PRACTICE PAPER 01 (2026-27) – ANSWER KEY WITH SOLUTIONS
CHAPTER 12 : LINEAR PROGRAMMING

SUBJECT: MATHEMATICS	**MAX. MARKS:** 40
CLASS: XII	**DURATION:** 1½ hrs

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. $Z = ax + by$

Ans: (b) objective function

The linear function to be optimised is the objective function.

2. $x \geq 0, y \geq 0, x + y \leq 5$

Ans: (c) bounded

The region is the triangle with vertices (0, 0), (5, 0), (0, 5), which can be enclosed in a circle. So it is bounded.

3. Max $Z = 3x + 2y$

Ans: (d) 12

$Z(0, 0) = 0$, $Z(4, 0) = 12$, $Z(0, 3) = 6$. Maximum = 12.

4. Max $Z = 5x + 3y$

Ans: (c) 26

Corner points: (0, 0), (4, 0), (4, 2), (0, 6). $Z = 0, 20, 26, 18$. Maximum = 26 at (4, 2).

5. Min $Z = 2x + 3y$, $x + y \geq 4$

Ans: (a) 8

Corner points of the unbounded region: (4, 0) and (0, 4). $Z = 8$ and 12. The half-plane $2x + 3y < 8$ has no point in common with the region, so the minimum is 8.

6. Time constraint

Ans: (b) $2x + 3y \leq 60$

Chairs use $2x$ hours and tables use $3y$ hours, so $2x + 3y \leq 60$.

7. Number of optimal points

Ans: (c) infinitely many

$Z(0, 0) = 0$, $Z(6, 0) = 18$, $Z(2, 4) = 30$, $Z(0, 5) = 30$. The maximum 30 occurs at two adjacent corner points, hence at every point of the segment joining them: infinitely many.

8. $x \geq 0, y \geq 0$

Ans: (d) non-negative constraints

These are called the non-negative restrictions (constraints).

9. Assertion–Reason

Ans: (c) A is true but R is false

A is true: for an unbounded region the maximum may not exist. R is false: an unbounded region still has corner points (e.g. Q5 above).

10. Assertion–Reason

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

The feasible region is the intersection of half-planes, each of which is convex, so the intersection is convex. R explains A.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Formulation of the toys problem

Let x toys of type A and y toys of type B be made per day. (½)

Maximise Z = 30x + 20y (objective function) (½)

subject to 2x + y ≤ 40 (machine I), x + 2y ≤ 40 (machine II) (½), and x ≥ 0, y ≥ 0. (½)

12. Corner points: x + y ≤ 6, x ≤ 4, x, y ≥ 0

The boundary lines meet the axes at (0, 0), (4, 0) and (0, 6); the lines x = 4 and x + y = 6 meet at (4, 2). (1)

The corner points are **(0, 0), (4, 0), (4, 2) and (0, 6)**. (1)

13. Max Z = 4x + y over (0, 0), (5, 0), (3, 4), (0, 6)

Z(0, 0) = 0, Z(5, 0) = 20, Z(3, 4) = 16, Z(0, 6) = 6. (1)

The region is bounded, so the maximum value is **20 at (5, 0)**. (1)

14. Max Z = x + 2y, x + y ≥ 3

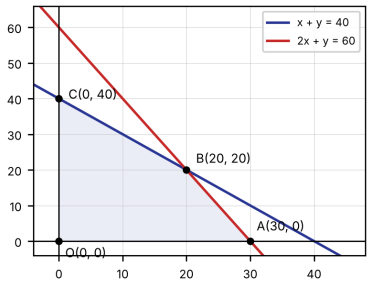
The feasible region lies on and above the line x + y = 3 in the first quadrant and is unbounded. (1)

Z = x + 2y can be made as large as we like by taking large x or y inside the region. So **no maximum exists**. (1)

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Max Z = 3x + 2y; x + y ≤ 40, 2x + y ≤ 60



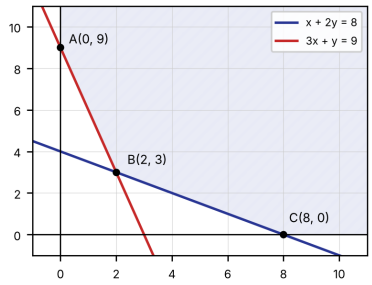
The feasible region is the quadrilateral OABC shown. The lines x + y = 40 and 2x + y = 60 meet at B(20, 20). (1)

Corner point	Value of Z
O(0, 0)	0
A(30, 0)	90
B(20, 20)	60 + 40 = 100
C(0, 40)	80

Evaluating Z at the corner points of the bounded region: (1)

The maximum value of Z is **100**, at x = 20, y = 20. (1)

16. Min Z = 4x + 3y; x + 2y ≥ 8, 3x + y ≥ 9



The feasible region is unbounded. The lines x + 2y = 8 and 3x + y = 9 meet at B(2, 3). Corner points: A(0, 9), B(2, 3), C(8, 0). (1)

Corner point	Value of Z
A(0, 9)	27
B(2, 3)	8 + 9 = 17
C(8, 0)	32

Values of Z: (1)

The smallest value is 17 at B. The open half-plane 4x + 3y < 17 has no point in common with the feasible region, so the minimum value is **17** at (2, 3). (1)

17. Formulation of the farmer's problem

Let the farmer grow x acres of wheat and y acres of rice. (½)

Maximise Z = 1000x + 1200y. (1)

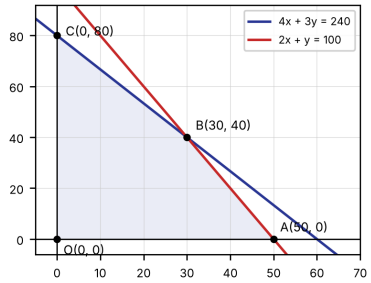
Subject to: x + y ≤ 20 (land); 200x + 300y ≤ 5000, i.e. 2x + 3y ≤ 50 (money); 3x + 2y ≤ 48 (labour days); x ≥ 0, y ≥ 0. (1½)

SECTION – D

Question 18 carries 5 marks.

18. Tables and chairs

Formulation: Let x tables and y chairs be made per week. Maximise Z = 60x + 40y subject to 4x + 3y ≤ 240, 2x + y ≤ 100, x ≥ 0, y ≥ 0. (1½)



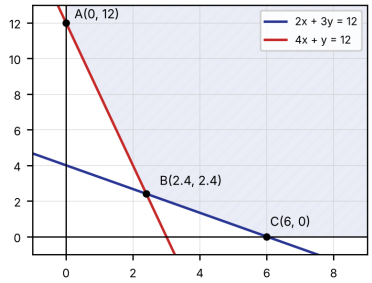
Graph: The feasible region is OABC. The lines 4x + 3y = 240 and 2x + y = 100 meet at B(30, 40): from the second line y = 100 − 2x, so 4x + 300 − 6x = 240 and x = 30. (2)

Corner point	Value of Z
O(0, 0)	0
A(50, 0)	3000
B(30, 40)	1800 + 1600 = 3400
C(0, 80)	3200

Corner point evaluation: (1)

The maximum profit is **₹3400**, obtained by making **30 tables and 40 chairs** each week. (½)

OR



The feasible region is unbounded. The lines $2x + 3y = 12$ and $4x + y = 12$ meet at B(2.4, 2.4): $y = 12 - 4x$ gives $2x + 36 - 12x = 12$, so $x = 2.4$. Corner points: A(0, 12), B(2.4, 2.4), C(6, 0). (2)

Corner point	Value of Z
A(0, 12)	600
B(2.4, 2.4)	96 + 120 = 216
C(6, 0)	240

Values of Z: (2)

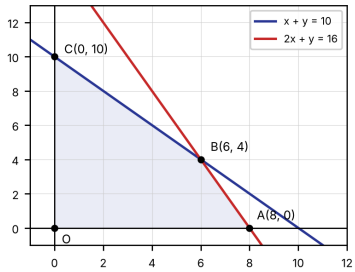
The smallest value is 216 at B. The half-plane $40x + 50y < 216$ has no point in common with the region, so the minimum is **216** at (2.4, 2.4). (1)

SECTION – E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. Bakery

(i) Objective function: **Z = 60x + 40y** (to be maximised). (1)



(ii) The line $x + y = 10$ meets the axes at (10, 0) and (0, 10); $2x + y = 16$ meets them at (8, 0) and (0, 16). They meet at B(6, 4). The corner points are **O(0, 0), A(8, 0), B(6, 4), C(0, 10)**. (1)

Corner point	Value of Z
O(0, 0)	0
A(8, 0)	480
B(6, 4)	360 + 160 = 520
C(0, 10)	400

(iii) Values of Z: (1)

Maximum profit = **₹520** with **6 cakes and 4 pastries** per day. (1)

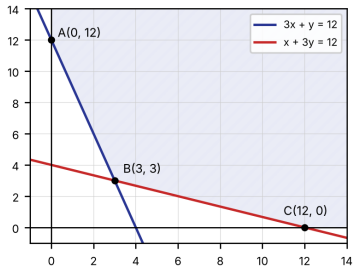
OR

(iii) With Z = 60x + 60y: Z(O) = 0, Z(A) = 480, Z(B) = 360 + 240 = 600, Z(C) = 600. (1)

The maximum profit is **₹600**, attained at both B and C, hence at every point of segment BC: **infinitely many** optimal solutions. (1)

20. Foods A and B

(i) Minimise Z = 10x + 15y subject to 3x + y ≥ 12 (protein), x + 3y ≥ 12 (fibre), x ≥ 0, y ≥ 0. (1)



(ii) The lines 3x + y = 12 and x + 3y = 12 meet at B(3, 3). The region is unbounded with corner points **A(0, 12), B(3, 3), C(12, 0)**. (1)

Corner point	Value of Z
A(0, 12)	180
B(3, 3)	30 + 45 = 75
C(12, 0)	120

(iii) Values of Z: (1)

The smallest value is 75 at B. The half-plane 10x + 15y < 75 has no point in common with the region, so the **minimum cost is ₹75**, using **3 units of A and 3 units of B**. (1)

OR

(iii) The feasible region is unbounded. (1)

Z = 10x + 15y can be made arbitrarily large by moving far into the region, so **no maximum exists**. (1)

— End of Solutions —