

Chapter : *Three*

Pair of Linear Equations in Two Variables



Competency Based Questions



◆ Multiple Choice Questions

1. A pair of linear equations $a_1x + b_1y + c_1 = 0$; $a_2x + b_2y + c_2 = 0$ is said to be inconsistent, if

- (a) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (b) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
(c) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (d) $\frac{a_1}{a_2} \neq \frac{c_1}{c_2}$

Ans. (b) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

2. Graphically, the pair of equations $7x - y = 5$; $21x - 3y = 10$ represents two lines which are

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

Ans. (b) parallel

3. The pair of equations $3x - 5y = 7$ and $-6x + 10y = 7$ have

- (a) a unique solution (b) infinite solutions
(c) no solution (d) two solutions

Ans. (c) no solution

4. If a pair of linear equations is consistent, then the lines will be

- (a) always coincident
(b) parallel
(c) always intersecting
(d) intersecting or coincident

Ans. (d) intersecting or coincident

5. The pair of equations $x = 0$ and $x = 5$ has

- (a) no solution (b) one solution
(c) two solutions (d) infinite solutions

Ans. (a) no solution

6. The pair of equation $x = -4$ and $y = -5$ graphically represents lines which are intersecting

- (a) at $(-5, -4)$ (b) at $(-4, -5)$
(c) at $(5, 4)$ (d) at $(4, 5)$

Ans. (b) at $(-4, -5)$

7. For what value of k , do the equations $2x - 3y + 10 = 0$ and $3x + ky + 15 = 0$ represent coincident lines

- (a) $\left(\frac{-9}{2}\right)$ (b) -11 (c) $\frac{9}{2}$ (d) -7

Ans. (a) $\left(\frac{-9}{2}\right)$

8. If the lines given by $2x + ky = 1$ and $3x - 5y = 7$ are parallel, then the value of k is

- (a) $\frac{-10}{3}$ (b) $\frac{10}{3}$ (c) -13 (d) -7

Ans. (a) $\frac{-10}{3}$

9. One equation of a pair of dependent linear equations is $2x + 5y = 3$. The second equation will be

- (a) $2x + 5y = 6$ (b) $3x + 5y = 3$
(c) $-10x - 25y + 15 = 0$ (d) $10x + 25y = 15$

Ans. (c) $-10x - 25y + 15 = 0$

10. If $x = a$, $y = b$ is the solution of the equations $x + y = 5$ and $2x - 3y = 4$, then the values of a and b are respectively

- (a) $6, -1$ (b) $2, 3$ (c) $1, 4$ (d) $\frac{19}{5}, \frac{6}{5}$

Ans. (d) $\frac{19}{5}, \frac{6}{5}$

11. The graph of $x = -2$ is a line parallel to the

- (a) x -axis (b) y -axis
(c) both x - and y -axis (d) none of these

Ans. (b) y -axis

12. The graph of $y = 4x$ is a line

- (a) parallel to x -axis (b) parallel to y -axis
(c) perpendicular to y -axis
(d) passing through the origin

Ans. (d) passing through the origin

13. The graph of $y = 5$ is a line parallel to the

- (a) x -axis (b) y -axis
(c) both axis (d) none of these

Ans. (a) x -axis

14. Two equations in two variables taken together are called

- (a) linear equations (b) quadratic equations
(c) simultaneous equations
(d) none of these

Ans. (c) simultaneous equations

15. If $am \neq bl$ then the system of equations $ax + by = c$, $lx + my = n$, has

- (a) a unique solution (b) no solution
(c) infinitely many solutions
(d) none of these

Ans. (a) a unique solution

16. If in the equation $x + 2y = 10$, the value of y is 6, then the value of x will be

- (a) -2 (b) 2 (c) 4 (d) 5

Ans. (a) -2

17. The graph of the equation $2x + 3y = 5$ is a

- (a) vertical line (b) straight line
(c) horizontal line (d) none of these

Ans. (b) straight line

18. The value of k , for which equations $3x + 5y = 0$ and $kx + 10y = 0$ has a non-zero solution is

- (a) 6 (b) 0 (c) 2 (d) 5

Ans. (a) 6

19. The value of k , for which the system of equations $x + (k + 1)y = 5$ and $(k + 1)x + 9y = 8k - 1$ has infinitely many solutions is

- (a) 2 (b) 3 (c) 4 (d) 5

Ans. (a) 2

20. The value of k for which the equations $(3k + 1)x + 3y = 2$; $(k^2 + 1)x + (k - 2)y = 5$ has no solution, then k is equal to

- (a) 2 (b) 3 (c) 1 (d) -1

Ans. (d) -1

21. The pair of equations $x = a$ and $y = b$ graphically represents lines which are

- (a) parallel
(b) intersecting at (b, a)
(c) coincident
(d) intersecting at (a, b)

Ans. (d) intersecting at (a, b)

22. Asha 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

- (a) 35 & 15 (b) 15 & 35 (c) 35 & 20 (d) 25 & 25

Ans. (d) 25 & 25

23. 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's age. The present ages of the son and the father are, respectively

- (a) 4 & 24 (b) 5 & 30 (c) 6 & 36 (d) 3 & 24

Ans. (c) 6 & 36

24. The sum of the digits of a two-digit number is 9. If 27 is added to it, the digits of the number get reversed. The number is

- (a) 27 (b) 72 (c) 45 (d) 36

Ans. (d) 36

◆ Assertion – Reason Questions

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true but Reason (R) is false.
(d) Assertion (A) is false but Reason (R) is true.

1. **Assertion:** The value of $q = \pm 2$, if $x = 3$, $y = 1$ is the solution of the line $2x + y - q^2 - 3 = 0$.

Reason: The solution of the line will satisfy the equation of the line.

Ans. (a) Both A and R are true and R is the correct explanation of A.

Explanation: As $x = 3$ and $y = 1$ is the solution of $2x + y - q^2 - 3 = 0$.

$$\begin{aligned} \text{When } x = 3 \text{ and } y = 1, 2 \times 3 + 1 - q^2 - 3 &= 0 \\ \Rightarrow 4 - q^2 &= 0 \\ \Rightarrow 4 &= q^2 \end{aligned}$$

$$\therefore q = \pm 2$$

So, both A and R are correct and R explains A.

2. **Assertion:** If the pair of lines are coincident, then we say that pair of lines is consistent and it has a unique solution.

Reason: If the pair of lines are parallel, then the pair has no solution and is called inconsistent pair of equations.

Ans. (d) Assertion (A) is false but Reason (R) is true.

Explanation: If the lines are coincident, then it has infinite number of solutions.

3. **Assertion:** $x + y - 4 = 0$ and $2x + ky - 3 = 0$ has no solution if $k = 2$.

Reason: $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are consistent if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

Ans. (b) Both A and R are true but R is not the correct explanation of A.

Explanation: For assertion, given equation has no solution if $\frac{1}{2} = \frac{1}{k} \neq \frac{-4}{-3}$ i.e., $\frac{4}{3}$. When $k = 2$, $\frac{1}{2} = \frac{1}{2} \neq \frac{4}{3}$

4. **Assertion:** If $kx - y - 2 = 0$ and $6x - 2y - 3 = 0$ are inconsistent, then $k = 3$.

Reason: $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are inconsistent of $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.

Ans. (a) Both A and R are true and R is the correct explanation of A.

Explanation: We have, $kx - y - 2 = 0$ and $6x - 2y - 3 = 0$

When $k = 3$, $\frac{3}{6} \cdot \frac{1}{2} = \frac{-1}{-2} \neq \frac{-2}{-3}$ $\therefore \frac{k}{6} = \frac{3}{6}$

5. **Assertion:** The linear equations $x - 2y - 3 = 0$ and $3x + 4y - 20 = 0$ have exactly one solution.

Reason: The linear equations $2x + 3y - 9 = 0$ and $4x + 6y - 18 = 0$ have a unique solution.

Ans. (c) Assertion (A) is true but Reason (R) is false.

Explanation: We have, $x - 2y - 3 = 0$ and $3x + 4y - 20 = 0$

Here, $\frac{1}{3} \neq \frac{-2}{4} \neq \frac{-3}{-20}$ $\therefore$ Intersecting lines have 1 solution

◆ Case Based Questions

- I. 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 answers to some of the questions. Rest of the questions he attempted by guessing. He answered 120 questions and got 90 marks.

Type of Questions	Marks given for correct answers	Marks deducted for wrong answers
True/false	1	0.25

- (i) If answers to all questions that he attempted by guessing were wrong, how many questions did he answer correctly?

(a) 96 (b) 86 (c) 76 (d) 106

Ans. (a) 96

Explanation: Let the no. of questions whose answers are known to the student x and questions attempted by guessing be y .

$$x + y = 120 \quad \dots(i) \quad x - \frac{1}{4}y = 90 \quad \dots(ii)$$

Solving (i) and (ii), we get $x = 96$ and $y = 24$

$\therefore$ No. of questions whose answer are known = 96

- (ii) How many questions did he guess?

(a) 12 (b) 18 (c) 24 (d) 26

Ans. (c) 24

- (iii) If answers to all the questions attempted by guessing were wrong and answered 80 correctly, then how many marks did he get?

(a) 50 (b) 70 (c) 80 (d) 20

Ans. (b) 70

Explanation: Total no. of questions = $96 + 24 = 120$

Marks = $80 - \frac{1}{4} \text{ of } 40 = 70$

- (iv) If answers to all the questions he attempted by guessing were wrong, then how many questions

did answer correctly to score 95 marks?

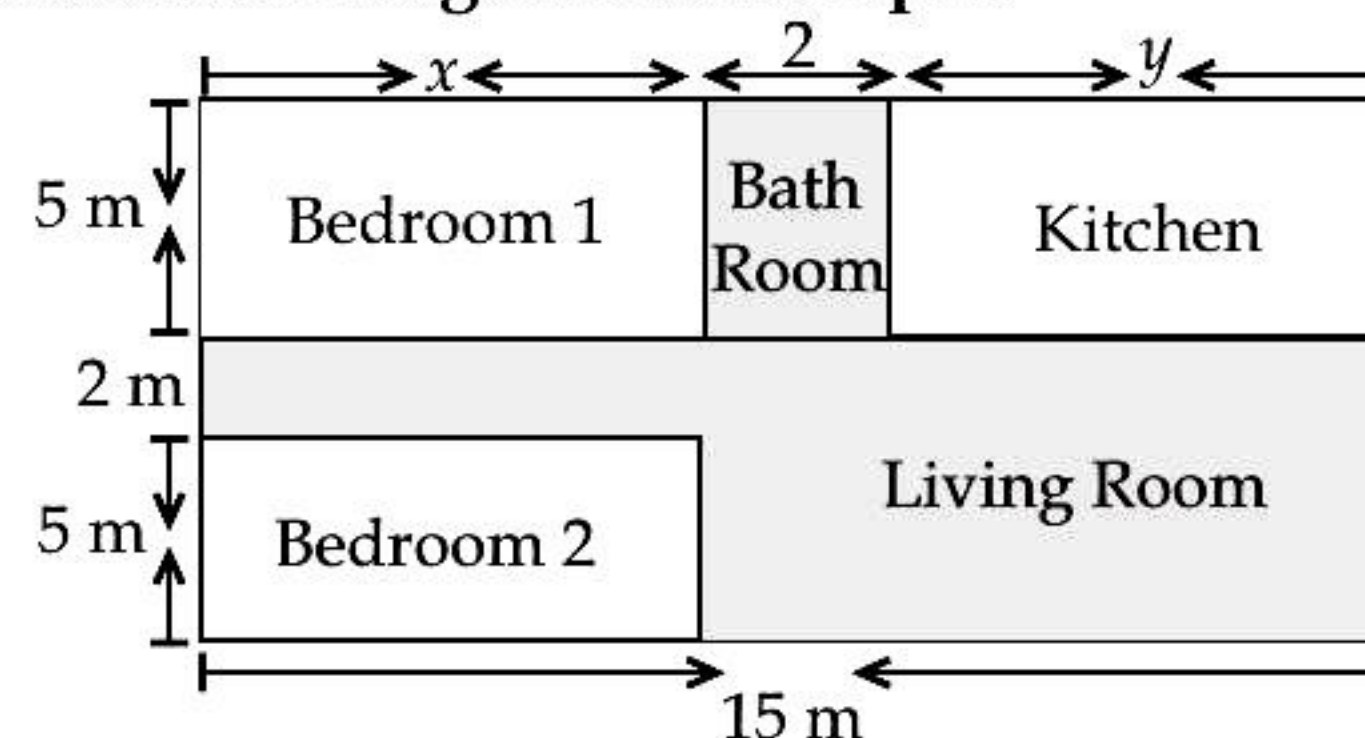
(a) 100 (b) 200 (c) 250 (d) 150

Ans. (a) 100

Explanation: $x - \frac{1}{4}$ of $(120 - x) = 95$

$$\Rightarrow 5x = 380 + 120 \Rightarrow 5x = 500 \therefore x = 100$$

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



Based on the above information, answer the following questions:

- (i) Which is the correct equation in two variables from this situation.

(a) $x + y = 13$ (b) $x + y = 15$
(c) $x + y = 17$ (d) $x + y = 19$

Ans. (a) $x + y = 13$

Explanation: $x + 2 + y = 15 \therefore x + y = 13$

- (ii) Find the length of the outer boundary of the layout.

(a) 86 m (b) 45 m (c) 34 m (d) 54 m

Ans. (d) 54 m

Explanation: Length = $12 + 15 + 12 + 15 = 54$ m

- (iii) Find the area of each bedroom and kitchen in the layout.

(a) Bedroom 20m^2 ; Kitchen 25m^2
(b) Bedroom 50m^2 ; Kitchen 55m^2
(c) Bedroom 30m^2 ; Kitchen 35m^2
(d) Bedroom 40m^2 ; Kitchen 45m^2

Ans. (c) Bedroom 30m^2 ; Kitchen 35m^2

Explanation: Area of two bedrooms = $5x + 5x = 10x \text{ m}^2$

Area of Kitchen = $5y \text{ m}^2$

According to Question, $10x + 5y = 95$ $\dots(i)$

$x + y = 13$ $\dots(ii)$

Solving the above, we get $x = 6$ and $y = 7$

$\therefore$ Area of each Bedroom = $5x = 30 \text{ m}^2$

$\therefore$ Area of the Kitchen = $5y = 35 \text{ m}^2$

- (iv) Find the area of living room in the layout.

(a) 85 m^2 (b) 65 m^2 (c) 45 m^2 (d) 75 m^2

Ans. (d) 75 m^2

Explanation: Total Area = $15 \times 12 = 180 \text{ m}^2$

Area of Bathroom = $2 \times 5 = 10 \text{ m}^2$

$\therefore$ Area of living room = $180 - (30 \times 2) - 10 - 35 = 75 \text{ m}^2$

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

(a) ₹1850 (b) ₹1750 (c) ₹1950 (d) ₹1650

Ans. (b) ₹1750

Explanation: Total cost = $7 \text{ m} \times 5 \text{ m} \times ₹50 = ₹1750$

III. 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 Autos, Rickshaws, Taxis, Radio cabs etc. The Auto charges in a city comprise of a fixed charge together with the charge for the distance covered. Study the following situations:



Name of the city	Distance travelled (km)	Amt. 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.

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) $10x + y = 75, 15x + y = 110$

Ans. (b) $x + 10y = 75, x + 15y = 110$

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

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

Ans. (c) 355

Explanation:

Solving equations from (i), we get $x = 5$ and $y = 7$

Now, fare for 50 km = $x + 5y = 5 + 50(7) = ₹355$

Situation 2:

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

(a) ₹185 (b) ₹289 (c) ₹275 (d) ₹305

Ans. (b) ₹289

Explanation:

$x + 8y = 91$... (i)

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

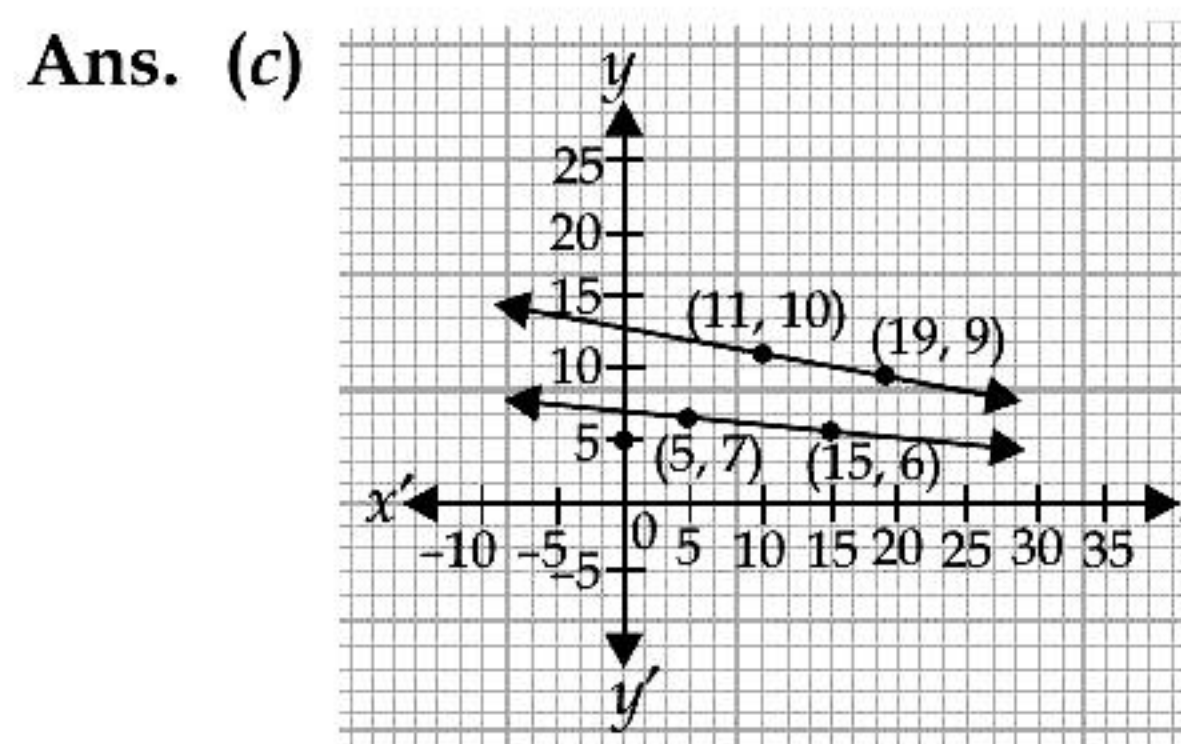
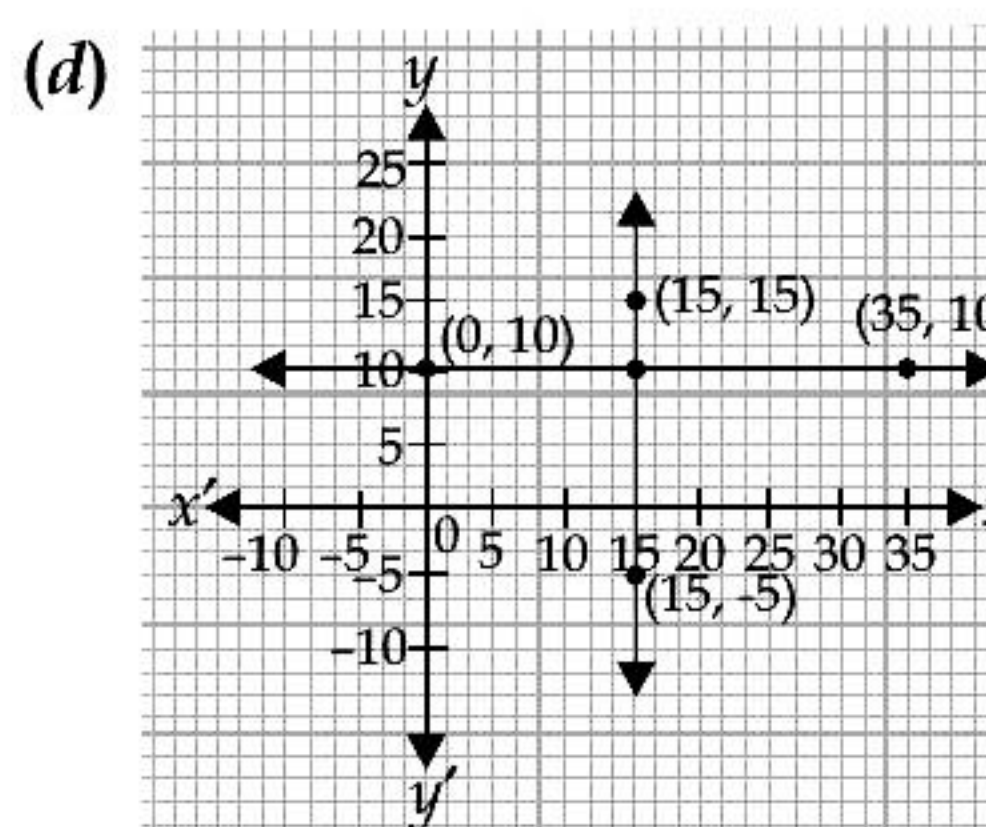
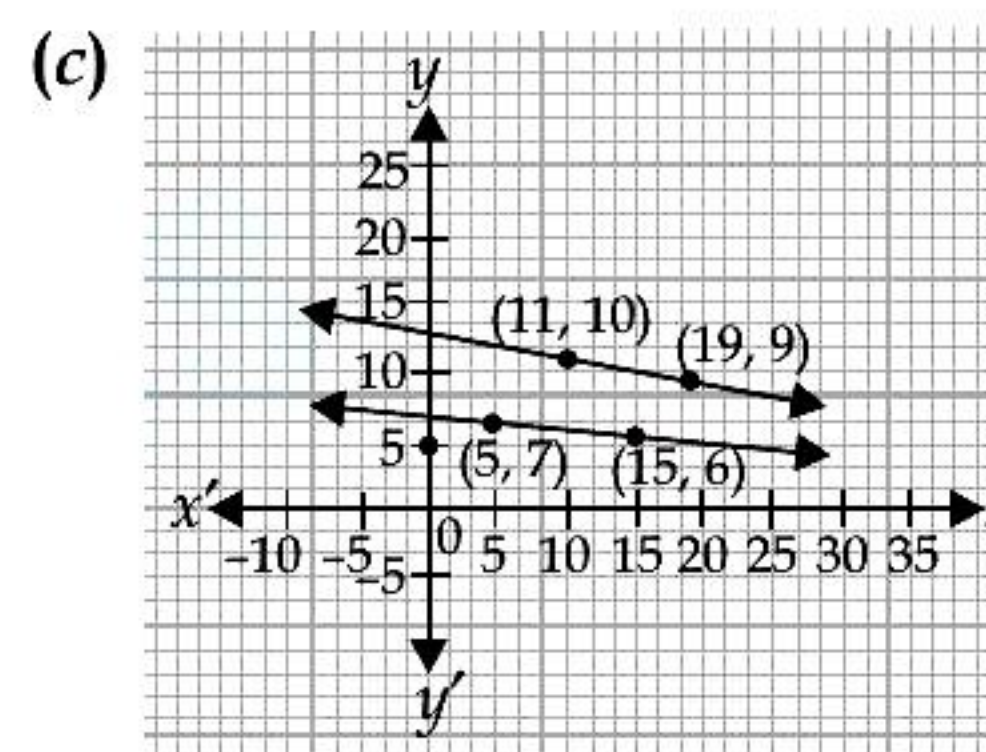
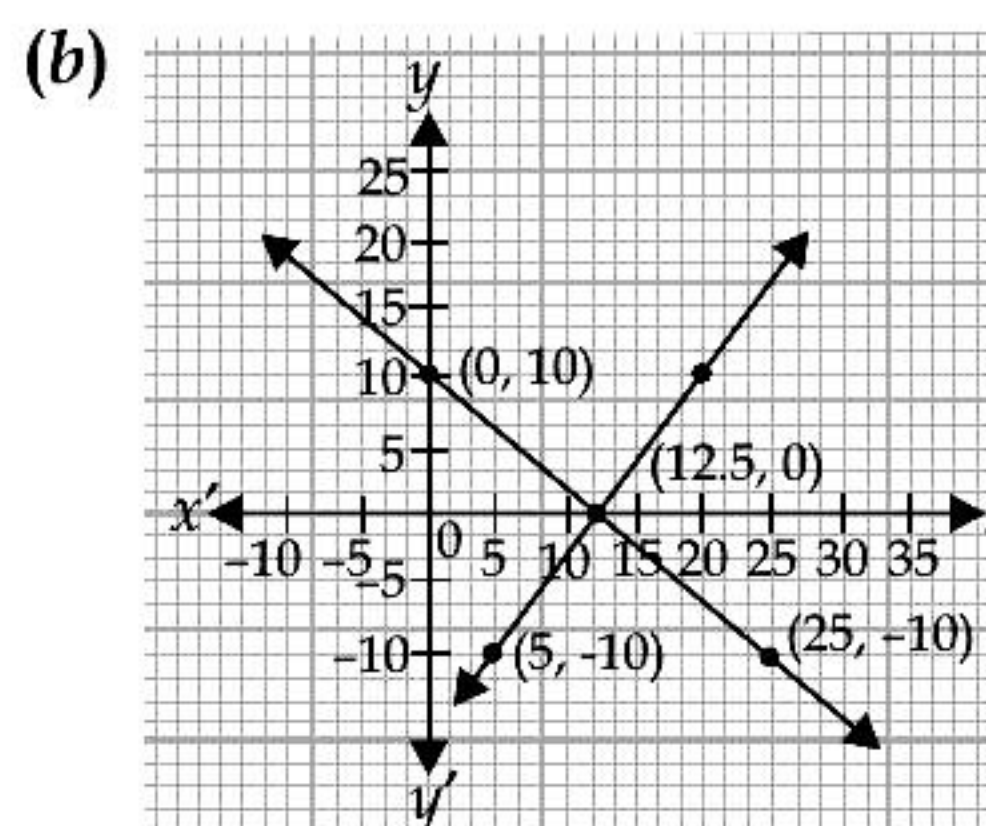
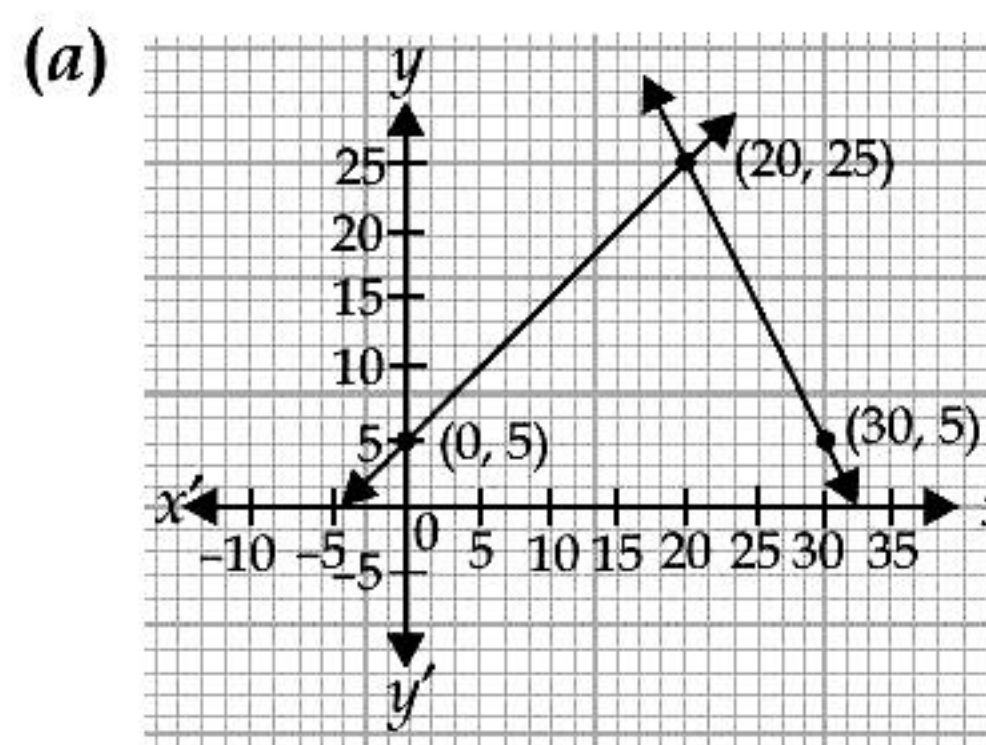
$$\begin{array}{r} x + 8y = 91 \\ x + 14y = 145 \\ \hline -6y = -54 \end{array}$$

$$\Rightarrow y = \frac{54}{6} = 9$$

Putting $y = 9$ in (i), we get $x = 19$

Now, fare for 30 km = $x + 30y = 19 + 30 \times 9 = ₹289$

(iv) The graph of lines representing the conditions of both the equations are depicted below. Which one is correct.



IV. A part of monthly hostel charges in a collage is fixed and the remaining depends on the number of days one has taken food in the mess. When a student Anu takes food for 25 days, she has to pay

₹4500 as hostel charges, whereas another student Bindu who takes food for 30 days has to pay ₹5200 as hostel charges.



Considering the fixed charges per month by ₹ x and the cost of food per day by ₹ y , then answer the following questions:

(i) Represent algebraically the situation faced by both Anu and Bindu.

(a) $x + 25y = 4500$, $x + 30y = 5200$

(b) $25x + y = 4500$, $30x + y = 5200$

(c) $x - 25y = 4500$, $x - 30y = 5200$

(d) $25x - y = 4500$, $30x - y = 5200$

Ans. (a) $x + 25y = 4500$, $x + 30y = 5200$

Explanation: For student Anu:

Fixed charges + cost of food for 25 days
 $= x + 25y = 4500$

For student Bindu:

Fixed charges + cost of food for 30 days
 $= x + 30y = 5200$

(ii) The system of linear equations, represented by above situations has

(a) No solution

(b) Unique solution

(c) Infinitely many solutions

(d) None of these

Ans. (b) Unique solution

Explanation: Using equations from point (i),

$a_1 = 1$, $b_1 = 25$, $c_1 = -4500$ and $a_2 = 1$, $b_2 = 30$, $c_2 = -5200$

$\therefore \frac{a_1}{a_2} = 1$, $\frac{b_1}{b_2} = \frac{25}{30} = \frac{5}{6}$, $\frac{c_1}{c_2} = \frac{-4500}{-5200} = \frac{45}{52}$

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

Thus, system of linear equations has **unique** solution.

(iii) The cost of food per day is

(a) ₹120 (b) ₹130 (c) ₹140 (d) ₹1300

Ans. (c) ₹140

Explanation: We have, $x + 25y = 4500$... (i)

and $x + 30y = 5200$... (ii)

Subtracting (i) and (ii), we get

$\Rightarrow 5y = 700 \Rightarrow y = 140$

$\therefore$ Cost of food per day is ₹140.

(iv) The fixed charges per month for the hostel is

(a) ₹1500 (b) ₹1200 (c) ₹1000 (d) ₹1300

Ans. (c) ₹1000

Explanation: We have, $x + 25y = 4500$

$\Rightarrow x = 4500 - 25 \times 140 \Rightarrow x = 4500 - 3500 = 1000$

$\therefore$ Fixed charges per month for the hostel is ₹1000.

(v) If Bindu takes food for 20 days, then what amount she has to pay?

(a) ₹4000 (b) ₹3500 (c) ₹3600 (d) ₹3800

Ans. (d) ₹3800

Explanation: We have, $x = 1000$ and $y = 140$

$\therefore$ Food charges for 20 days $= 1000 + 20 \times 140 = ₹3800$

V. Mr. Manoj Jindal arranged a lunch partly for some of his friends. The expense of the lunch is partly constant and partly proportional to the number of guests. The expenses amount to ₹650 for 7 guests and ₹970 for 11 guests.



Denote the constant expense by x and proportional expense per person by y and answer the following questions:

(i) Represent both the situations algebraically.

(a) $x + 7y = 650$, $x + 11y = 970$

(b) $x - 7y = 650$, $x - 11y = 970$

(c) $x + 11y = 650$, $x + 7y = 970$

(d) $11x + 7y = 650$, $11x - 7y = 970$

Ans. (a) $x + 7y = 650$, $x + 11y = 970$

(ii) Proportional expense for each person is

(a) ₹50 (b) ₹80 (c) ₹90 (d) ₹100

Ans. (b) ₹80

Explanation: Subtracting equations (i) from (ii), we get

$4y = 320 \therefore y = 80$

(iii) The fixed (or constant) expense for the party is

(a) ₹50 (b) ₹80 (c) ₹90 (d) ₹100

Ans. (c) ₹90

Explanation: Putting $y = 80$ in equation (i), we get

$x + 7 \times 80 = 650 \Rightarrow x = 650 - 560 = ₹90$

(iv) If there are 15 guests at the lunch party, then what amount Mr. Jindal has to pay?

(a) ₹1,250 (b) ₹1,430 (c) ₹1,350 (d) ₹1,290

Ans. (d) ₹1,290

Explanation: If there will be 15 guests, then amount that Mr. Jindal has to pay $= ₹(90 + 15 \times 80) = ₹1290$

(v) The system of linear equations representing both the situations will have

(a) a unique solution (b) no solution

(c) infinitely solutions (d) none of these

Ans. (a) a unique solution

Explanation: $x + 7y - 650 = 0$; $x + 11y - 970 = 0$

$a_1 = 1$, $b_1 = 7$, $c_1 = 650$; $a_2 = 1$, $b_2 = 11$, $c_2 = 970$

$\therefore \frac{a_1}{a_2} = 1$, $\frac{b_1}{b_2} = \frac{7}{11}$, $\frac{c_1}{c_2} = \frac{-650}{-970} = \frac{65}{97}$ Here, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Thus, system of linear equations has a **unique** solution.