Linear Inequalities

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions (MCQs)

1. Which of the following statements is correct?
(a) If $x > y$ and $b < 0$, then $bx < by$
(b) If $x > y$, then $x > 0$ and $y < 0$
(c) If $xy < 0$, then $x > 0$ and $y > 0$
(d) All of these

2. If $4x + 3 < 6x + 7$, then $x \in$
(a) $(2, \infty)$ (b) $(-2, \infty)$
(c) $(-\infty, 2)$ (d) $(-\infty, \infty)$

3. If $7x + 3 < 5x + 9$ then $x \in$
(a) $(-\infty, 3]$ (b) $(-\infty, \infty)$
(c) $(-\infty, 3)$ (d) $[3, \infty)$

4. The marks obtained by a student of Class XI in first and second terminal examination are 62 and 48, respectively. Find the minimum marks he should get in the annual examination to have an average of at least 60 marks.
(a) 50 (b) 60 (c) 70 (d) 80

5. Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.
(a) (11, 13), (13, 15), (15, 17), (17, 19)
(b) (11, 13), (13, 15), (15, 17)
(c) (21, 23), (23, 25), (25, 27), (27, 29)
(d) (15, 17), (17, 19), (19, 21), (21, 23)

6. If $-8 \le 5x - 3 < 7$, then $x \in$
(a) $(-1, 2)$ (b) $[-1, 2)$ (c) $[-2, \infty)$ (d) $[-2, 0)$

7. If $-5 \le \frac{5-3x}{2} \le 8$, then $x \in$
(a) $\left[-\frac{11}{3}, 5\right]$ (b) $[-5, 5]$
(c) $\left[-\frac{11}{3}, \infty\right)$ (d) $(-\infty, \infty)$

8. If $3x - 7 < 5 + x$, $11 - 5x \le 1$, then $x \in$
(a) $[2, 6]$ (b) $[-2, 6]$
(c) $[2, 6)$ (d) $(-2, 6)$

9. If $\frac{x-2}{x+5} > 2$, then $x \in$
(a) $(-12, 5)$ (b) $(-12, -5)$
(c) $(-5, 12)$ (d) $(5, 12)$

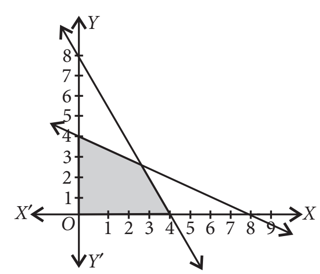
10. If $|3 - 4x| \ge 9$, then $x \in$
(a) $(-\infty, -3) \cup (3, \infty)$ (b) $\left(-\infty, \frac{-3}{2}\right] \cup (3, \infty)$
(c) $\left(-\infty, \frac{-3}{2}\right) \cup (0, \infty)$ (d) $\left(-\infty, \frac{-3}{2}\right] \cup [3, \infty)$

11. If $1 \le |x - 2| \le 3$, then $x \in$
(a) $[-1, 5]$ (b) $[-1, 1] \cup [3, 5]$
(c) $(-1, 0) \cup (2, 5)$ (d) $(-1, 5)$

12. The cost and revenue functions of a product are given by $C(x) = 20x + 4000$ and $R(x) = 60x + 2000$, respectively, where x is the number of items produced and sold. How many items must be sold to realise some profit?
(a) Less than 40 (b) More than 50
(c) Less than 50 (d) Exactly 50

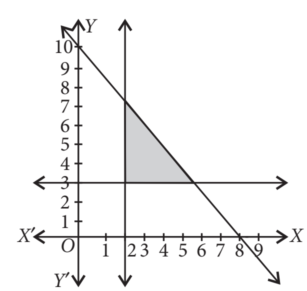
Direction : (13 and 14) : Which of the following inequalities satisfy the given figure.

13. (i) $x + 2y \le 8$
(ii) $x \ge 0, y \ge 0$
(iii) $x \le 0, y \le 0$
(iv) $2x + y \le 8$
(v) $4x + 5y \ge 40$



(a) (i), (iii) and (v)
(b) (i), (iv) and (v)
(c) (i), (iii) and (iv)
(d) (i), (ii) and (iv)

14. (i) $x \ge 2$
(ii) $y \ge 3$
(iii) $5x + 4y \le 40$
(iv) $8x + 3y \le 10$
(v) $x \le 0$



(a) (i), (ii) and (iv)
(b) (i), (ii) and (iii)
(c) only (iii) and (iv)
(d) (ii), (iii) and (v)

15. If $-3x + 17 < -13$, then
(a) $x \in (10, \infty)$ (b) $x \in [10, \infty)$
(c) $x \in (-\infty, 10)$ (d) $x \in [-10, 10)$

16. If $\frac{|x-2|}{x-2} \geq 0$, then $x \in$

(a) $[2, \infty)$ (b) $(2, \infty)$

(c) $(-\infty, 2)$ (d) $(-\infty, 2]$

17. The length of a rectangle is three times the breadth. If the minimum perimeter of the rectangle is 160 cm, then

(a) breadth > 20 cm (b) length < 20 cm

(c) breadth ≥ 20 cm (d) length ≤ 20 cm

18. If $|x + 3| \geq 10$, then

(a) $x \in (-13, 7]$ (b) $x \in (-13, 7)$

(c) $x \in (-\infty, -13] \cup [7, \infty)$ (d) $x \in (-\infty, -13) \cup [7, \infty)$

19. If the expression $\left(mx - 1 + \frac{1}{x}\right)$ is always non-negative, then the minimum value of m must be

(a) $-\frac{1}{2}$ (b) 0 (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

20. If $|2x - 3| < |x + 5|$, then x belongs to

(a) $(-3, 5)$ (b) $(5, 9)$

(c) $\left(-\frac{2}{3}, 8\right)$ (d) $\left(-8, \frac{2}{3}\right)$

21. If $(x - 1)(x^2 - 5x + 7) < (x - 1)$, then x belongs to

(a) $(1, 2) \cup (3, \infty)$ (b) $(2, 3)$

(c) $(-\infty, 1) \cup (2, 3)$ (d) None of these

22. The inequality $\frac{2}{x} < 3$ is true, when x belongs to

(a) $\left[\frac{2}{3}, \infty\right)$ (b) $\left(-\infty, \frac{2}{3}\right]$

(c) $(-\infty, 0) \cup \left(\frac{2}{3}, \infty\right)$ (d) None of these

23. Solution of $\frac{x-7}{x+3} > 2$ is

(a) $(-3, \infty)$ (b) $(-\infty, -13)$

(c) $(-13, -3)$ (d) $(-13, 3)$

24. Solution of $\frac{2x-3}{3x-5} \geq 3$ is

(a) $\left[1, \frac{12}{7}\right)$ (b) $\left(\frac{5}{3}, \frac{12}{7}\right]$

(c) $\left(-\infty, \frac{5}{3}\right)$ (d) $\left[\frac{12}{7}, \infty\right)$

25. Solution of $(x - 1)^2(x + 4) < 0$ is

(a) $(-\infty, 1)$ (b) $(-\infty, -4)$

(c) $(-1, 4)$ (d) $(1, 4)$

26. Solution of $|3x + 2| < 1$ is

(a) $\left[-1, -\frac{1}{3}\right]$ (b) $\left\{-\frac{1}{3}, -1\right\}$

(c) $\left(-1, -\frac{1}{3}\right)$ (d) None of these

27. Solution of $|3 - x| = 3 - x$ is

(a) $x < 3$ (b) $x > 3$ (c) $x \geq 3$ (d) $x \leq 3$

28. Solution of $\left|1 + \frac{3}{x}\right| > 2$ is

(a) $(0, 3]$ (b) $[-1, 0)$

(c) $(-1, 0) \cup (0, 3)$ (d) None of these

29. Solution of $|x^2 - 10| \leq 6$ is

(a) $(2, 4)$ (b) $(-4, -2)$

(c) $(-4, -2) \cup (2, 4)$ (d) $[-4, -2] \cup [2, 4]$

30. Solution of $2x - 1 = |x + 7|$ is

(a) -2 (b) 8

(c) $-2, 8$ (d) None of these

31. Solution of $0 < |3x + 1| < \frac{1}{3}$ is

(a) $\left(-\frac{4}{9}, -\frac{2}{9}\right)$ (b) $\left[-\frac{4}{9}, -\frac{2}{9}\right]$

(c) $\left(-\frac{4}{9}, -\frac{2}{9}\right) - \left\{-\frac{1}{3}\right\}$ (d) $\left[-\frac{4}{9}, -\frac{2}{9}\right] - \left\{-\frac{1}{3}\right\}$

32. Solution of $\left|x + \frac{1}{x}\right| > 2$ is

(a) $R - \{0\}$ (b) $R - \{-1, 0, 1\}$

(c) $R - \{1\}$ (d) $R - \{-1, 1\}$

33. Solution of $\left|x + \frac{1}{x}\right| < 4$ is

(a) $\left(2-\sqrt{3}, 2+\sqrt{3}\right) \cup \left(-2-\sqrt{3}, -2+\sqrt{3}\right)$

(b) $R - \left(2-\sqrt{3}, 2+\sqrt{3}\right)$

(c) $R - \left(-2-\sqrt{3}, -2+\sqrt{3}\right)$

(d) none of these

34. Solution of $|x - 1| \geq |x - 3|$ is

(a) $x \leq 2$ (b) $x \geq 2$

(c) $[1, 3]$ (d) None of these

35. The set of values of x which satisfy the inequations

$5x + 2 < 3x + 8$ and $\frac{x+2}{x-1} < 4$ is

(a) $(-\infty, 1)$ (b) $(2, 3)$

(c) $(-\infty, 3)$ (d) $(-\infty, 1) \cup (2, 3)$

36. Solutions of the inequalities comprising a system in variable x are represented on number lines as given below, then

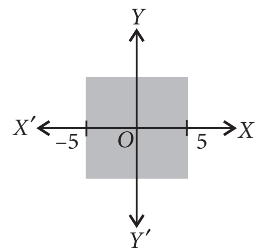
(a) $x \in (-\infty, -4] \cup [3, \infty)$
(b) $x \in [-3, 1]$
(c) $x \in (-\infty, -4) \cup [3, \infty)$
(d) $x \in [-4, 3]$

37. x and b are real numbers. If $b > 0$ and $|x| > b$, then
(a) $x \in (-b, \infty)$
(b) $x \in (-\infty, b)$
(c) $x \in (-b, b)$
(d) $x \in (-\infty, -b) \cup (b, \infty)$

38. If $|x - 1| > 5$, then
(a) $x \in (-4, 6)$
(b) $x \in [-4, 6]$
(c) $x \in (-\infty, -4) \cup (6, \infty)$
(d) $x \in (-\infty, -4) \cup [6, \infty)$

39. If $|x + 2| \le 9$, then
(a) $x \in (-7, 11)$
(b) $x \in [-11, 7]$
(c) $x \in (-\infty, -7) \cup (11, \infty)$
(d) $x \in (-\infty, -7) \cup [11, \infty)$

40. The inequality representing the following graph is:



(a) $|x| < 5$
(b) $|x| \le 5$
(c) $|x| > 5$
(d) $|x| \ge 5$

Case Based MCQs

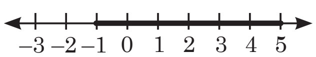
Case I : Read the following passage and answer the questions from 41 to 45.

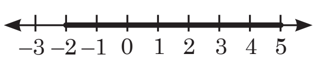
Reema went to a stationary shop with ₹100 to buy notebooks. The price of each notebook is ₹25. Let x denotes the number of notebooks .

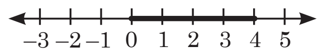
41. The inequality which represents the above situation is
(a) $25x > 100$ (b) $25x \ge 100$
(c) $25x < 100$ (d) $25x \le 100$

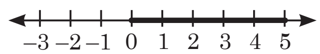
42. The maximum number of notebooks that Reema can buy is
(a) 2 (b) 3 (c) 4 (d) 5.

43. The graph representing the above situation is

(a) 

(b) 

(c) 

(d) 

44. If Reema gets discount of ₹5 on each notebook, then the maximum number of notebooks that she can buy is
(a) 2 (b) 3 (c) 4 (d) 5

45. If Reema gets ₹25 extra from her mother, then the inequality representing the given situation is
(a) $25x \ge 125$ (b) $25x \le 125$
(c) $25x \ge 100$ (d) $25x \le 100$.

Case II : Read the following passage and answer the questions from 46 to 50.

Amit's mother gave him ₹200 to buy some packet of rice and maggi from the market. The cost of one packet of rice is ₹30 and that of one packet of maggi is ₹20. Let x denotes the number of packet of rice and y denotes the number of packet of maggi.

46. The inequality that represents the given situation is

(a) $30x + 20y > 200$ (b) $30x + 20y \geq 200$

(c) $30x + 20y < 200$ (d) $30x + 20y \leq 200$

47. If he buys 3 packets of rice and 2 packets of maggi, then the amount that he paid is

(a) ₹110 (b) ₹120

(c) ₹130 (d) ₹140

48. If he buys 4 packets of rice and spends entire amount of ₹200, then the maximum number of packets of maggi that he can buy is

(a) 3 (b) 4

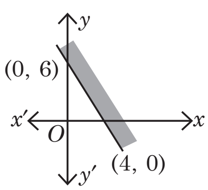
(c) 5 (d) 6

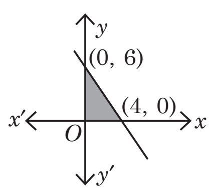
49. The maximum value of x and y respectively, if he spends his entire amount is

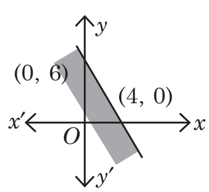
(a) 4, 6 (b) 4, 3

(c) 4, 5 (d) 5, 5.

50. The graph representing the given situation is

(a) 

(b) 

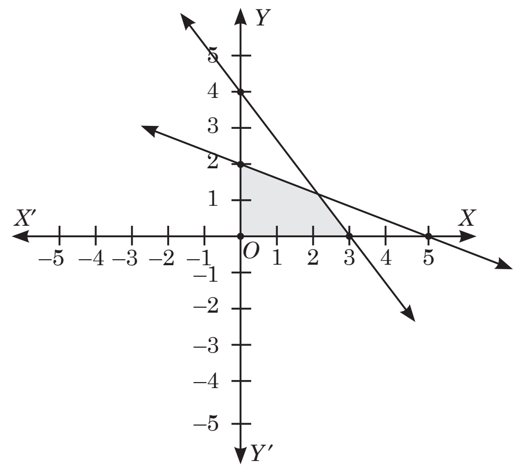
(c) 

(d) None of these.

Case III : Read the following passage and answer the questions from 51 to 55.

Rita and Neha wants to buy some pencils and erasers. Rita has ₹12 whereas Neha has ₹10 with her. Let x denotes the number of pencils and y denotes the number of erasers.

Consider the following graph related to the given situation.



51. The inequalities that represent the above shaded region are

(a) $4x + 3y \leq 12$, $5x + 2y \leq 10$ and $x, y \geq 0$

(b) $4x + 3y \leq 12$, $2x + 5y \leq 10$ and $x, y \geq 0$

(c) $x + 2y \leq 12$, $2x + 5y \leq 10$ and $x, y \geq 0$

(d) $3x + 4y \leq 12$, $x + y \leq 10$ and $x, y \geq 0$

52. The point of intersection of inequalities that represent the given situation is

(a) $\left(\frac{8}{7}, \frac{15}{7}\right)$ (b) $\left(\frac{14}{7}, \frac{8}{7}\right)$

(c) $\left(\frac{15}{7}, \frac{8}{7}\right)$ (d) $\left(\frac{8}{7}, \frac{14}{7}\right)$

53. The range of x in the given graph is

(a) (0, 4) (b) [0, 4]

(c) [0, 3] (d) (0, 3)

54. The point lies in the given shaded region is

(a) (1, 2) (b) (1/2, 3/2)

(c) (2, 2) (d) (1, 3)

55. The given region is bounded by the points

(a) (0, 0), (3, 0), (2, 0), (15/7, 8/7)

(b) (0, 0), (0, 3), (2, 0), (14/7, 8/7)

(c) (0, 0), (3, 0), (0, 2), (8/7, 14/7)

(d) (0, 0), (3, 0), (0, 2), (15/7, 8/7)

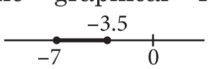
Assertion & Reasoning Based MCQs

Directions (Q.-56 to 60) : In these questions, a statement of Assertion is followed by a statement of Reason is given. Choose the correct answer out of the following choices :

(a) Assertion and Reason both are correct statements and Reason is the correct explanation of Assertion.
(b) Assertion and Reason both are correct statements but Reason is not the correct explanation of Assertion.
(c) Assertion is correct statement but Reason is wrong statement.
(d) Assertion is wrong statement but Reason is correct statement.

56. Assertion : If $x \geq -3$, then $x + 5 \geq 2$.
Reason : Same number can be added to both sides of the inequality without changing the sign of inequality.

57. Assertion : If $a < b$, $c < 0$, then $\frac{a}{c} < \frac{b}{c}$.
Reason : If both sides are divided by the same negative quantity, then the inequality is reversed.

58. Assertion : If $-5 \leq 2x + 9 \leq 2$, then $x \in [-7, -3.5]$.
Reason : The graphical representation of $-5 \leq 2x + 9 \leq 2$ is 

59. Assertion : If $11x - 9 \leq 68$, then $x \in (-\infty, 7)$.
Reason : If an inequality consist of signs $\leq$ or $\geq$, then the point on the line are also included in the solution region.

60. Assertion : $|3x - 5| > 9$
$$\Rightarrow x \in \left(-\infty, \frac{-4}{3}\right) \cup \left(\frac{14}{3}, \infty\right).$$
Reason : The region containing all the solutions of an inequality is called the solution region.

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions (VSA)

1. Solve the following inequation for x, where x is a natural number : $5x - 2 < 3x + 3$

2. Solve $14x > 72$ where x is natural number.

3. Solve $5x - 2 < 3x + 1$ when x is real.

4. Solve the linear inequation : $2x - 6 \leq 0$

5. Solve the linear inequation : $-3x + 15 < 0$

6. Solve the linear inequation : $4x - 20 \geq 0$

7. Solve the linear inequation : $7x + 9 > 37$

8. Solve the inequation : $3x - 10 > 5x + 1$

9. Solve : $-8 \leq 5x - 3 < 7$ where $x \in Z$.

10. Solve : $30x < 200$, when x is a natural number.

Short Answer Type Questions (SA-I)

11. Solve the linear inequality
$$\frac{x}{4} > \frac{5x-2}{3} - \frac{7x-3}{5},\ x \in R.$$

12. Solve the inequality for real x.
$$\frac{(2x-1)}{3} \geq \frac{(3x-2)}{4} - \frac{(2-x)}{5}$$

13. Solve the inequality $\frac{x}{3} - \frac{x-2}{4} > \frac{x-1}{5}$, where x belongs to R.

14. Solve the inequality : $\frac{x+8}{x-2} \geq 0$.

15. Solve the inequation $\frac{x+3}{x-2} \geq 4$.

16. In drilling a hole, x km below the surface of the earth it was found that the temperature T in degree Celsius was given by $T = 30° + 25°(x - 3)$, $3 < x < 15$. At what depth will the temperature be between 200°C and 300°C?

17. A person was not feeling well, so he went to a doctor. Doctor on examination found that his temperature varies between 30°C to 35°C. What is the range of temperature for body in Fahrenheit? Use conversion formula $F = \frac{9}{5}C + 32°$.

18. Solve for the real x :
$\frac{4+2x}{3} \geq \frac{x}{2} - 3$.

19. Solve : $\frac{5-2x}{3} \leq \frac{x}{6} - 5$

20. Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.

Short Answer Type Questions (SA-II)

21. Solve and represent the solution graphically on number line :

$3x - 7 > 2(x - 6)$, $6 - x > 11 - 2x$

22. Solve the following system of inequation

$5x - 7 < 3(x + 3)$, $1 - \frac{3x}{2} \leq x - 4$.

23. Solve and represent the solution on number line :

$\frac{3x+1}{4} - \frac{x-2}{3} > \frac{1}{12}$, $\frac{2x-3}{4} + 6 \leq 2 + \frac{4x}{3}$.

24. Solve the following system of inequations :

$\frac{5x}{4} + \frac{3x}{8} > \frac{39}{8}$, $\frac{2x-1}{12} - \frac{x-1}{3} < \frac{3x+1}{4}$

25. Solve the system of inequations :

$\frac{x}{2x+1} \geq \frac{1}{4}$, $\frac{6x}{4x-1} < \frac{1}{2}$

26. The cost and revenue functions of a product are given by $C(x) = 2x + 400$ and $R(x) = 6x + 20$ respectively, where x is the number of items produced by the manufacturer. How many items the manufacturer must sell to realize some profit?

27. Solve the inequalities $\frac{x}{2} < \frac{(5x-2)}{3} - \frac{(7x-3)}{5}$ and show the graph of the solution on number line.

28. Solve the following system of inequalities graphically :

$x - 2y \leq 3$, $3x + 4y \geq 12$, $x \geq 0$, $x - y \geq 1$

29. Solve the following system of inequalities graphically :

$5x + 4y \leq 40$, $x \geq 2$, $y \geq 3$.

30. Solve the following system of linear inequalities graphically :

$4x + 3y \leq 60$, $y \geq 2x$, $x \geq 3$, $x \geq 0$, $y \geq 0$.

31. Solve the following system of linear inequalities graphically :

$x - 2y \leq 3$, $3x + 4y \geq 12$, $x \geq 0$, $y \geq 1$

32. Solve : $5(2x - 7) - 3(2x + 3) \leq 0$ and $2x + 19 \leq 6x + 47$ and represent the solution on number line.

33. Solve the following system of inequations graphically :

$x - 2y \leq 0$, $2x - y + 2 \geq 0$, $x \geq 0$, $y \geq 0$

34. Solve the inequality $\frac{x-1}{x+1} \geq 0$ and represent the solution set on the number line.

35. Solve the following system of inequalities graphically : $y \leq 4x + 1$, $y - 2x \geq 1$, $x \leq 3$, $x \geq 0$, $y \geq 0$.

Long Answer Type Questions (LA)

36. Solve graphically : $5x + y \geq 10$, $2x + 2y \leq 12$, $x + 4y \leq 12$, $x \geq 3$, $y \geq 0$.

37. Solve graphically : $2x + 3y \geq 3$, $x - y \leq 1$, $3x + 4y \leq 12$, $y \geq 2$, $x \geq 0$.

38. A milkman has 80% milk in his stock of 800 litres of adulterated milk. How much 100% pure milk is to be added to it so that purity is between 90% and 95%. How much pure milk he should add to his stock to obtain 99% pure milk? What should be done to stop adulteration in foods?

39. Solve the following system of inequalities graphically :

$x + 2y \leq 10$, $x + y \geq 1$, $x - y \leq 0$, $x \geq 0$, $y \geq 0$

40. Solve the following system of inequalities graphically :

$x + y \geq 1$, $3x + 4y < 12$, $x - 2y \leq 2$, $x \geq 0$, $y \geq 0$

ANSWERS

OBJECTIVE TYPE QUESTIONS

1. **(a) :** Option (a) is true, because the sign of inequality is reversed when we multiply both sides of an inequality by a negative quantity.

2. **(b) :** We have, $4x + 3 < 6x + 7$.

$\Rightarrow \quad 4x - 6x < 7 - 3 \Rightarrow -2x < 4 \Rightarrow x > -2$

i.e., all real numbers which are greater than –2, are solutions of the given inequality. Hence, the solution set is $(-2, \infty)$.

3. **(c) :** We have, $7x + 3 < 5x + 9 \Rightarrow 2x < 6 \Rightarrow x < 3$

Thus, all real numbers which are less than 3 is the solution set of the given inequality *i.e.*, $x \in (-\infty, 3)$.

4. **(c) :** Let x be the marks obtained by student in the annual examination. Then

$$\frac{62 + 48 + x}{3} \geq 60 \Rightarrow 110 + x \geq 180 \Rightarrow x \geq 70$$

Thus, the student must obtain a minimum of 70 marks to get an average of at least 60 marks.

5. **(a) :** Let x be the smaller of the two consecutive odd natural numbers, so that the other one is $x + 2$. Then, we should have

$x > 10$ and $(x + 2) > 10$ ...(i)

and $x + (x + 2) < 40$

$\Rightarrow \quad 2x + 2 < 40 \Rightarrow 2x < 38 \Rightarrow x < 19$ ...(ii)

From (i) and (ii), we get $10 < x < 19$

Since x is an odd number, x can take the values 11, 13, 15, and 17. So, the required possible pairs will be

(11, 13), (13, 15), (15, 17) and (17, 19).

6. **(b) :** We have, $-8 \leq 5x - 3 < 7$

$\Rightarrow -5 \leq 5x < 10 \Rightarrow -1 \leq x < 2 \therefore x \in [-1, 2)$

7. **(a) :** We have, $-5 \leq \dfrac{5 - 3x}{2} \leq 8$

$\Rightarrow -10 \leq 5 - 3x \leq 16$ or $-15 \leq -3x \leq 11$

$\Rightarrow \quad 5 \geq x \geq -\dfrac{11}{3}$, which can be written as $\dfrac{-11}{3} \leq x \leq 5$.

$\therefore \quad x \in \left[\dfrac{-11}{3}, 5\right]$

8. **(c) :** We have, $3x - 7 < 5 + x \Rightarrow x < 6$

Also, we have, $11 - 5x \leq 1 \Rightarrow -5x \leq -10 \Rightarrow x \geq 2$

Thus, solution of the given system are all real numbers lying between 2 and 6 including 2, *i.e.*, $2 \leq x < 6$

$\therefore \quad x \in [2, 6)$

9. **(b) :** We have, $\dfrac{x-2}{x+5} > 2$

$$\Rightarrow \quad \frac{x-2}{x+5} - 2 > 0 \Rightarrow \frac{-(x+12)}{x+5} > 0 \Rightarrow \frac{x+12}{x+5} < 0$$

$\Rightarrow \quad x + 12 > 0$ and $x + 5 < 0$ or $x + 12 < 0$ and $x + 5 > 0$

$\Rightarrow \quad x > -12$ and $x < -5$ or $x < -12$ and $x > -5$

(Not possible)

Therefore, $-12 < x < -5$, *i.e.*, $x \in (-12, -5)$

10. **(d) :** We have, $|3 - 4x| \geq 9$

$\Rightarrow \quad 3 - 4x \leq -9$ or $3 - 4x \geq 9$

$\Rightarrow \quad -4x \leq -12$ or $-4x \geq 6$

$\Rightarrow \quad x \geq 3$ or $x \leq \dfrac{-3}{2} \quad \Rightarrow \quad x \in \left(-\infty, \dfrac{-3}{2}\right] \cup [3, \infty)$

11. **(b) :** We have, $1 \leq |x - 2| \leq 3$.

$\Rightarrow \quad |x - 2| \geq 1$ and $|x - 2| \leq 3$

$\Rightarrow \quad (x - 2 \leq -1$ or $x - 2 \geq 1)$ and $(-3 \leq x - 2 \leq 3)$

$\Rightarrow \quad (x \leq 1$ or $x \geq 3)$ and $(-1 \leq x \leq 5)$

$\Rightarrow \quad x \in (-\infty, 1] \cup [3, \infty)$ and $x \in [-1, 5]$

Combining the solutions of two inequalities, we have

$x \in [-1, 1] \cup [3, 5]$

12. **(b) :** We have, Profit = Revenue – Cost

$= (60x + 2000) - (20x + 4000) = 40x - 2000$

To earn some profit, $40x - 2000 > 0 \Rightarrow x > 50$

Hence, the manufacturer must sell more than 50 items to realise some profit.

13. **(d)** **14.** **(b)**

15. **(a) :** $-3x < -13 - 17$

$\Rightarrow \quad -3x < -30 \Rightarrow x > 10 \Rightarrow x \in (10, \infty)$

16. **(b) :** $\dfrac{|x-2|}{x-2} \geq 0$, for $x - 2 > 0$, and $x - 2 \neq 0$.

17. **(c) :** Let the breadth be x cm. Then length = $3x$ cm.

$2(3x + x) \geq 160 \Rightarrow x \geq 20$

18. **(c) :** Since $|x + 3| \geq 10 \Rightarrow x + 3 \leq -10$ or $x + 3 \geq 10$

$\Rightarrow \quad x \leq -13$ or $x \geq 7 \Rightarrow x \in (-\infty, -13] \cup [7, \infty)$

19. **(c) :** We know that, $ax^2 + bx + c \geq 0$, if $a > 0$ and $b^2 - 4ac \leq 0$

Now, $mx - 1 + \dfrac{1}{x} \geq 0$

$\Rightarrow \quad \dfrac{mx^2 - x + 1}{x} \geq 0$

$\Rightarrow \quad mx^2 - x + 1 \geq 0$ and $x > 0$

Now, $mx^2 - x + 1 \geq 0$, if $m > 0$ and $1 - 4m \leq 0$ or if $m > 0$ and $m \geq \dfrac{1}{4}$.

Thus, the minimum value of m is $\dfrac{1}{4}$.

20. **(c) :** We have, $|2x - 3| < |x + 5|$

$\Rightarrow \quad |2x - 3| - |x + 5| < 0$

$$\Rightarrow \begin{cases} 3 - 2x + x + 5 < 0, x \leq -5 \\ 3 - 2x - x - 5 < 0, -5 < x \leq \dfrac{3}{2} \\ 2x - 3 - x - 5 < 0, x > \dfrac{3}{2} \end{cases}$$

$$\Rightarrow \begin{cases} x > 8, x \le -5 \\ x > -\dfrac{2}{3}, -5 < x \le \dfrac{3}{2} \\ x < 8, x > \dfrac{3}{2} \end{cases}$$

$\Rightarrow \quad x \in \left(-\frac{2}{3}, \frac{3}{2}\right] \cup \left(\frac{3}{2}, 8\right) \ \Rightarrow x \in \left(-\frac{2}{3}, 8\right)$

21. **(c) :** We have, $(x - 1)(x^2 - 5x + 7) < (x - 1)$

$\Rightarrow \quad (x - 1)(x^2 - 5x + 6) < 0$

$\Rightarrow (x - 1)(x - 2)(x - 3) < 0$

$\therefore \quad x \in (-\infty, 1) \cup (2, 3)$

22. **(c) : Case I :** When $x > 0$, $\frac{2}{x} < 3 \Rightarrow 2 < 3x \Rightarrow \frac{2}{3} < x$ or $x > \frac{2}{3}$

Case II : When $x < 0$, $\frac{2}{x} < 3 \Rightarrow 2 > 3x \Rightarrow \frac{2}{3} > x$ or $x < \frac{2}{3}$ which is satisfied when $x < 0$.

$\therefore \quad x \in (-\infty, 0) \cup \left(\frac{2}{3}, \infty\right)$.

23. **(c) :** We have, $\frac{x-7}{x+3} > 2$

$\Rightarrow \quad \frac{x-7}{x+3} - 2 > 0 \Rightarrow \frac{x+13}{x+3} < 0$

$\Rightarrow \quad \{x + 13 > 0$ and $x + 3 < 0\}$

or $\quad \{x + 13 < 0$ and $x + 3 > 0\}$

$\Rightarrow \quad \{x > -13$ and $x < -3\}$ or $\{x < -13$ and $x > -3\}$,which is not possible

$\Rightarrow \quad x \in (-13, -3)$

24. **(b) :** We have, $\frac{2x-3}{3x-5} \ge 3$

$\Rightarrow \quad \frac{2x-3}{3x-5} - 3 \ge 0 \Rightarrow \frac{7x-12}{3x-5} \le 0$

$\Rightarrow \quad \{7x - 12 \le 0$ and $3x - 5 > 0\}$

or $\quad \{7x - 12 \ge 0$ and $3x - 5 < 0\}$

$\Rightarrow \quad \left\{x \le \frac{12}{7} \text{ and } x > \frac{5}{3}\right\}$ or $\left\{x \ge \frac{12}{7} \text{ and } x < \frac{5}{3}\right\}$

$\Rightarrow \quad x \in \left(\frac{5}{3}, \frac{12}{7}\right]$

25. **(b) :** $(x - 1)^2$ is always positive except when $x = 1$.

$\therefore \quad$ Solution is when $x + 4 < 0$ and $x \ne 1$

i.e., $x < -4, x \ne 1 \ \therefore \ x \in (-\infty, -4)$.

26. **(c) :** $|3x + 2| < 1 \Rightarrow -1 < 3x + 2 < 1 \Rightarrow -3 < 3x < -1$

$\Rightarrow \quad -1 < x < -\frac{1}{3}$.

27. **(d) :** $|3 - x| = 3 - x$ is true only when $3 - x \ge 0$ *i.e.*, iff $3 \ge x$ or $x \le 3$.

28. **(c) :** $\left|1 + \frac{3}{x}\right| > 2$

Case I: $1 + \frac{3}{x} > 2 \Rightarrow \frac{3}{x} > 1$ (Clearly $x > 0$)

$\Rightarrow \quad 3 > x$ or $x < 3$.

Case II: $1 + \frac{3}{x} < -2 \Rightarrow \frac{3}{x} < -3$ (Clearly $x < 0$)

$\Rightarrow \quad 3 > -3x \Rightarrow -1 < x$ or $x > -1$

Hence, either $0 < x < 3$ or $-1 < x < 0$.

29. **(d) :** $|x^2 - 10| \le 6$

$\Rightarrow \quad -6 \le x^2 - 10 \le 6 \Rightarrow 4 \le x^2 \le 16 \Rightarrow 2 \le |x| \le 4$

$\therefore \quad$ Either $2 \le x \le 4$ or $-4 \le x \le -2$

$\therefore \quad x \in [-4, -2] \cup [2, 4]$

30. **(b) :** $2x - 1 = |x + 7| = \begin{cases} x+7 & , \text{ if } x \ge -7 \\ -(x+7) & , \text{ if } x < -7 \end{cases}$

$\therefore \quad$ If $x \ge -7$, $2x - 1 = x + 7 \Rightarrow x = 8$

If $x < -7$, $2x - 1 = -(x + 7) \Rightarrow 3x = -6$

$\Rightarrow \quad x = -2$, Not possible.

31. **(c) :** Let us first solve $|3x + 1| < \frac{1}{3}$

$\Rightarrow -\frac{1}{3} < 3x + 1 < \frac{1}{3} \Rightarrow -\frac{4}{3} < 3x < -\frac{2}{3}$

$\Rightarrow \quad -\frac{4}{9} < x < -\frac{2}{9}$

Also, $0 < |3x + 1|$ is satisfied by each x except when

$3x + 1 = 0$, *i.e.*, $x = -\frac{1}{3}$.

$\therefore \quad$ Solution is $\left(-\frac{4}{9}, -\frac{2}{9}\right) - \left\{-\frac{1}{3}\right\}$.

32. **(b) :** We have, $\left|x + \frac{1}{x}\right| > 2$ (Clearly $x \ne 0$)

$\Rightarrow \quad \left|\frac{x^2+1}{x}\right| > 2 \Rightarrow \frac{x^2+1}{|x|} > 2$ $\quad (\because x^2 + 1 > 0)$

$\Rightarrow \quad x^2 + 1 > 2|x|$

$\Rightarrow \quad |x|^2 - 2|x| + 1 > 0 \Rightarrow (|x| - 1)^2 > 0$

$\Rightarrow \quad |x| \ne 1 \Rightarrow x \ne -1, 1 \ \therefore \ x \in R - \{-1, 0, 1\}$.

33. **(a) :** We have, $\left|x + \frac{1}{x}\right| < 4$ (Clearly $x \ne 0$)

$\Rightarrow \quad \frac{x^2+1}{|x|} < 4 \Rightarrow x^2 + 1 < 4|x| \ \Rightarrow |x|^2 - 4|x| + 1 < 0$

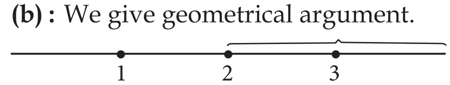
$\Rightarrow \quad (|x| - 2)^2 < 3 \Rightarrow (|x| - 2)^2 < (\sqrt{3})^2$

$\Rightarrow \quad ||x| - 2| < \sqrt{3} \Rightarrow 2 - \sqrt{3} < |x| < 2 + \sqrt{3}$

$\therefore \quad$ When $x > 0$, $2 - \sqrt{3} < x < 2 + \sqrt{3}$.

When $x < 0$, $-2 + \sqrt{3} > x > -2 - \sqrt{3}$.

34. **(b) :** We give geometrical argument.



$|x - 1|$ is the distance of x from 1.

$|x - 3|$ is the distance of x from 3.

The point $x = 2$ is equidistant from 1 and 3. Hence, the solution consists of all $x \ge 2$.

35. (d) : We have, $5x + 2 < 3x + 8$ and $\frac{x+2}{x-1} < 4$

$\Rightarrow$ $x < 3$ and $\frac{(x+2)(x-1)}{(x-1)^2} < 4, x \neq 1$

$\Rightarrow$ $x < 3$ and $(x + 2)(x - 1) < 4x^2 - 8x + 4, x \neq 1$

$\Rightarrow$ $x < 3$ and $3x^2 - 9x + 6 > 0, x \neq 1$

$\Rightarrow$ $x < 3$ and $x^2 - 3x + 2 > 0, x \neq 1$

$\Rightarrow$ $x < 3$ and $(x - 1)(x - 2) > 0, x \neq 1$

$\Rightarrow$ $x < 3$ and $(x < 1$ or $x > 2)$

$\Rightarrow$ $x \in (-\infty, 1) \cup (2, 3)$.

36. (b)

37. (d) : Given $|x| > b$

$\therefore$ $x > b$ or $x < -b$

38. (c) : $x - 1 < -5$ or $x - 1 > 5$

$\Rightarrow$ $x < -4$ or $x > 6$

39. (b) : Given, $|x + 2| \leq 9$

$\Rightarrow$ $-9 \leq x + 2 \leq 9 \Rightarrow -11 \leq x \leq 7$

40. (a)

41. (d) : Here, x denotes the number of notebooks.

Cost of one notebook = ₹25

Total amount spent by her = ₹$25x$

As she has the total amount of ₹100

$\therefore$ Required inequality is $25x \leq 100$.

42. (c) : We have, $25x \leq 100$

$\Rightarrow$ $x \leq 4$, where x is the number of notebooks

$\therefore$ The maximum number of notebooks that Reema can buy is 4.

43. (c) : As, x represent the number of notebooks

$\therefore$ $x \geq 0$ ... (1)

Also, $x \leq 4$ ... (2)

Combining (1) and (2), we get

$0 \leq x \leq 4$

44. (d) : If Reema gets discount of ₹5 on each notebook, then the cost of one notebook = ₹20

Also, $20x \leq 100$

$\Rightarrow$ $x \leq 5$.

$\therefore$ The maximum number of notebooks that Reema can buy is 5.

45. (b) : If Reema gets ₹25 extra from her mother, then she has ₹125 as total amount.

Also cost of each notebook is ₹25

$\therefore$ $25x \leq 125$

46. (d) : Total amount = ₹200

Cost of one packet of rice = ₹30

and cost of one packet of maggi = ₹20

Here, x and y denote the number of packets of rice and maggi respectively,

Total amount spent by Amit is $30x + 20y$.

$\therefore$ Required inequality is $30x + 20y \leq 200$.

47. (c) : Cost of 3 packet of rice = ₹(30×3) = ₹90

cost of 2 packets of maggi = ₹ (20×2) = ₹40

Total amount paid = ₹$(90 + 40)$ = ₹130

48. (b) : If he spends his entire amount, then

We have, $30x + 20y = 200$ (1)

Since, number of packet of rice = 4

$\therefore$ At $x = 4$, equation (1) becomes

$30 \times 4 + 20y = 200$

$\Rightarrow$ $120 + 20y = 200$

$\Rightarrow$ $20y = 200 - 120$

$\Rightarrow$ $20y = 80$

$\therefore$ Maximum number of packets of maggi that he can buy is 4.

49. (a) : If he spends his entire amount, then

we have, $30x + 20y = 120$

At $x = 0$, $y = 6$ and at $y = 0$, $x = 4$

$\therefore$ Maximum value of x and y which satisfies this equation is 4 and 6 respectively.

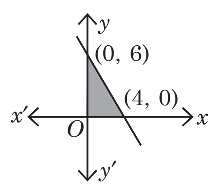
50. (b) : As, x and y denotes the number of packets of rice and maggi respectively.

$\therefore$ $x \geq 0$ and $y \geq 0$.

and inequality representing the given situation is

$30x + 20y \leq 200$.

$\therefore$ The graph showing these inequalities is given by



51. (b) : Consider, $4x + 3y = 12$,

when $x = 0 \Rightarrow y = 4$

$y = 0 \Rightarrow x = 3$

$\therefore$ The points are (0, 4) and (3, 0).

Also, $2x + 5y = 10$

when $x = 0 \Rightarrow y = 2$

$y = 0 \Rightarrow x = 5$

$\therefore$ The points are (0, 2) and (5, 0).

$\therefore$ Required inequalities are

$4x + 3y \leq 12$ and $2x + 5y \leq 10$

52. (c) : Converting the given inequalities in equalities, we get

$4x + 3y = 12$ ... (i)

$2x + 5y = 10$ ...(ii)

Multiply (ii) by 2, we get

$4x + 10y = 20$ ...(iii)

Subtracting (i) from (iii), we get

$7y = 8 \Rightarrow y = \frac{8}{7}$

From (i), $\Rightarrow 4x + 3\left(\frac{8}{7}\right) = 12 \Rightarrow 4x = 12 - \frac{24}{7}$

$\Rightarrow 4x = \frac{60}{7} \Rightarrow x = \frac{15}{7}$

$\therefore$ Required point of intersection is $\left(\frac{15}{7}, \frac{8}{7}\right)$.

53. **(c) :** As in the given figure, x lies between 0 and 3

$\Rightarrow x \in [0, 3]$

$\therefore$ The range of x is $[0, 3]$.

54. **(b) :** Put $x = \frac{1}{2}$ and $y = \frac{3}{2}$ in the above inequalities we get, $4x + 3y \le 12$

$\Rightarrow \quad 4 \times \frac{1}{2} + 3 \times \frac{3}{2} = 2 + \frac{9}{2} = \frac{13}{2} < 12$

and $2x + 5y \le 10$

$\Rightarrow \quad 2 \times \frac{1}{2} + 5 \times \frac{3}{2} = 1 + \frac{15}{2} = \frac{17}{2} < 10$

$\therefore$ Point $\left(\frac{1}{2}, \frac{3}{2}\right)$ satisfies the above inequalities.

55. **(d) :** The points that bounded the above region are $(0, 0), (3, 0), (0, 2), \left(\frac{15}{7}, \frac{8}{7}\right)$.

56. **(a)**

57. **(d) :** Assertion is wrong but Reason is correct statement because if $a < b$, $c < 0$ then $\frac{a}{c} > \frac{b}{c}$.

58. **(a) :** We have, $-5 \le 2x + 9 \le 2 \Rightarrow -14 \le 2x \le -7$

$\Rightarrow \quad -7 \le x \le \frac{-7}{2} \quad \therefore \quad x \in \left[-7, \frac{-7}{2}\right]$

Both Assertion and Reason are correct statements and Reason is the correct explanation of Assertion.

59. **(d) :** We have, $11x - 9 \le 68$

$\Rightarrow \quad 11x \le 77 \quad \Rightarrow \quad x \le 7 \quad \therefore \quad x \in (-\infty, 7]$

So, Assertion is wrong but Reason is correct.

60. **(b) :** We have, $|3x - 5| > 9$

$\Rightarrow \quad 3x - 5 < -9 \quad$ or $\quad 3x - 5 > 9$

$\Rightarrow \quad 3x < -4 \quad$ or $\quad 3x > 14$

$\Rightarrow \quad x < \frac{-4}{3} \quad$ or $\quad x > \frac{14}{3}$

$\therefore \quad x \in \left(-\infty, \frac{-4}{3}\right) \cup \left(\frac{14}{3}, \infty\right)$

Both Assertion and Reason are correct statements but Reason is not the correct explanation of Assertion.

SUBJECTIVE TYPE QUESTIONS

1. We have,

$5x - 2 < 3x + 3 \quad \Rightarrow 2x < 5 \quad \Rightarrow x < \frac{5}{2}$

Since, $x \in N$. So, $x = \{1, 2\}$

2. We have, $14x > 72 \quad \Rightarrow x > 5\frac{1}{7}$

Since, $x \in N$. So, $x = \{6, 7, ...\}$

3. We have, $5x - 2 < 3x + 1 \quad \Rightarrow 2x < 3 \quad \Rightarrow x < 3/2$

$\therefore \quad x \in (-\infty, 3/2)$

4. We have, $2x - 6 \le 0 \quad \Rightarrow 2x \le 6 \quad \Rightarrow x \le 3$

Hence, any real number less than or equal to 3 is a solution of the given inequation.

The solution set of the given inequation is $(-\infty, 3]$

5. We have, $-3x + 15 < 0 \quad \Rightarrow -3x < -15 \quad \Rightarrow x > 5$

Thus, any real number greater than 5 is a solution of the given inequation.

$\therefore \quad x \in (5, \infty)$

6. We have, $4x - 20 \ge 0 \quad \Rightarrow 4x \ge 20 \quad \Rightarrow x \ge 5$

Hence, the solution set of the given inequation is $[5, \infty)$.

7. We have, $7x + 9 > 37 \quad \Rightarrow 7x > 37 - 9$

$\Rightarrow \quad 7x > 28 \quad \Rightarrow x > 4$

Hence, $(4, \infty)$ is the solution set of the given inequation.

8. Given inequation is $3x - 10 > 5x + 1$

$\Rightarrow 3x - 5x > 1 + 10 \Rightarrow -2x > 11 \Rightarrow x < -\frac{11}{2}$

Hence, the solution set of the given inequation is $\left\{x \in R : x < -\frac{11}{2}\right\}$; *i.e.*, the set $\left(-\infty, -\frac{11}{2}\right)$.

9. We have, $-8 \le 5x - 3 < 7$

$\Rightarrow \quad -8 \le 5x - 3 \quad$ and $\quad 5x - 3 < 7$

$\Rightarrow \quad 5x \ge -5 \quad$ and $\quad 5x < 10$

$\Rightarrow \quad x \ge -1 \quad$ and $\quad x < 2$

$\therefore \quad -1 \le x < 2$

Also, $x \in Z$. So, $x = \{-1, 0, 1\}$

10. We have, $30x < 200$

$\Rightarrow x < \frac{20}{3}$, as $x \in N$

$\therefore \quad x = \{1, 2, 3, 4, 5, 6\}$

11. We have, $\frac{x}{4} > \frac{5x - 2}{3} - \frac{7x - 3}{5}$

$\Rightarrow \frac{x}{4} > \frac{25x - 10 - 21x + 9}{15}$

$\Rightarrow \frac{x}{4} > \frac{4x - 1}{15} \quad \Rightarrow \quad 15x > 16x - 4 \Rightarrow x < 4$

$\therefore \; x \in (-\infty, 4)$

12. We have, $\frac{2x - 1}{3} \ge \frac{3x - 2}{4} - \frac{2 - x}{5}$

$\Rightarrow \quad \frac{2x - 1}{3} \ge \frac{15x - 10 - 8 + 4x}{20}$

$\Rightarrow \quad 40x - 20 \ge 57x - 54$

$\Rightarrow \quad 34 \ge 17x \quad \Rightarrow \quad x \le 2$

$\therefore \quad x \in (-\infty, 2]$

13. We have, $\frac{x}{3} - \frac{x - 2}{4} > \frac{x - 1}{5}$

$\Rightarrow \quad \frac{4x - 3x + 6}{12} > \frac{x - 1}{5}$

$\Rightarrow \quad \dfrac{x+6}{12} > \dfrac{x-1}{5}$

$\Rightarrow \quad 5x + 30 > 12x - 12 \ \Rightarrow 7x < 42 \ \Rightarrow x < 6$

$\therefore \quad x \in (-\infty, 6)$

14. $\dfrac{x+8}{x-2} \geq 0$, can be written as

$\dfrac{x+8}{x-2} \times (x-2)^2 \geq 0 \times (x-2)^2 \ \Rightarrow (x+8)(x-2) \geq 0$

Product of two factors $(x + 8)$ and $(x - 2)$ will be positive :

Case I : If both are positive, *i.e.*, $(x + 8) \geq 0$ and $(x - 2) > 0$, *i.e.*, $x \geq -8$ and $x > 2 \ \Rightarrow x > 2 \ \Rightarrow x \in (2, \infty)$

Case II : If both are negative, *i.e.*, $(x + 8) \leq 0$ and $(x - 2) < 0$, *i.e.*, $x \leq -8$ and $x < 2 \ \Rightarrow x \leq -8 \ \Rightarrow x \in (-\infty, -8]$

Thus, the solution is $(-\infty, -8] \cup (2, \infty)$

15. We have, $\dfrac{x+3}{x-2} \geq 4, \ \ x \neq 2$

$\Rightarrow \ \dfrac{x+3}{x-2} - 4 \geq 0 \ \ \Rightarrow \ \dfrac{x+3-4x+8}{x-2} \geq 0$

$\Rightarrow \ \dfrac{-3x+11}{x-2} \geq 0 \ \ \Rightarrow \ \dfrac{-(3x-11)}{x-2} \geq 0$

$\Rightarrow \ \dfrac{3x-11}{x-2} \leq 0 \ \Rightarrow \ 2 < x \leq \dfrac{11}{3}$

Thus, the solution set of given inequation is $\left(2, \dfrac{11}{3}\right]$

16. We have, $T = 30° + 25°(x - 3)$, $3 < x < 15$

Now $200° < 30° + 25°(x - 3) < 300°$

$\Rightarrow 170° < 25°(x - 3) < 270°$

$\Rightarrow \ \dfrac{170°}{25°} < (x-3) < \dfrac{270°}{25°}$

$\Rightarrow 6.8 < (x - 3) < 10.8$

$\Rightarrow 6.8 + 3 < x < 10.8 + 3$

$\Rightarrow 9.8 < x < 13.8$

Thus required depth will be between 9.8 km and 13.8 km.

17. We are given that,

$30° < C < 35°$

$\Rightarrow \ \dfrac{9}{5} \times 30° < \dfrac{9}{5}C < \dfrac{9}{5} \times 35° \ \Rightarrow \ 54° < \dfrac{9}{5}C < 63°$

$\Rightarrow \ 54° + 32° < \dfrac{9}{5}C + 32° < 63° + 32°$

$\Rightarrow \ 86° < \dfrac{9}{5}C + 32° < 95° \Rightarrow 86° < F < 95°$

18. We have, $\dfrac{4+2x}{3} \geq \dfrac{x}{2} - 3$

$\Rightarrow \ \dfrac{4+2x}{3} \geq \dfrac{x-6}{2}$

$\Rightarrow 8 + 4x \geq 3x - 18 \quad \Rightarrow x \geq -26$

$\therefore \quad x \in [-26, \infty)$

19. We have, $\dfrac{5-2x}{3} \leq \dfrac{x}{6} - 5$

$\Rightarrow \ \dfrac{5-2x}{3} \leq \dfrac{x-30}{6}$

$\Rightarrow 10 - 4x \leq x - 30 \Rightarrow 40 \leq 5x \Rightarrow 8 \leq x \Rightarrow x \geq 8$

20. Let x be the smaller of two positive consecutive even integers, then the other one is $x + 2$.

We have, $x > 5$ and $x + x + 2 < 23 \Rightarrow 2x + 2 < 23$

$\Rightarrow \ 2x < 21 \ \ \Rightarrow \ x < 21/2$

$\therefore \ \ x$ can be 6, 8, 10 ($\because \ x > 5$ and numbers are even integers)

$\therefore$ The pairs are [(6, 8), (8, 10), (10, 12)]

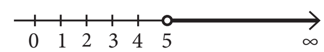
21. We have, $3x - 7 > 2(x - 6)$ and $6 - x > 11 - 2x$

$\Rightarrow 3x - 7 > 2x - 12$ and $x > 5$

$\Rightarrow x > -5$ and $x > 5$

So, the solution set is $(5, \infty)$.

The solution on the number line is as shown below :



22. We have, $5x - 7 < 3(x + 3)$; $\ 1 - \dfrac{3x}{2} \leq x - 4$

$\Rightarrow \quad 5x - 3x < 9 + 7$ and $2 - 3x \leq 2x - 8$

$\Rightarrow \quad 2x < 16$ and $-5x \leq -10$

$\Rightarrow \quad x < 8$ and $x \geq 2$

$\Rightarrow \quad 2 \leq x < 8$.

23. We have, $\dfrac{3x+1}{4} - \dfrac{x-2}{3} > \dfrac{1}{12}$

$\Rightarrow 9x + 3 - 4x + 8 > 1$

$\Rightarrow 5x + 11 > 1 \ \ \Rightarrow 5x > -10 \ \ \Rightarrow x > -2$ ...(i)

Also, $\dfrac{2x-3}{4} + 6 \leq 2 + \dfrac{4x}{3}$

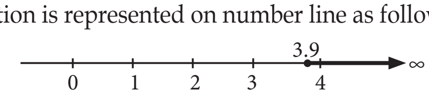
$\Rightarrow \ \dfrac{2x-3+24}{4} \leq \dfrac{6+4x}{3}$

$\Rightarrow \ \dfrac{2x+21}{4} \leq \dfrac{6+4x}{3}$

$\Rightarrow 6x + 63 \leq 24 + 16x$

$\Rightarrow 10x \geq 39 \ \ \Rightarrow x \geq 3.9$ ...(ii)

The solution is represented on number line as follows :



24. The given system of inequation is

$\dfrac{5x}{4} + \dfrac{3x}{8} > \dfrac{39}{8}$ ...(i)

And $\dfrac{2x-1}{12} - \dfrac{x-1}{3} < \dfrac{3x+1}{4}$ ...(ii)

Now, $\dfrac{5x}{4} + \dfrac{3x}{8} > \dfrac{39}{8} \ \ \Rightarrow \ \dfrac{10x+3x}{8} > \dfrac{39}{8}$

$\Rightarrow 13x > 39 \ \ \Rightarrow x > 3$

$\Rightarrow x \in (3, \infty)$

So, the solution set of inequation (i) is the interval $(3, \infty)$.

And $\dfrac{2x-1}{12} - \dfrac{x-1}{3} < \dfrac{3x+1}{4}$

$\Rightarrow \dfrac{(2x-1)-4(x-1)}{12} < \dfrac{3x+1}{4}$

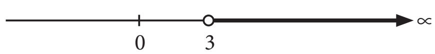
$\Rightarrow -2x + 3 < 3(3x + 1)$

$\Rightarrow -2x + 3 < 9x + 3 \Rightarrow -2x - 9x < 3 - 3$

$\Rightarrow -11x < 0 \Rightarrow x > 0 \Rightarrow x \in (0, \infty)$

So, the solution set of inequation (ii) is the interval $(0, \infty)$.

We observe that the intersection of the solution sets of inequations (i) and (ii) is interval $(3, \infty)$.



25. We have,

$\dfrac{x}{2x+1} \geq \dfrac{1}{4}$ ...(i)

And $\dfrac{6x}{4x-1} < \dfrac{1}{2}$ ...(ii)

Now, $\dfrac{x}{2x+1} \geq \dfrac{1}{4} \Rightarrow \dfrac{x}{2x+1} - \dfrac{1}{4} \geq 0$

$\Rightarrow \dfrac{4x-(2x+1)}{4(2x+1)} \geq 0 \Rightarrow \dfrac{2x-1}{2x+1} \geq 0$

$\Rightarrow x \in \left(-\infty, \dfrac{-1}{2}\right) \cup \left[\dfrac{1}{2}, \infty\right)$ ...(iii)

Also, $\dfrac{6x}{4x-1} < \dfrac{1}{2} \Rightarrow \dfrac{6x}{4x-1} - \dfrac{1}{2} < 0$

$\Rightarrow \dfrac{12x-(4x-1)}{2(4x-1)} < 0 \Rightarrow \dfrac{8x+1}{2(4x-1)} < 0$

$\Rightarrow \dfrac{8x+1}{4x-1} < 0$

$\Rightarrow x \in (-1/8, 1/4)$ ...(iv)

We can see that the intersection of (iii) and (iv) is the null set. Hence, the given system of inequations has no solution.

26. We know that, Profit = Revenue – Cost

Therefore, to earn some profit we must have

Revenue > Cost

$\Rightarrow 6x + 20 > 2x + 400 \quad \Rightarrow 6x - 2x > 400 - 20$

$\Rightarrow 4x > 380$

$\Rightarrow x > \dfrac{380}{4} \Rightarrow x > 95$

Hence, the manufacturer must sell more than 95 items to realize some profit.

27. We have, $\dfrac{x}{2} < \dfrac{5x-2}{3} - \dfrac{7x-3}{5}$

$\Rightarrow \dfrac{x}{2} < \dfrac{25x-10-21x+9}{15}$

$\Rightarrow 15x < 2(4x - 1) \Rightarrow 15x < 8x - 2$

$\Rightarrow 7x < -2 \quad \Rightarrow x < \dfrac{-2}{7}$

$\therefore$ Solution set is $\left(-\infty, \dfrac{-2}{7}\right)$, *i.e.,*

28. Converting the given inequations into equations, we get

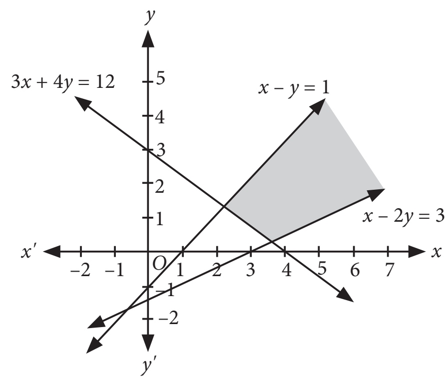
$x - 2y = 3$ ...(i)

$3x + 4y = 12$ ...(ii)

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

$x = 0$ ...(iv)

Now, we draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region including all the points on the lines represents the solution set of the given system of linear inequalities.

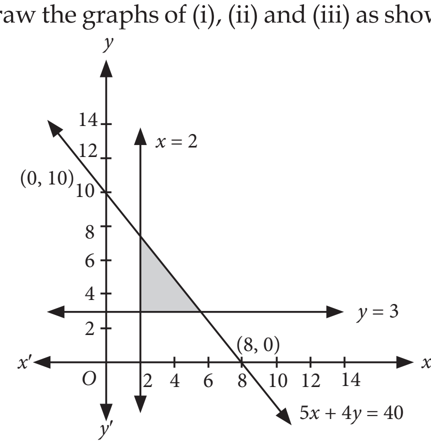
29. Converting the given inequations into equations, we get

$5x + 4y = 40$ ...(i)

$x = 2$ ...(ii)

$y = 3$ ...(iii)

Now, draw the graphs of (i), (ii) and (iii) as shown below.



So, the shaded region including all the points on the lines represents the solution set of the given system of inequalities.

30. Converting the given inequations into equations, we get

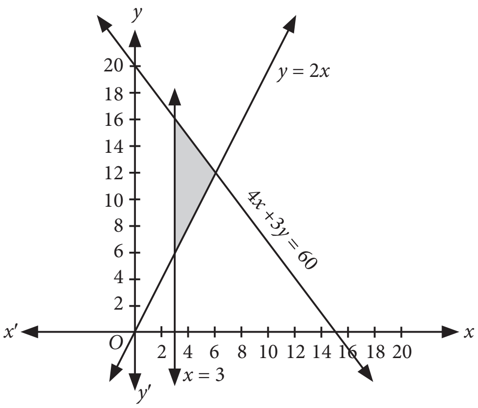
$4x + 3y = 60$ ...(i)

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

$x = 3$ ...(iii)

$x = 0, \quad y = 0$ ...(iv)

Now, we draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region including all the points on the lines represents the solution set of the given system of linear inequalities.

31. Converting the inequations into equations, we get

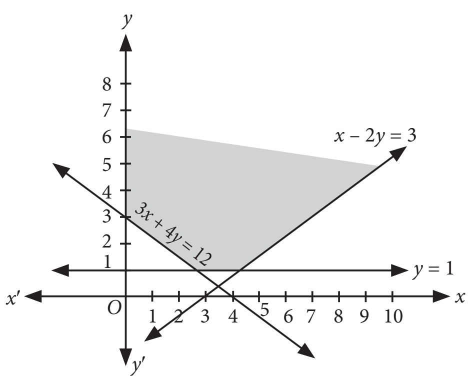
$x - 2y = 3$ ...(i)

$3x + 4y = 12$ ...(ii)

$y = 1$ ...(iii)

$x = 0$ ...(iv)

Now, draw the graphs of (i), (ii) (iii) and (iv) as shown below.



So, the shaded region represents the solution set of given system of linear inequalities.

32. Consider the inequation

$5(2x - 7) - 3(2x + 3) \le 0$

$\Rightarrow 10x - 35 - 6x - 9 \le 0$

$\Rightarrow 4x \le 44 \Rightarrow x \le 11$ ...(i)

Consider the inequation,

$2x + 19 \le 6x + 47$

$\Rightarrow 19 - 47 \le 6x - 2x$

$\Rightarrow -28 \le 4x \Rightarrow -7 \le x$

$\Rightarrow x \ge -7$ ...(ii)

From (i) and (ii), we get $-7 \le x \le 11$, which can be represented on the number line as shown below.

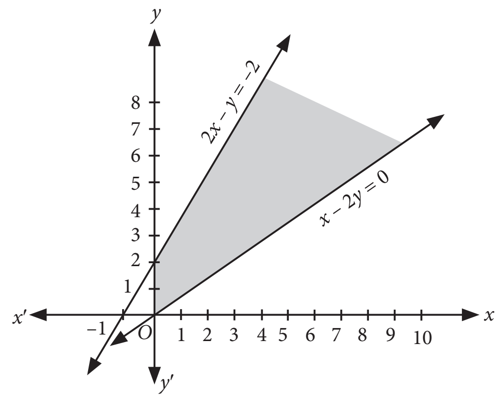
33. Converting the given inequations into equations, we get

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

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

$x = 0, \quad y = 0$ ...(iii)

Now, draw the graphs of (i), (ii) and (iii), as shown below.



So, the shaded region represents the solution set of given system of linear inequalities.

34. Given inequality is $\dfrac{x-1}{x+1} \ge 0$ ...(i)

First of all we note that $x + 1 \ne 0$

Case I : If $x + 1 > 0$, *i.e.*, if $x > -1$, then

(i) $\Rightarrow x - 1 \ge 0$, *i.e.*, $x \ge 1$

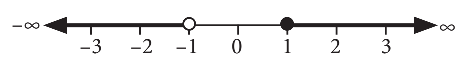
So $[1, \infty)$ is a subset of the solution set.

Case II : If $x + 1 < 0$, i.e., if $x < -1$, then

(i) $\Rightarrow x - 1 \le 0$, *i.e.*, $x \le 1$; but $x < -1$,

So $(-\infty, -1)$ is also a subset of the solution set.

Thus, the solution set of the given inequality is $(-\infty, -1) \cup [1, \infty)$ which can be represented on the number line as shown below.

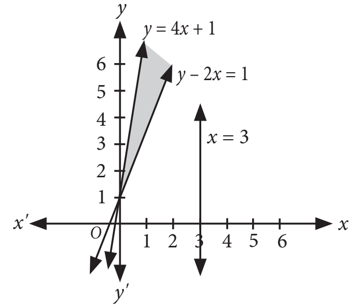


35. Converting the given inequations into equations, we get

$y = 4x + 1$ ...(i) $\quad y - 2x = 1$ ...(ii)

$x = 3$ ...(iii) $\quad x = 0, \quad y = 0$ ...(iv)

Now, we draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region represents the solution set of given system of linear inequalities.

36. Converting the given inequalities into equalities, we get

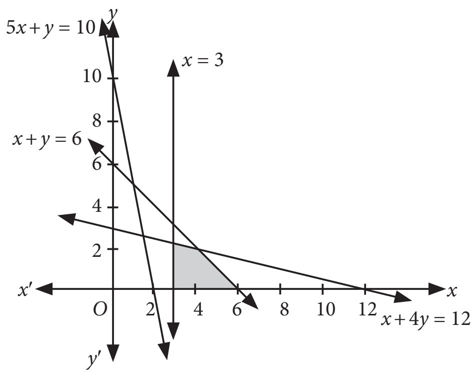
$5x + y = 10$ ...(i)

$2x + 2y = 12 \quad \Rightarrow x + y = 6$ ...(ii)

$x + 4y = 12$ ...(iii)

$x = 3$ ...(iv)

Now, draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region represents the solution set of the given system of linear inequalities.

37. Converting the given inequations into equations, we get

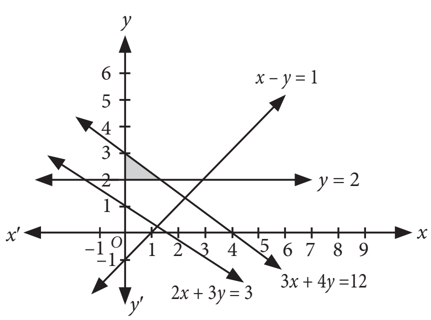
$2x + 3y = 3$ ...(i)

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

$3x + 4y = 12$ ...(iii)

$y = 2$ ...(iv)

Now, draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region represents the solution set of the given system of linear inequalities.

38. Let x litres of 100% pure milk be added so that we get purity between 90% and 95%. We have to given that 80% of milk of stock is adulterated milk. It mean's that there is 20% or 200 litre pure milk is available in his stock. Hence total mixture is 1000 litres.

$$\therefore \ \frac{1000 \times 90}{100} \le 800 + x \le \frac{95 \times 1000}{100}$$

$\Rightarrow \quad 900 \le 800 + x$ and $800 + x \le 950$

$\Rightarrow \quad 100 \le x$ and $x \le 150$

Hence for getting 90% and 95% pure milk we must add 100 and 150 litres of pure milk.

For 99% pure milk

$$800 + x \ge \frac{99 \times 1000}{100}$$

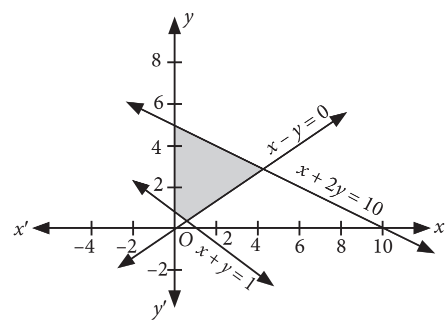
$\Rightarrow \quad 800 + x \ge 990 \ \Rightarrow \ x \ge 190$ litres

$\therefore$ 190 litres pure milk must be added for getting 99% pure milk.

39. Converting the given inequations into equations, we get $x + 2y = 10$, $x + y = 1$, $x - y = 0$,

$x = 0$, $y = 0$

Now, we draw the graphs of above equations as shown below.



So, the shaded region represents the solution set of given system of linear inequalities.

40. Converting the given inequations into equations, we get

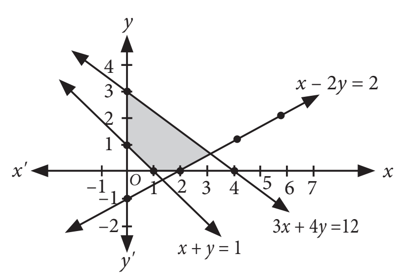
$x + y = 1$ ...(i)

$3x + 4y = 12$ ...(ii)

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

$x = 0, \quad y = 0$ ...(iv)

Now, we draw the graphs of (i), (ii), (iii) and (iv) as shown below.



So, the shaded region represents the solution set of given system of linear inequalities.