

Mathematics Practice Test - Set 9

Chapter: Linear Programming (Intermediate to Difficult)

SOLUTIONS

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Solutions

- Correct Option: (A).** $x + y \leq 4$ and $3(x + y) \geq 18 \implies x + y \geq 6$. Since a sum cannot be both ≤ 4 and ≥ 6 simultaneously for non-negative x, y , the feasible region is empty.
- Correct Option: (C).** If max occurs at two points, $Z(2, 4) = Z(5, 2) \implies 2p + 4q = 5p + 2q \implies 2q = 3p$.
- Correct Option: (B).** $Z(0, 2) = -6, Z(3, 0) = 12, Z(6, 0) = 24, Z(6, 8) = 24 - 24 = 0, Z(0, 5) = -15$. Max = 24, Min = -15. Difference = $24 - (-15) = 39$.
- Correct Option: (B).** The intersection of half-planes defined by linear inequalities is always a convex set.
- Correct Option: (C).** For $(3, 3)$: $3 + 2(3) = 9 \leq 10$ (T); $3(3) + 3 = 12 \leq 15$ (T); $3 \geq 2, 3 \geq 2$ (T). All other options fail at least one constraint.
- Correct Option: (A).** Corner points: $(0, 0), (2, 0), (2, 2), (0, 6)$. $Z(2, 0) = 22, Z(2, 2) = 22 + 14 = 36, Z(0, 6) = 42$. Max = 42.
- Correct Option: (A).** $x + y = 1$ is "inside" $2x + 3y = 6$ relative to the origin for the first quadrant. The intersection with axes for $x + y \leq 1$ gives $(0, 0), (1, 0), (0, 1)$.
- Correct Option: (C).** $-3x_1 + x_2 \geq 3 \implies x_2 \geq 3 + 3x_1$. For $x_1, x_2 \geq 0$, the smallest x_2 can be is 3. However, $x_1 + x_2 \leq 1$ requires the sum to be at most 1. This is impossible.
- Correct Option: (A).** Solve $2x + y = 10$ and $x + 2y = 8$. Multiply second by 2: $2x + 4y = 16$. Subtract: $3y = 6 \implies y = 2, x = 4$.
- Correct Option: (C).** $x + y \leq 0$ with $x, y \geq 0$ can only be true if $x = 0$ and $y = 0$.
- Correct Option: (A).** Intersection points: $(5, 5)$ from $x + y = 10$ and $x = y$. Evaluation: $Z(5, 5) = 15 + 45 = 60, Z(0, 10) = 90, Z(0, 20) = 180, Z(15, 15) = 45 + 135 = 180$. Min is 60.
- Correct Option: (B).** Lines $x = 1, y = 1$ and $x + y = 4$ intersect at $(1, 1), (3, 1), (1, 3)$, forming a triangle.
- Correct Option: (B).** $Z(0, 0) = 0, Z(2, 0) = 2, Z(2, 2) = 2 - 4 = -2, Z(0, 1) = -2$. Minimum is -2.
- Correct Option: (B).** $x - y \geq 0 \implies x \geq y$ or $y \leq x$. This is the region below (or to the right of) the line $y = x$.
- Correct Option: (A).** ≤ 5 and ≥ 5 together mean $= 5$. The feasible region is the line segment of $x + y = 5$ in the first quadrant.