exemplar*]**

(*a*) 4 and 24 (*b*) 5 and 30 (*c*) 6 and 36 (*d*) 3 and 24

2. If the lines given by $4x + 5ky = 10$ and $3x + y + 1 = 0$ are parallel, then find value of k.

Sol. Since the given lines are parallel.

$$\therefore \quad \frac{4}{3} = \frac{5k}{1} \neq \frac{-10}{1} \quad i.e., \ k = \frac{4}{15}.$$

3. Given the linear equation $2x + 3y - 8 = 0$. Write another linear equation in two variables such that the geometrical representation of the pair so formed are parallel lines.

Sol. For parallel lines, we have

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

$$\Rightarrow \quad \frac{2}{a_2} = \frac{3}{b_2} \neq \frac{-8}{c_2} \qquad [\text{Here, } a_1 = 2, b_1 = 3, c_1 = -8]$$

$\Rightarrow$ $\frac{a_2}{b_2}$ should be equal to $\frac{2}{3}$ and c_2 can take any value.

$\therefore$ For the lines to be parallel another possible linear equation can be $4x + 6y + 5 = 0$. However, more such equations are possible.

4. Do the equations $4x + 3y - 1 = 5$ and $12x + 9y = 15$ represent a pair of coincident lines?
[*NCERT Exemplar*]

Sol. Here, $\frac{4}{12} = \frac{3}{9} \neq \frac{6}{15}$ *i.e.,* $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore$ Given equations do not represent a pair of coincident lines as both lines are parallel.

5. Find the co-ordinate where the line $x - y = 8$ will intersect y-axis.

Sol. The given line will intersect y-axis when $x = 0$.

$$\therefore \quad 0 - y = 8 \quad \Rightarrow \quad y = -8$$

Required coordinate is $(0, -8)$.

6. Write the number of solutions of the following pair of linear equations:

$x + 2y - 8 = 0, \quad 2x + 4y = 16$

Sol. Here, $\frac{a_1}{a_2} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$

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

$\therefore$ The given pair of linear equations has infinitely many solutions.

Short Answer Questions–I

Each of the following questions are of 2 marks.

1. Find c if the system of equations **[*CBSE* 2019 (30/1/1)]**

$cx + 3y + (3 - c) = 0; \ 12x + cy - c = 0$ has infinitely many solutions.

Sol. Given system of equations,

$$cx + 3y + (3 - c) = 0 \text{ and } 12x + cy - c = 0$$

For infinite solutions, we know that

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \quad \Rightarrow \quad \frac{c}{12} = \frac{3}{c} = \frac{3 - c}{-c}$$

Now, $\frac{c}{12} = \frac{3}{c}$ and $\frac{3}{c} = \frac{3-c}{-c}$

$\Rightarrow \quad c^2 = 36$	$-3c = (3-c)\,c$
	$\Rightarrow \quad -3 = 3 - c$
	$\Rightarrow \quad c = 3 + 3 = 6$
$\Rightarrow \quad c = \pm 6$	$\Rightarrow \quad c = 6$

$\therefore \quad c = 6$, for infinitely many solutions.

2. Solve the following pair of linear equations:

$3x - 5y = 4$,

$2y + 7 = 9x$ **[*CBSE* 2019(30/3/2)]**

Sol.

10. Given -

$3x - 5y = 4$ —— ①

$9x - 2y = 7$ —— ②

To find - 'x' and 'y'

Multiplying ① × 3, and ② × 1 and ~~adding~~ subtracting ② from ①; we get :

$(3x - 5y) \times 3 - (9x - 2y) \times 1 = 4 \times 3 - 7 \times 1$

$\Rightarrow 9x - 15y - 9x + 2y = 12 - 7$

$\Rightarrow -13y = 5 \quad \Rightarrow \boxed{y = -\frac{5}{13}}$

Then, putting $y = -\frac{5}{13}$ in ①;

$3x = 4 + 5y$

$\Rightarrow 3x = 4 + 5 \times -\frac{5}{13}$

$\Rightarrow 3x = \frac{52 - 25}{13} \quad \Rightarrow x = \frac{27^{9}}{13 \times 3}$

$\Rightarrow \boxed{x = \frac{9}{13}}$

[*Topper's Answer* 2019]

3. Find the value(s) of *k* for which the pair of equations

$$\begin{cases} kx + 2y = 3 \\ 3x + 6y = 10 \end{cases}$$

has a unique solution. **[*CBSE* 2019(30/4/2)]**

Sol. For unique solution $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{2}{6}$ **1**

$\Rightarrow \quad k \neq 1$ **1**

The pair of equations have unique solution for all real values of k except 1.

[*CBSE Marking Scheme* 2019 (30/4/2)]

4. For what value of k, does the system of linear equations

$$2x + 3y = 7$$
$$(k - 1)x + (k + 2)y = 3k$$

have an infinite number of solutions? [*CBSE* 2019 (30/5/1)]

Sol. For infinitely many solutions

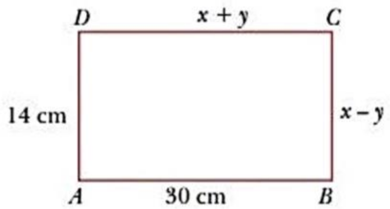
$$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k} \quad 1$$

$$2k + 4 = 3k - 3; \quad 9k = 7k + 14$$
$$k = 7 \quad\quad k = 7$$

Hence $k = 7$ **1**

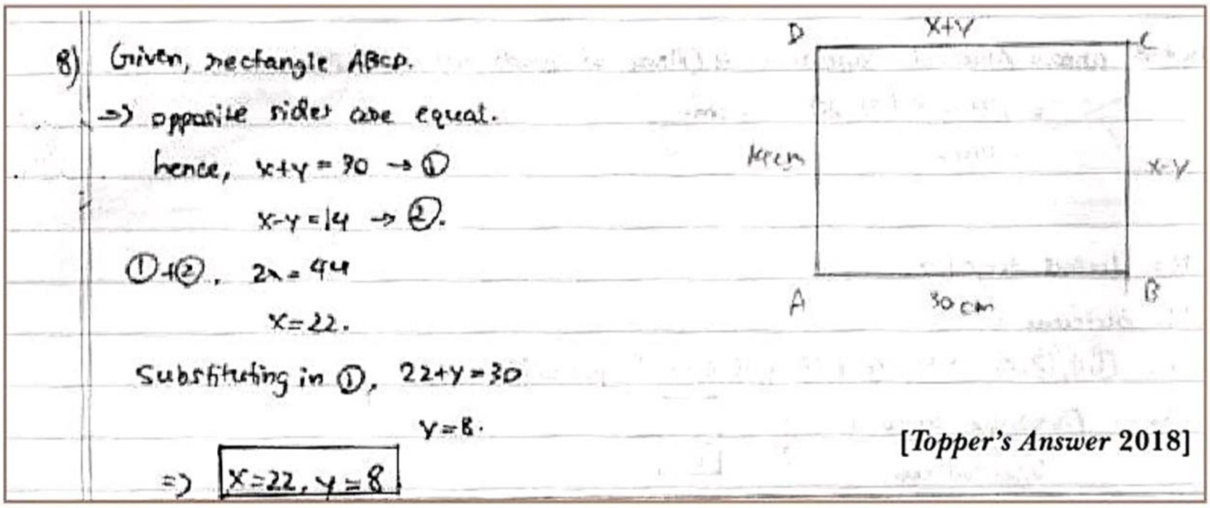
[*CBSE Marking Scheme* 2019 (30/5/1)]

5. In figure, *ABCD* is a rectangle. Find the values of x and y.



[*CBSE* 2018(30/1/1)]

Sol.


8) Given, rectangle ABCD.
⇒ opposite sides are equal.
hence, x+y = 30 → ①
x-y = 14 → ②
①+②, 2x = 44
x = 22.
Substituting in ①, 22+y = 30
y = 8.
⇒ x=22, y=8

[*Topper's Answer* 2018]

6. Solve the following pair of linear equations. [*CBSE* 2019(30/3/3)]

$$3x + 4y = 10 \text{ and } 2x - 2y = 2$$

Sol. Given equations:

$$3x + 4y = 10 \quad \dots (i)$$
$$2x - 2y = 2 \quad \dots (ii)$$

Multiply (*i*) by 2 and (*ii*) by 3 and then subtracting, we get

$$6x + 8y = 20$$
$$6x - 6y = 6$$
$$- \quad + \quad -$$

$$14y = 14 \Rightarrow y = 1$$

$\therefore \quad 2x - 2(1) = 2 \Rightarrow 2x = 4 \Rightarrow x = 2$

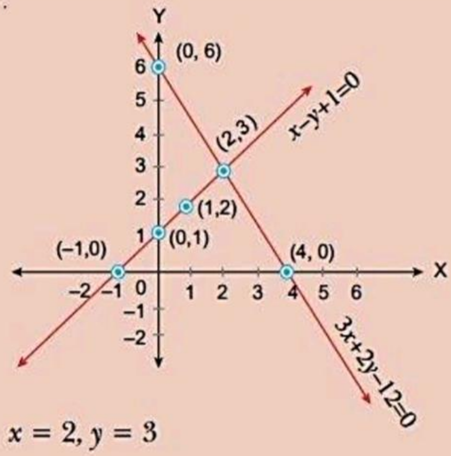
$\therefore \quad x = 2, y = 1$

Short Answer Questions–II

Each of the following questions are of 3 marks.

1. Draw the graph of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Using this graph, find the values of x and y which satisfy both the equations. [*CBSE* 2019(30/3/1)]

Sol.

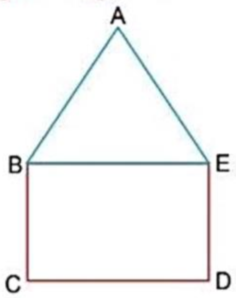


2

$x = 2, y = 3$ ½ + ½

[*CBSE Marking Scheme* 2019(30/3/1)]

2. In figure, *ABCDE* is a pentagon with *BE* ∥ *CD* and *BC* ∥ *DE*. *BC* is perpendicular to *CD*. $AB = 5$ cm, $AE = 5$ cm, $BE = 7$ cm, $BC = x - y$ and $CD = x + y$. If the perimeter of *ABCDE* is 27 cm. Find the value of x and y, given $x, y \neq 0$. [*CBSE Sample Question Paper* 2020]



Sol. $x + y = 7$ and $2(x - y) + x + y + 5 + 5 = 27$ ½ + 1

$\therefore x + y = 7$ and $3x - y = 17$ ½

Solving, we get, $x = 6$ and $y = 1$ 1

[*CBSE Marking Scheme Sample Question Paper* 2020]

3. If $2x + y = 23$ and $4x - y = 19$, find the value of $(5y - 2x)$ and $\left(\frac{y}{x} - 2\right)$. [*CBSE* 2020(30/2/1)]

Sol. Given equations are

$$2x + y = 23; \quad 4x - y = 19$$

Adding given pair of linear equations, we get

$$2x + y = 23 \quad \ldots(i)$$
$$4x - y = 19 \quad \ldots(ii)$$
$$6x = 42$$

$\Rightarrow \quad x = \frac{42}{6} = 7$

$\therefore \quad x = 7$

Putting the value of $x = 7$ in eq. (i), we get

$$2 \times 7 + y = 23 \quad \Rightarrow \quad 14 + y = 23$$

$\Rightarrow \quad y = 23 - 14 = 9 \quad \Rightarrow \quad y = 9$

$\therefore \quad x = 7,\ y = 9$

Now, $\quad 5y - 2x = 5 \times 9 - 2 \times 7 = 45 - 14 = 31$

and, $\quad \frac{y}{x} - 2 = \frac{9}{7} - 2 = \frac{9-14}{7} = \frac{-5}{7}$

4. The present age of a father is three years more than three times the age of his son. Three years hence the father's age will be 10 years more than twice the age of the son. Determine their present ages. **[*CBSE* 2020(30/5/1)]**

Sol. Let father's present age be x years and his son's present age be y years.

According to question,

$x = 3y + 3 \quad \Rightarrow \quad x - 3y = 3 \quad ...(i)$

After three years,

Father's age will be $(x + 3)$ years and

his son's age will be $(y + 3)$ years.

Again, according to question

$\Rightarrow \quad x + 3 = 2(y + 3) + 10$

$\Rightarrow \quad x + 3 = 2y + 6 + 10 \quad \Rightarrow \quad x - 2y = 13 \quad ...(ii)$

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

$$\begin{array}{r} x - 3y = 3 \\ \underline{-x \mp 2y = -13} \\ -y = -10 \end{array}$$

$\Rightarrow \quad y = 10$

Putting the value of $y = 10$ in equation (*i*), we get

$x - 3 \times 10 = 3 \quad \Rightarrow \quad x = 33$

$\therefore$ Present age of father is 33 years and his son's present age is 10 years.

5. Taxi charges in a city consist of fixed charges and the remaining charges depend upon the distance travelled. For a journey of 10 km, the charge paid is ₹75 and for a journey of 15 km, the charge paid is ₹110. Find the fixed charge and charges per km. Hence, find the charge of covering a distance of 35 km. **[*CBSE* 2020(30/4/1)]**

Sol. Let ₹ x be the fixed charge and ₹ y be the charge per km.

Therefore, charge paid for 10 km $= x + 10y$

$\Rightarrow \quad 75 = x + 10y$

$\Rightarrow \quad x + 10y = 75 \quad ...(i)$

Also, charge paid for 15 km $= x + 15y$

$\Rightarrow \quad x + 15y = 110 \quad ...(ii)$

Subtracting equation (*ii*) from (*i*), we have

$$\begin{array}{r} x + 10y = 75 \\ \underline{\overset{-}{x} + \overset{-}{15y} = \overset{-}{110}} \\ -5y = -35 \end{array} \quad \Rightarrow y = 7$$

Putting the value of $y = 7$ in equation (*i*), we get

$x + 10 \times 7 = 75 \quad \Rightarrow \quad x = 75 - 70 = 5 \quad \Rightarrow \quad x = 5$

$\therefore$ Fixed charge = ₹ 5 and charge per km is ₹ 7

Now, charge for covering a distance of 35 km

$= x + 35\,y$

$= 5 + 35 \times 7 = 5 + 245 =$ ₹ 250

Long Answer Questions

Each of the following questions are of 5 marks.

1. **A train covered a certain distance at a uniform speed. If the train would have been 6 km/h faster, it would have taken 4 hours less than the scheduled time and if the train were slower by 6 km/h, it would have taken 6 hours more than the scheduled time. Find the length of the journey.** **[*CBSE* 2020 (30/3/1)]**

Sol. Let original speed of the train be x km/h and scheduled time of journey be y hours.

$\therefore$ Distance covered $= xy$

Now, When speed is 6 km/h faster and time taken is 4 hour less

$\therefore$ Distance $= (x + 6)(y - 4)$

$\Rightarrow xy = xy - 4x + 6y - 24$

$\Rightarrow 4x - 6y = -24$

$\Rightarrow 2x - 3y = -12$ ...(*i*)

Again, When speed be 6 km/h slower and time taken 6 hours more

$\therefore$ Distance $= (x - 6)(y + 6)$

$\Rightarrow xy = xy + 6x - 6y - 36$

$\Rightarrow 6x - 6y = 36$

$\Rightarrow x - y = 6$ ...(*ii*)

Multiply (*ii*) by 3 and subtract from (*i*), we get

$$\begin{array}{rcl} 2x - 3y &=& -12 \\ \underset{-}{x} - \underset{+}{y} &=& \underset{-}{6} \\ \hline -x &=& -30 \end{array} \quad \Rightarrow \quad x = 30 \text{ km/h}$$

Putting the value of $x = 30$ in equation (*ii*), we have

$30 - y = 6 \Rightarrow y = 30 - 6 = 24$

$\therefore$ $y = 24$ hours

$\therefore$ Total distance covered $= xy = 30 \times 24 = 720$ km.

Length of journey $= 720$ km.

2. **A boat goes 30 km upstream and 44 km downstream in 10 hours. In 13 hours, it can go 40 km upstream and 55 km downstream. Determine the speed of the stream and that of the boat in still water.** **[*CBSE* 2019(30/1/1)]**

Sol. Let the speed of the boat be x km/h and speed of the stream be y km/h.

$\therefore$ Speed of boat in upstream $= (x - y)$ km/h

and speed of boat in downstream $= (x + y)$ km/h

$\therefore$ According to question,

$$\frac{30}{x-y} + \frac{44}{x+y} = 10 \quad \text{...}(i)$$

and

$$\frac{40}{x-y} + \frac{55}{x+y} = 13 \quad \text{...}(ii)$$

(*i*) × 4 – (*ii*) × 3 gives

HELPLINE : +91-9939586130 // +91-7739650505
2ND FLOOR, SATKOUDI COMPLEX, THANA CHOWK, RAMGARH - 829122,JH

$$\frac{1}{x+y}(176-165) = 1$$

$\Rightarrow \quad 11 = x + y$

$\Rightarrow \quad x + y = 11 \quad \ldots(iii)$

Putting the value of $x + y = 11$ in equation (i), we have

$$\frac{30}{x-y} + \frac{44}{11} = 10$$

$\Rightarrow \quad \frac{30}{x-y} + 4 = 10$

$\Rightarrow \quad \frac{30}{x-y} = 10 - 4 = 6$

$\Rightarrow \quad x - y = 5 \quad \ldots(iv)$

From equation (iii) and (iv), we have

$$\begin{aligned} x + y &= 11 \\ x - y &= 5 \\ \hline 2x &= 16 \end{aligned} \quad \text{(on adding)}$$

$\Rightarrow \quad x = 8$

Putting $x = 8$ in equation (iii), we have

$8 + y = 11$

$\Rightarrow \quad y = 11 - 8 = 3$

$\Rightarrow \quad y = 3$

$\therefore$ Speed of boat is 8 km/h and speed of stream is 3 km/h.

3. Students of a class are made to stand in rows. If one student is extra in each row, there would be 2 rows less. If one student is less in each row, there would be 3 rows more. Find the number of students in the class. [*Competency Based Question*]

Sol. Let total number of rows be y and total number of students in each row be x.

$\therefore \quad$ Total number of students $= xy$

Case I: If one student is extra in each row, there would be two rows less.

Now, number of rows $= (y - 2)$

Number of students in each row $= (x + 1)$

Total number of students = number of rows × number of students in each row

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

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

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

$\Rightarrow \quad 2x - y = -2 \quad \ldots(i)$

Case II: If one student is less in each row, there would be 3 rows more.

Now, number of rows $= (y + 3)$

and number of students in each row $= (x - 1)$

Total number of students = number of rows × number of students in each row

$\therefore \quad xy = (y + 3)(x - 1)$

$\Rightarrow \quad xy = xy - y + 3x - 3$

$xy - xy + y - 3x = -3$

$\Rightarrow \quad -3x + y = -3 \quad \ldots(ii)$

On adding equations (*i*) and (*ii*), we have

$$\begin{array}{r} 2x - y = -2 \\ -3x + y = -3 \\ \hline -x = -5 \end{array}$$

or $\quad x = 5$

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

$2(5) - y = -2$

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

$-y = -2 - 10$

$\Rightarrow \quad -y = -12 \quad$ or $\quad y = 12$

$\therefore$ Total number of students in the class $= 5 \times 12 = 60$.

4. Draw the graph of $2x + y = 6$ and $2x - y + 2 = 0$. Shade the region bounded by these lines and x-axis. Find the area of the shaded region.

Sol. We have, $\quad 2x + y = 6$

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

When $x = 0$, we have $\quad y = 6 - 2 \times 0 = 6$

When $x = 3$, we have $\quad y = 6 - 2 \times 3 = 0$

When $x = 2$, we have $\quad y = 6 - 2 \times 2 = 2$

When $x = 1$, we have $\quad y = 6 - 2 \times 1 = 4$

Thus, we get the following table:

x	0	3	2	1
y	6	0	2	4

Now, we plot the points $A(0, 6)$, $F(1, 4)$ $C(2, 2)$ and $B(3, 0)$ on the graph paper as shown. We join A, B and C and extend it on both sides to obtain the graph of the equation $2x + y = 6$.

We have, $\quad 2x - y + 2 = 0$

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

When $x = 0$, we have $\quad y = 2 \times 0 + 2 = 2$

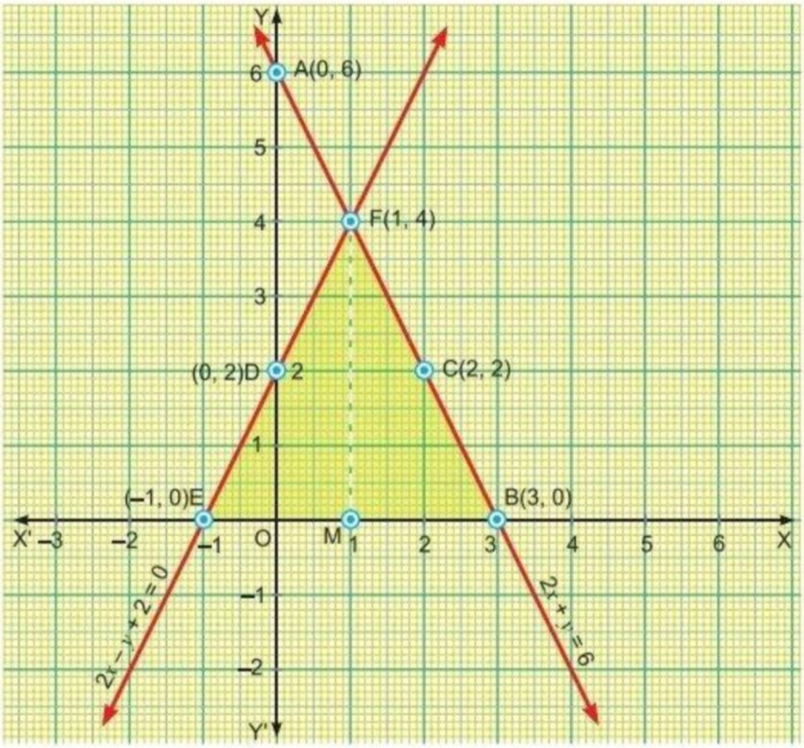
When $x = -1$, we have $\quad y = 2 \times (-1) + 2 = 0$

When $x = 1$, we have $\quad y = 2 \times 1 + 2 = 4$

Thus, we have the following table:

x	0	-1	1
y	2	0	4

Now, we plot the points $D(0, 2)$, $E(-1, 0)$ and $F(1, 4)$ on the same graph paper. We join D, E and F and extend it on both sides to obtain the graph of the equation $2x - y + 2 = 0$.



It is evident from the graph that the two lines intersect at point $F(1, 4)$. The area enclosed by the given lines and x-axis is shown in figure by the shaded region.

Thus, $x = 1, y = 4$ is the solution of the given system of equations. Draw FM perpendicular from F on x-axis.

Clearly, we have $FM = y$-coordinate of point $F(1, 4) = 4$ and $BE = 4$

$\therefore$ Area of the shaded region = Area of ΔFBE

$\Rightarrow$ Area of the shaded region $= \frac{1}{2}(\text{base} \times \text{height}) = \frac{1}{2}(BE \times FM)$

$= \left(\frac{1}{2} \times 4 \times 4\right) = 8$ sq. units.

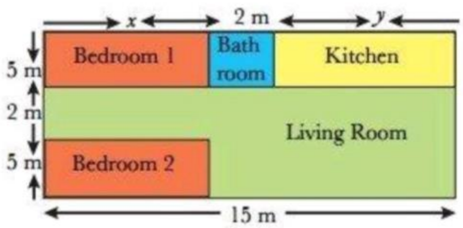
Case Study-based Questions

Each of the following questions are of 4 marks.

1. Read the following and answer any four questions from (*i*) to (*v*).

Amit is planning to buy a house and the layout is given below figure. The design and the measurement has been made such that areas of two bedrooms and kitchen together is 95 sq.m.

[*CBSE Question Bank*]



(*i*) The pair of linear equations in two variables from this situation are

(*a*) $x + y = 19$, $x + y = 13$ (*b*) $2x + y = 19$, $x + 2y = 13$ (*c*) $2x + y = 19$, $x + y = 13$ (*d*) none of these

(ii) The length of the outer boundary of the layout is

(a) 50 m (b) 52 m (c) 54 m (d) 56 m

(iii) The area of each bedroom and kitchen in the layout is

(a) $30\text{ m}^2, 40\text{ m}^2$ (b) $30\text{ m}^2, 35\text{ m}^2$ (c) $30\text{ m}^2, 45\text{ m}^2$ (d) $35\text{ m}^2, 45\text{ m}^2$

(iv) The area of living room in the layout is

(a) 60 m^2 (b) 75 m^2 (c) 80 m^2 (d) 100 m^2

(v) The cost of laying tiles in kitchen at the rate of ₹50 per sq.m is

(a) ₹1700 (b) ₹1800 (c) ₹1900 (d) ₹1750

Sol. We have length of each bedroom be x m and length of kitchen be y m.

(i) Areas of two bedrooms and kitchen together

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

$$\Rightarrow \quad 95 = 10x + 5y$$

$$\Rightarrow \quad 2x + y = 19 \quad \ldots(a)$$

Also, total length $= x + 2 + y$

$$\Rightarrow \quad 15 = x + 2 + y \quad \Rightarrow \quad x + y = 13 \quad \ldots(b)$$

$\therefore$ Option (c) is correct.

(ii) Length of outer boundary of the layout $= 15 + 12 + 15 + 12$

$= 54$ metre

$\therefore$ Option (c) is correct.

(iii) Subtracting (b) from (a), we get

$$x = 6$$

Putting $x = 6$ in (b), we get $y = 7$

$\therefore \quad x = 6$ and $y = 7$

Area of each bedroom $=$ length $\times$ breadth

$= x \times 5 = 6 \times 5 = 30\text{ m}^2$

and area of kitchen $=$ length $\times$ breadth

$= y \times 5 = 7 \times 5 = 35\text{ m}^2$

$\therefore$ Option (b) is correct.

(iv) Area of living room $= 15 \times 7 -$ area of bedroom 2

$= 15 \times 7 - x \times 5$

$= 15 \times 7 - 6 \times 5 = 105 - 30 = 75\text{ m}^2$

$\therefore$ Option (b) is correct.

(v) We have area of kitchen $= 35\text{ m}^2$

$\therefore$ Total cost of laying tiles in the kitchen at the rate of ₹50 per m^2

$= 35 \times 50$

$=$ ₹1750

$\therefore$ Option (d) is correct.

2. Read the following and answer any four questions from (i) to (v).

It is common that governments revise travel fares from time to time based on various factors such as inflation (a general increase in prices and fall in the purchasing value of money) on different types of vehicles like auto, rickshaws, taxis, radio cab etc. The auto charges in a city comprise of a fixed charge together with the charge for the distance covered. Study the following situations: ***[CBSE Question Bank]***

Name of the city	Distance travelled (km)	Amount paid (₹)
City A	10	75
	15	110
City B	8	91
	14	145

Situation 1: In city A, for a journey of 10 km, the charge paid is ₹75 and for a journey of 15 km, the charge paid is ₹110.

Situation 2: In a city B, for a journey of 8 km, the charge paid is ₹91 and for a journey of 14 km, the charge paid is ₹145.

Refer situation 1

(*i*) If the fixed charges of auto rickshaw be ₹ x and the running charges be ₹ y per km, the pair of linear equations representing the situation is

(*a*) $x + 10y = 110, x + 15y = 75$ (*b*) $x + 10y = 75, x + 15y = 110$

(*c*) $10x + y = 110, 15x + y = 75$ (*d*) $10x + y = 75, 15x + y = 110$

(*ii*) A person travels a distance of 50 km. The amount he has to pay is

(*a*) ₹155 (*b*) ₹255 (*c*) ₹355 (*d*) ₹455

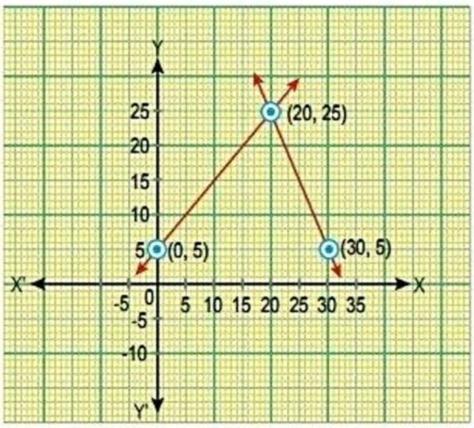
Refer situation 2

(*iii*) What will a person have to pay for travelling a distance of 30 km?

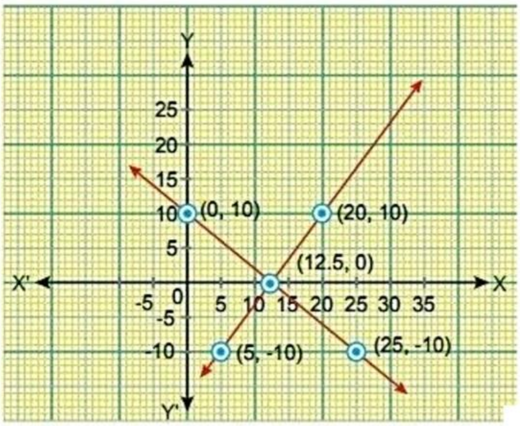
(*a*) ₹185 (*b*) ₹289 (*c*) ₹275 (*d*) ₹305

(*iv*) The graph of lines representing the conditions are: (situation 2)

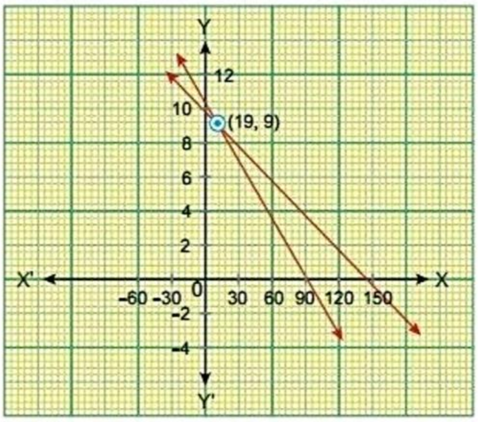
(*a*)



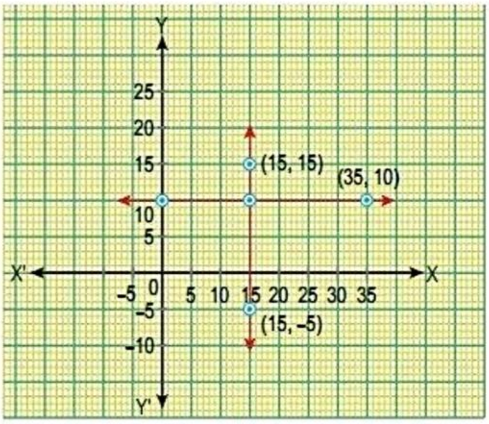
(*b*)



(c)



(d)



(v) Out of both the city, which one has cheaper fare?

(a) City A (b) City B (c) Both are same (d) cannot be decided

Sol. (i) In city A, for journey of 10 km, the charge paid is ₹75.

$\therefore \quad x + 10y = 75$ ...(i)

Where x be the fixed charge and y be the running charge per km.

Also, for journey of 15 km, the charge paid is ₹110.

$\therefore \quad x + 15y = 110$ ...(ii)

$\therefore$ Option (b) is correct.

(ii) When a person travels a distance of 50 km.

$\therefore$ Amount he has to pay $= x + 50\,y$ ...(iii)

On solving equation (i) and (ii), we get $x = 5, y = 7$

Putting in (iii), we have

Total payment $= x + 50y = 5 + 50 \times 7 =$ ₹355

$\therefore$ Option (c) is correct.

(iii) **Referring Situation 2**

We have, In a city B, for a journey of 8 km, the charge paid is ₹91 and for a journey of 14 km, the charge paid is ₹145.

$\therefore \quad x + 8y = 91$ ...(i)

$x + 14y = 145$ ...(ii)

be the required pair of linear equations.

Subtracting (i) from (ii), we have

$6y = 54 \quad \Rightarrow \quad y = 9$

from (i), we have

$x + 8 \times 9 = 91$

$\Rightarrow \quad x = 91 - 72 = 19$

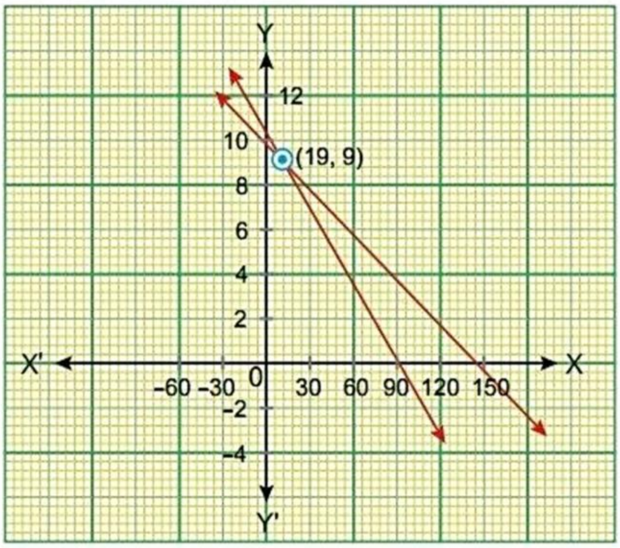
$\therefore \quad x = 19$

Total payment for travelling a distance of 30 km

$= x + 30y = 19 + 30 \times 9 = 19 + 270 =$ ₹289

$\therefore$ Option (b) is correct.

(*iv*) From situation 2, we have pair of linear equations



$$\left.\begin{aligned} x + 8y &= 91 \\ x + 14y &= 145 \end{aligned}\right\}$$ and point of intersection of these lines is (19,9).

∴ Option (*c*) is correct.

(*v*) From the table given, we can easily find out that city A is more cheaper than city B as per the fare charge.

∴ Option (*a*) is correct.

3. A test consists of 'True' or 'False' questions. One mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer. A student knew correct answers of some of the questions. Rest of the questions he attempted by guessing. He answered 120 questions and got 90 marks.

Type of Question	Marks given for correct answer	Marks deducted for wrong answer
True/False	1	0.25

Based on the above information answer the following questions.

(*i*) (*a*) How many number of questions did he guess?

(*b*) If answer to all questions he attempted by guessing were wrong and answered 80 correctly, then how many marks will he get?

(*ii*) (*a*) If answer to all questions he attempted by guessing were wrong, then how many questions were answered correctly to score 95 marks?

(*b*) How many maximum marks can a student score?

Sol. Let the student answered *x* question correctly and *y* question incorrectly (wrong).

∴ Total number of questions = 120

$$x + y = 120 \quad ...(i)$$

Also, one mark is awarded for each correct answer and $\frac{1}{4}$ mark is deducted for every wrong answer.

∴ Total marks student got = 90

$$x - \frac{1}{4}y = 90 \quad ...(ii)$$

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

$$y + \frac{1}{4}y = 120 - 90 = 30$$

$$\frac{5y}{4} = 30 \qquad \Rightarrow \quad y = 24$$

From (*ii*), $x - \frac{1}{4} \times 24 = 90$

$$\Rightarrow \quad x = 96$$

(*i*) (*a*) The number of questions student guess (do incorrect) = 120 – 96 = 24.

(*b*) As the student answered all 120 questions in which 80 questions answered correctly *i.e.* rest 40 questions do incorrectly.

$\therefore$ Student got the marks = $80 - \frac{1}{4} \times 40 = 70$ marks

(*ii*) (*a*) Let student answered correctly *x* questions.

$$\therefore \quad x - \frac{1}{4} \times (120 - x) = 95$$

$$\Rightarrow \quad x - 30 + \frac{x}{4} = 95$$

$$\Rightarrow \quad \frac{5x}{4} = 125$$

$$\Rightarrow \quad x = 100$$

(*b*) Since the total questions are 120.

If a student answered all questions correctly then he can score maximum marks *i.e*; 120.

PROFICIENCY EXERCISE

■ **Objective Type Questions:** **[1 mark each]**

1. Choose and write the correct option in each of the following questions.

(*i*) If $x^{2n-1} + y^{m-4} = 0$ is a linear equation, which of these is also a linear equation?

(*a*) $x^n + y^m = 0$ (*b*) $x^{1/2n} + y^{m/5} = 0$

(*c*) $x^{n+1/2} + y^{m+4} = 0$ (*d*) $x^{\frac{n}{5}} + y^{\frac{m}{5}} = 0$

(*ii*) Raghav earned ₹ 3550 by selling some bags each for ₹ 500 and some baskets each for ₹ 150. Aarav earned ₹ 3400 by selling the same number of bags each for ₹ 400 and the same number of baskets each for ₹ 200 as Raghav sold. Which of these equations relate the number of bags *x*, and the number of baskets, *y*? **[*CBSE Question Bank*]**

(*a*) $500x + 150y = 3400$ and $400x + 200y = 3550$

(*b*) $400x + 150y = 3550$ and $500x + 200y = 3400$

(*c*) $500x + 150y = 3550$ and $400x + 200y = 3400$

(*d*) $500x + 200y = 3550$ and $400x + 150y = 3400$

(*iii*) The pair of equations $y = 0$ and $y = -7$ has **[*NCERT Exemplar*]**

(*a*) one solution (*b*) two solutions

(*c*) infinitely many solutions (*d*) no solution (*iv*) For what value of k, do the equations $3x - y + 8 = 0$ and $6x - ky = -16$ represent coincident lines? [*NCERT Exemplar*]

(*a*) $\frac{1}{2}$ (*b*) $-\frac{1}{2}$ (*c*) 2 (*d*) -2

(*v*) For which value(s) of p will the lines represented by the following pair of linear equations be parallel : $3x - y - 5 = 0$ and $6x - 2y - p = 0$? [*CBSE Question Bank*]

(*a*) all real values except 10 (*b*) 10

(*c*) $\frac{5}{2}$ (*d*) $\frac{1}{2}$

■ Very Short Answer Questions: [1 mark each]

2. Do the following equations represent a pair of coincident lines?

$-2x - 3y = 1,\ 6y + 4x = -2$ [*NCERT Exemplar*]

3. Write the number of solutions of the following pair of linear equations:

$3x - 7y = 1$ and $6x - 14y - 3 = 0$

4. Find the value of k for which the system of equations $kx - y = 2$, $6x - 2y = 3$, has a unique solution.

5. Find the value of k for which the system of equations $2x + 3y = 7$ and $8x + (k + 4)y - 28 = 0$ has infinitely many solutions.

6. Find the value of k for which the system of equations $2x + y - 3 = 0$ and $5x + ky + 7 = 0$ has no solution.

7. If $x = a, y = b$ is the solution of the pair of equations $x - y = 2$ and $x + y = 4$, find the value of a and b. [*CBSE* 2018(*C*)(30/1)]

■ Short Answer Questions–I: [2 marks each]

8. Find the value of k for which the lines $(k + 1)x + 3ky + 15 = 0$ and $5x + ky + 5 = 0$ are coincident.

9. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the linear equations $4x - 5y = 8$ and $3x - \frac{15}{4}y = 6$ are consistent or inconsistent.

10. Find the value of k for which the system of equations $x + 3y - 4 = 0$ and $2x + ky = 7$ is inconsistent.

11. Find the value of k for which the following pair of linear equations have infinitely many solutions.

$2x + 3y = 7,\ (k + 1)x + (2k - 1)y = 4k + 1$ [*CBSE* 2019(30/1/2)]

12. Find the value(s) of k for which the pair of equations

$\begin{cases} kx + 2y = 3 \\ 3x + 6y = 10 \end{cases}$ has unique solution. [*CBSE* 2019(30/4/2)]

13. If the system of equations $2x + 3y = 7$ and $(a + b)x + (2a - b)y = 21$ has infinitely many solutions, then find a and b.

14. Solve the following pair of linear equations as :

$$3x - 5y = 4$$
$$2y + 7 = 9x$$ [*CBSE* 2019(30/3/1)]

15. Sumit is 3 times as old as his son. Five years later, he shall be two and a half time as old as his son. How old is sumit at present? [*CBSE* 2019(30/2/3)]

Short Answer Questions–II: [3 marks each]

16. Find the solution of the pair of equations $\frac{x}{10}+\frac{y}{5}-1=0$ and $\frac{x}{8}+\frac{y}{6}=15$. Hence, find λ, if $y = \lambda x + 5$.

17. If $3x + 7y = -1$ and $4y - 5x + 14 = 0$, then find the values of $3x - 8y$ and $\frac{y}{x}-2$.

18. A part of monthly hostel charges in a college hostel are fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 25 days, he has to pay ₹ 4,500, whereas a student B who takes food for 30 days, has to pay ₹ 5,200. Find the fixed charges per month and the cost of food per day.

19. There are some students in the two examination halls *A* and *B*. To make the number of students equal in each hall, 10 students are sent from *A* to *B*. But if 20 students are sent from *B* to *A*, the number of students in *A* becomes double the number of students in *B*. Find the number of students in the two halls.

20. The age of the father is twice the sum of the ages of his two children. After 20 years, his age will be equal to the sum of the ages of his children. Find the age of the father.

21. The angles of a cyclic quadrilateral *ABCD* are $\angle A = (2x + 4)^\circ$, $\angle B = (y + 3)^\circ$, $\angle C = (2y + 10)^\circ$, $\angle D = (4x - 5)^\circ$. Find *x* and *y* and hence the values of the four angles.

22. Two numbers are in the ratio of 1 : 3. If 5 is added to both the numbers, the ratio becomes 1 : 2. Find the numbers.

Long Answer Questions: [5 marks each]

23. Draw the graphs of the equations $y = -1$, $y = 3$ and $4x - y = 5$. Also, find the area of the quadrilateral formed by the lines and the *y*-axis.

24. Solve the following system of linear equations graphically and shade the region between the two lines and *x*-axis.

(*i*) $3x + 2y - 4 = 0$
$2x - 3y - 7 = 0$

(*ii*) $3x + 2y - 11 = 0$
$2x - 3y + 10 = 0$

25. The sum of a two digit number and the number formed by interchanging its digits is 110. If 10 is subtracted from the first number, the new number is 4 more than 5 times the sum of the digits in the first number. Find the first number.

26. Ankita travels 14 km to her home partly by rickshaw and partly by bus. She takes half an hour if she travels 2 km by rickshaw, and the remaining distance by bus. On the other hand, if she travels 4 km by rickshaw and the remaining distance by bus, she takes 9 minutes longer. Find the speed of the rickshaw and of the bus. [*NCERT Exemplar*]

27. The sum of the numerator and denominator of a fraction is 3 less than twice the denominator. If the numerator and denominator are decreased by 1, the numerator becomes half the denominator. Determine the fraction.

28. Points *A* and *B* are 70 km apart on a highway. A car starts from *A* and another car starts from *B* simultaneously. If they travel in the same direction, they meet in 7 hours, but if they travel towards each other, they meet in one hour. Find the speed of the two cars.

29. *A* takes 6 days less than *B* to do a work. If both *A* and *B* working together can do it in 4 days, how many days will *B* take to finish it?

Answers

1. (*i*) (*b*) (*ii*) (*c*) (*iii*) (*d*) (*iv*) (*c*) (*v*) (*a*)

2. Yes **3.** No solution **4.** $k \neq 3$ **5.** $k = 8$ **6.** $k = \frac{5}{2}$ **7.** $a = 3, b = 1$

8. 14 **9.** consistent **10.** 6 **11.** $k = 5$

12. $k \neq 1$ (the pair of equations have unique solution for all real values of k except 1)

13. $a = 5, b = 1$ **14.** $x = \frac{9}{13}, y = \frac{-5}{13}$ **15.** 45 years

16. $x = 340, y = -165, \lambda = \frac{-1}{2}$ **17.** $14, -\frac{5}{2}$

18. Fixed charge = ₹ 1000; cost of food per day = ₹140

19. 100 students in Hall A, 80 students in Hall B **20.** 40 years

21. $x = 33, y = 50, \angle A = 70°, \angle B = 53°, \angle C = 110°, \angle D = 127°$ **22.** 5 and 15

23. 6 square units **24.** (*i*) $x = 2, y = -1$ (*ii*) $x = 1, y = 4$ **25.** 64

26. 10 km/h, 40 km/h **27.** $\frac{4}{7}$

28. Speed of car from point A = 40 km/ h and from point B = 30 km/h **29.** 12 days

Self-Assessment

Time allowed: 1 hour Max. marks: 40

SECTION A

1. Choose and write the correct option in the following questions. **(3 × 1 = 3)**

(*i*) The cost of production per unit for two products, A and B, are ₹100 and ₹80 respectively. In a week, the total production cost is ₹32000. In the next week, the production cost reduces by 20%, and the total cost of producing the same number of units of each product is ₹25600. Which of these are the equations that can be used to find the number of units of A, x and the number of units of B, y?

(*a*) $100x + 80y = 32000$ and $80x + 64y = 25600$

(*b*) $100x + 64y = 32000$ and $80x + 100y = 25600$

(*c*) $80x + 64y = 25600$ and $80x + 64y = 32000$

(*d*) $80x + 80y = 32000$ and $100x + 64y = 25600$

(*ii*) Consider the equations shown. $p + q = 5$ and $p - q = 2$

Which of these are the values of p and q?

(*a*) $p = 1.5, q = 3.5$ (*b*) $p = 3.5, q = 1.5$ (*c*) $p = 2, q = 3$ (*d*) $p = 3, q = 2$

(*iii*) The value of k for which the lines $(k + 1)x + 3ky + 15 = 0$ and $5x + ky + 5 = 0$ are coincident is

(*a*) 14 (*b*) 2 (*c*) –14 (*d*) –2

2. Solve the following questions. **(2 × 1 = 2)**

(*i*) If $\sqrt{a}x - \sqrt{b}y = b - a$ and $\sqrt{b}x - \sqrt{a}y = 0$ then what is the value of $x - y$?

(*ii*) For the pair of equations $\lambda x + 3y = -7$, $2x - 6y = 14$ to have infinitely many solutions, find the value of λ.

SECTION B

■ **Solve the following questions.** **(4 × 2 = 8)**

3. For what value of k, will the following pair of equations have infinitely many solutions?
$2x + 3y = 7$ and $(k + 2)x - 3(1 - k)y = 5k + 1$ **[*CBSE* 2019(30/2/2)]**

4. Find the solution of the pair of equations:
$\frac{3}{x} + \frac{8}{y} = -1, \frac{1}{x} - \frac{2}{y} = 2, x, y \neq 0$ **[*CBSE* 2019(30/2/3)]**

5. Find the value of k for which the system of equations $x + 3y - 4 = 0$ and $2x + ky = 7$ is inconsistent.

6. The larger of two supplementary angles exceeds thrice the smaller by 20 degrees. Find them.

■ **Solve the following questions.** **(4 × 3 = 12)**

7. Solve graphically the system of linear equations:
$4x - 3y + 4 = 0$ and $4x + 3y - 20 = 0$
Find the area bounded by these lines and x-axis.

8. Solve the following pair of linear equations: **[*CBSE* 2019(30/3/3)]**
$3x + 4y = 10$
$2x - 2y = 2$

9. Determine graphically the coordinates of the vertices of a triangle, the equations of whose sides are given by $2y - x = 8$, $5y - x = 14$ and $y - 2x = 1$. **[*CBSE* 2020(30/1/1)]**

10. A person, rowing at the rate of 5 km/h in still water, takes thrice as much time in going 40 km upstream as in going 40 km downstream. Find the speed of the stream. **[*NCERT Exemplar*]**

■ **Solve the following questions.** **(3 × 5 = 15)**

11. Determine graphically, the vertices of the triangle formed by the lines $y = x$, $3y = x$, $x + y = 8$. **[*NCERT Exemplar*]**

12. Susan invested certain amount of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum respectively. She received ₹1860 as annual interest. However, had she interchanged the amount of investment in the two schemes, she would have received ₹20 more as annual interest. How much money did she invest in each scheme? **[*NCERT Exemplar*]**

13. The sum of a two digit number and the number obtained by reversing the order of its digits is 165. If the digits differ by 3, find the number.

Answers

1. (*i*) (*a*) (*ii*) (*b*) (*iii*) (*a*)

2. (*i*) $\sqrt{b} - \sqrt{a}$ (*ii*) -1 **3.** $k = 4$ **4.** $x = 1, y = -2$ **5.** 6

6. 40°, 140° **7.** $x = 2, y = 4$; 12 sq. units **8.** $x = 2, y = 1$

9. $A(-4, 2)$, $B(1, 3)$, $C(2, 5)$ **10.** 2.5 km/h **11.** (0, 0), (4, 4), (6, 2)

12. Scheme $A \rightarrow$ ₹12,000, Scheme $B \rightarrow$ ₹10,000 **13.** 69 or 96