Engineering Daily 24 [Set 03] EV

Real Numbers and Inequalities + Linear Programming

Total Marks: 50 **Negative Marks:** 0.25 **Time:** 1 Hour

MCQ 50 marks

1. If $S = \{(-1)^n\left(2 - \frac{1}{n}\right) : n \in \mathbb{N}\}$, what is the value of $\sup S - \inf S$?

(A) $\frac{7}{2}$ (B) 4 (C) 2 (D) 3

2. What is the supremum of the set $S = \{3 - \frac{2}{n} : n \in \mathbb{N}\}$?

(A) 1 (B) 2
(C) 3 (D) No supremum exists

3. If $S = \{x \in \mathbb{R} : x^2 < 4x + 5\}$, which of the following is correct?

(A) $\sup S = 5,\ \inf S = -1$ (B) $\sup S = 5,\ \inf S = 1$
(C) $\sup S = 1,\ \inf S = -5$ (D) $\max S = 5,\ \min S = -1$

4. Which is the solution set of $|x| < 7$ in interval notation?

(A) $[-7, 7]$ (B) $(-7, 7)$ (C) $(0, 7)$ (D) $(-\infty, 7)$

5. What is the solution set of the inequality $||x - 2| - 3| < 1$?

(A) $(0, 4)$ (B) $(-\infty, 0) \cup (4, \infty)$
(C) $(-2, 6)$ (D) $(-2, 0) \cup (4, 6)$

6. For which values of a does the inequality $|x - 5| + |x + 2| < a$ have no real solution?

(A) $a > 7$ (B) $a < 7$ (C) $a \leq 2$ (D) $a \leq 7$

7. How many integers x satisfy the inequality $|x - 1| + |2x + 3| \leq 7$?

(A) 5 (B) 7 (C) 4 (D) 6

8. What is the solution set of the inequality $|2x + 3| < 7$?

(A) $(-2, 5)$ (B) $[-5, 2]$
(C) $(2, 5)$ (D) $(-5, 2)$

9. What is the solution of the inequality $\frac{|x-2|}{x+1} < 1$?

(A) $x < -1$ (B) $-1 < x < \frac{1}{2}$
(C) $x < -1$ or $x > \frac{1}{2}$ (D) $x > \frac{1}{2}$

10. What is the solution of the inequality $\frac{1}{|x+3|} > 2$?

(A) $x > -\frac{5}{2}$ (B) $x < -\frac{7}{2}$ or $x > -\frac{5}{2}$
(C) $-\frac{7}{2} < x < -\frac{5}{2}$ (D) $-\frac{7}{2} < x < -\frac{5}{2},\ x \neq -3$

11. What is the solution of the inequality $\left|\frac{3x-2}{x-2}\right| > 3$?

(A) $x > \frac{4}{3},\ x \neq 2$ (B) $x > 2$
(C) $x < \frac{4}{3}$ (D) $\frac{4}{3} < x < 2$

12. If $x \in [-2, 4]$, what is the range of values of $|3x - 2|$?

(A) $[0, 8]$ (B) $[0, 10]$
(C) $[8, 10]$ (D) $[2, 10]$

13. What is the solution set of the inequality $|x - 2| + |x - 6| \leq 6$?

(A) $[1, 7]$ (B) $[1, 6]$ (C) $[0, 7]$ (D) $[2, 6]$

14. What is the minimum value of $f(x) = |x - 1| + |x - 4| + |x - 6|$?

(A) 3 (B) 4 (C) 6 (D) 5

15. What is the solution of the inequality $|x - 3| < 2x$?

(A) All real x (B) $0 < x < 1$
(C) $x > 3$ (D) $x > 1$

16. What is the solution set of the equation $|x - 2| + |x - 5| = |2x - 7|$?

(A) $\{\frac{7}{2}\}$ (B) $(-\infty, 2] \cup [5, \infty)$
(C) $\mathbb{R}$ (D) $[2, 5]$

17. If $|x - 5| < 2$ and $|y - 1| < 3$, which of the following must be true?

(A) $|x + y - 6| < 5$ (B) $|x + y - 6| < 2$
(C) $|x + y - 6| < 3$ (D) $|x + y| < 5$

18. How many integers x satisfy the inequality $|x - 2| + |x + 1| < 9$?

(A) 9 (B) 8 (C) 7 (D) 6

19. What is the solution of the inequality $(x + 1)(x - 2)(x - 4) < 0$?

(A) $-1 < x < 4$ (B) $-1 < x < 2$ or $x > 4$
(C) $x < -1$ or $2 < x < 4$ (D) $x < 4$

20. How many integers x satisfy the inequality $x^2 - 7|x| + 10 < 0$?

(A) 2 (B) 0 (C) 6 (D) 4

21. What is the solution of the inequality $\frac{x+4}{x-2} \leq 3$?

(A) $x < 2$ or $x \geq 5$ (B) $x \geq 5$
(C) $x \leq 2$ or $x \geq 5$ (D) $2 < x \leq 5$

22. What is the solution set of the inequality $x^2 - 3|x| - 4 \leq 0$?

(A) $[-4, 1]$ (B) $[0, 4]$
(C) $[-1, 4]$ (D) $[-4, 4]$

23. How many integers x satisfy both $(x - 1)(x - 9) \leq 0$ and $|x - 5| > 2$?

(A) 5 (B) 3 (C) 4 (D) 2

24. What is the solution of the inequality $\sqrt{x^2 - 5x + 6} > x - 4$?

(A) $(-\infty, 2] \cup [3, \infty)$ (B) $(\frac{10}{3}, \infty)$
(C) $[4, \infty)$ (D) $[3, \infty)$

25. What is the solution of the inequality $|x^2 - 4x| < 3$?

Ⓐ $(-\infty, 1) \cup (3, \infty)$ Ⓑ $(2 - \sqrt{7}, 1) \cup (3, 2 + \sqrt{7})$

Ⓒ $(1, 3)$ Ⓓ $(2 - \sqrt{7}, 2 + \sqrt{7})$

26. What is the solution set of the inequality $\frac{x^2-4}{x^2-9} \leq 0$?

Ⓐ $[-3, -2] \cup [2, 3]$ Ⓑ $(-2, 2)$

Ⓒ $(-3, -2] \cup [2, 3)$ Ⓓ $(-\infty, -3) \cup (3, \infty)$

27. For which values of k is $x^2 + kx + 9 > 0$ for all real x ?

Ⓐ $k < -6$ Ⓑ $-6 < k < 6$ Ⓒ $-6 \leq k \leq 6$ Ⓓ $k > 6$

28. What is the solution set of the inequality $|x^2 - 5| \leq 4$?

Ⓐ $[1, 3]$ Ⓑ $(-3, 3)$ Ⓒ $[-3, 3]$ Ⓓ $[-3, -1] \cup [1, 3]$

29. What is the solution of the inequality $\frac{x+2}{x-2} > \frac{x-2}{x+2}$?

Ⓐ $(0, 2)$ Ⓑ $x > 0$

Ⓒ $(-2, 0) \cup (2, \infty)$ Ⓓ $(-\infty, -2) \cup (0, 2)$

30. If $x > 0$, what is the minimum value of $x + \frac{25}{x}$?

Ⓐ 25 Ⓑ 5 Ⓒ 10 Ⓓ 50

31. If $x, y > 0$ and $3x + 2y = 24$, what is the maximum value of xy?

Ⓐ 48 Ⓑ 12 Ⓒ 24 Ⓓ 36

32. Which of the following points lies in the region $3x + y \leq 6, x \geq 0, y \geq 0$?

Ⓐ $(1, 2)$ Ⓑ $(2, 1)$ Ⓒ $(0, 7)$ Ⓓ $(3, 0)$

33. What is the area, in square units, of the region formed by $x \geq 0, y \geq 0, x + y \leq 8$?

Ⓐ 64 Ⓑ 16 Ⓒ 24 Ⓓ 32

34. What is the area, in square units, of the region bounded by $x + y \leq 7, x \geq 2, y \geq 2$?

Ⓐ 3 Ⓑ $\frac{9}{2}$ Ⓒ 9 Ⓓ 6

35. What is the area, in square units, of the region $|x| + |y| \leq 3$?

Ⓐ 18 Ⓑ 36 Ⓒ 9 Ⓓ 12

36. What is the area, in square units, of the region bounded by $y \geq |x|$ and $y \leq 5$?

Ⓐ 15 Ⓑ 25 Ⓒ 50 Ⓓ 10

37. A dealer sells tables and chairs and cannot stock more than 20 pieces of furniture in total. A table costs 300 taka and a chair costs 100 taka, and the total investment is at most 3600 taka. If the profit is 40 taka per table and 30 taka per chair, what is the maximum profit in taka?

Ⓐ 600 Ⓑ 680 Ⓒ 480 Ⓓ 720

38. Subject to $x + 2y \leq 10, 2x + y \leq 11, x, y \geq 0$, the maximum of $z = x + ky$ occurs at $(4, 3)$. What is the range of k?

Ⓐ $\frac{1}{2} \leq k \leq 2$ Ⓑ $k \geq \frac{1}{2}$ Ⓒ $\frac{1}{3} \leq k \leq 1$ Ⓓ $1 \leq k \leq 2$

39. What is the maximum value of $z = 2x + 5y$ over the region $|x| + |y| \leq 2$?

Ⓐ 4 Ⓑ 10 Ⓒ 14 Ⓓ 7

40. How many points with integer coordinates lie in the region $x + 3y \leq 9, x \geq 0, y \geq 0$ (boundary included)?

Ⓐ 26 Ⓑ 22 Ⓒ 24 Ⓓ 20

41. Subject to $x + y \leq 5, x + 2y \leq 8, x \geq 0, y \geq 0$, what is the maximum value of $z = 2x + 3y$?

Ⓐ 10 Ⓑ 15 Ⓒ 13 Ⓓ 12

42. Subject to $x + 2y \leq 8, 2x + y \leq 10, x, y \geq 0$, what is the maximum value of $z = x + y$?

Ⓐ 6 Ⓑ 9 Ⓒ 7 Ⓓ 5

43. Subject to $x + y \geq 6, x + 3y \geq 10, x, y \geq 0$, what is the minimum value of $z = 2x + 3y$?

Ⓐ 18 Ⓑ 14 Ⓒ 20 Ⓓ 12

44. If $x > 1$, what is the minimum value of $x + \frac{16}{x-1}$?

Ⓐ 8 Ⓑ 12 Ⓒ 10 Ⓓ 9

45. Subject to $x + y \leq 6, x \leq 4, y \leq 5, x, y \geq 0$, what is the maximum value of $z = 4x + 3y$?

Ⓐ 24 Ⓑ 19 Ⓒ 16 Ⓓ 22

46. Subject to $x + 2y \leq 8, 2x + y \leq 9, x, y \geq 0$, what is the maximum value of $z = x + y$?

Ⓐ $\frac{17}{3}$ Ⓑ 6 Ⓒ $\frac{9}{2}$ Ⓓ 4

47. For the problem of maximising $z = 3x + 6y$ subject to $x + 2y \leq 10, 3x + 2y \leq 18, x, y \geq 0$, which statement is correct?

Ⓐ Unique solution $(0, 5)$, $z_{max} = 30$

Ⓑ Unique solution $(4, 3)$, $z_{max} = 30$

Ⓒ Infinitely many solutions, $z_{max} = 30$

Ⓓ z is unbounded

48. For maximising $z = x + y$ subject to $x - 2y \leq 4, x \geq 0, y \geq 0$, which statement is correct?

Ⓐ z has no finite maximum value

Ⓑ There is no feasible region

Ⓒ $z_{max} = 4$

Ⓓ $z_{max} = 2$

49. What is the area, in square units, of the region bounded by $|x - y| \leq 2$ and $|x + y| \leq 5$?

Ⓐ 40 Ⓑ 25 Ⓒ 20 Ⓓ 10

50. A patient needs at least 10 units of protein and 15 units of vitamins daily. Each packet of food A contains 2 units of protein and 1 unit of vitamins, and each packet of food B contains 1 unit of protein and 3 units of vitamins. If a packet of A costs 25 taka and a packet of B costs 20 taka, what is the minimum cost in taka?

Ⓐ 175 Ⓑ 200 Ⓒ 155 Ⓓ 375