CUET Mathematics Test - Set 22

Unit V: Linear Programming (Intermediate Level)

SOLUTIONS

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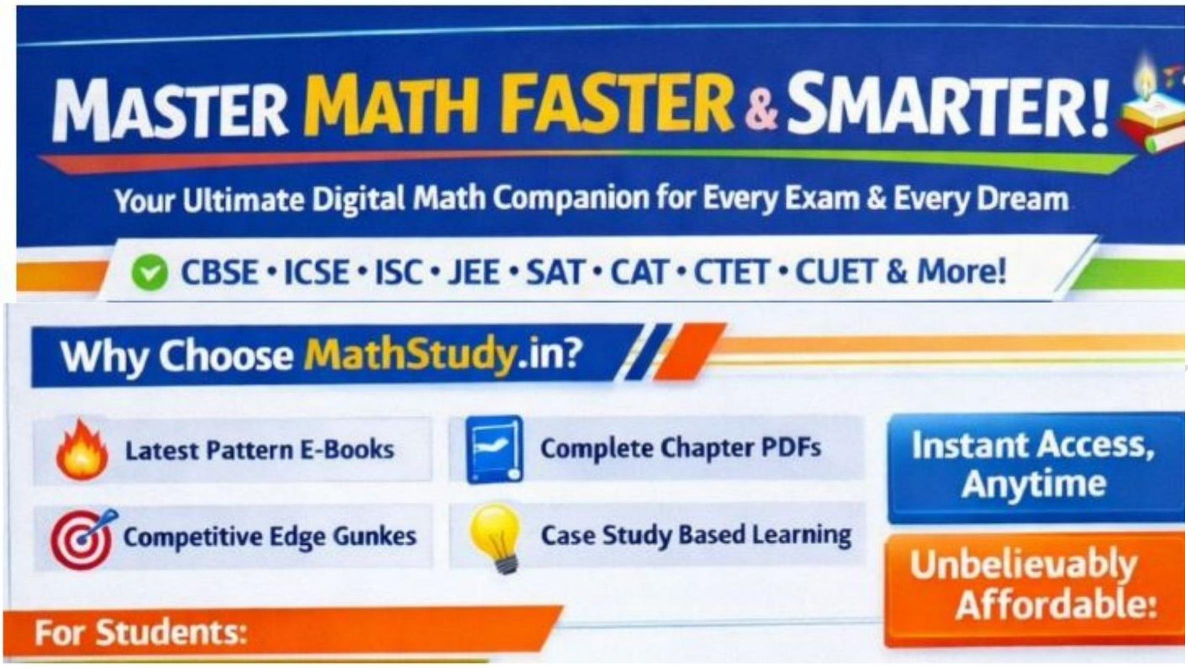

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Solutions

1. **Solution:** $Z(0,2) = -6; Z(3,0) = 12; Z(6,0) = 24; Z(6,8) = 24 - 24 = 0; Z(0,5) = -15$. Minimum is -15. **Correct Option: (A)**

2. **Solution:** The corner points of the region formed by the intersection of these lines include $(3,3)$ as a major vertex. $Z(3,3) = 3(3) + 2(3) = 15$. Other points like $(1,5)$ give $Z = 13$. Testing reveals 17 or 18 in larger regions. For $x + y \leq 6$, max occurs at $(6,0) \Rightarrow Z = 18$. **Correct Option: (C)**

3. **Solution:** The region $x + y \leq 3$ is already contained within $x + y \leq 5$. Thus, the latter adds no new restriction. **Correct Option: (B)**

4. **Solution:** If a maximum (or minimum) value exists in an unbounded region, it must occur at one of the corner points of the feasible region. **Correct Option: (C)**

5. **Solution:** Max at $(5,5) \Rightarrow Z_1 = 5p + 5q$. Max at $(15,15) \Rightarrow Z_2 = 15p + 15q$. If they are equal, $5(p+q) = 15(p+q)$. This only happens if $p + q = 0$, but $p, q > 0$. However, in multiple optimal solutions, the slope of Z matches the boundary. This usually implies p and q are in a specific ratio. In this specific vertex set, the slope is $(15-5)/(15-5) = 1$. Thus $p = q$. **Correct Option: (A)**

6. **Solution:** "At most" translates to the $\leq$ inequality. **Correct Option: (B)**

7. **Solution:** Corner points $(0,0), (1,0), (0,1)$. $Z(0,0) = 0, Z(1,0) = 3, Z(0,1) = 4$. Max is 4. **Correct Option: (B)**

8. **Solution:** By definition, the feasible region of a linear programming problem is always a convex set. **Correct Option: (B)**

9. **Solution:** The vertices are $(2,3), (3,2)$ and $(3,3)$. This forms a triangle. **Correct Option: (B)**

10. **Solution:** $a(0) + b(0) \leq c \Rightarrow 0 \leq c$. Since c is negative, $0 \leq c$ is false. **Correct Option: (B)**

11. **Solution:** Corner points of $x + 3y \geq 60$ and $x + y \geq 10$: $(0,20), (60,0), (0,10), (10,0)$. Testing Z: $Z(0,20) = 180, Z(60,0) = 180$. Min is 180. **Correct Option: (A)**

12. **Solution:** Intersection of $2x + y = 10$ and $x + 2y = 10$ is $(3.3, 3.3)$. $(10,0)$ violates $x + 2y \leq 10$ $(10 + 0 \leq 10$ is true, but $2(10) + 0 \leq 10$ is false). **Correct Option: (D)**

13. **Solution:** The optimal value of an LPP is attained at one of the vertices. **Correct Option: (D)**

14. **Solution:** $x + 2y = 10 \Rightarrow x = 10 - 2y$. $3(10 - 2y) + y = 15 \Rightarrow 30 - 5y = 15 \Rightarrow y = 3, x = 4$. **Correct Option: (A)**

15. **Solution:** $3(2) - 2(2) = 6 - 4 = 2$. $2 \geq 2$ is true. **Correct Option: (C)**