LPP **Marks: 50**

ANSWER KEY

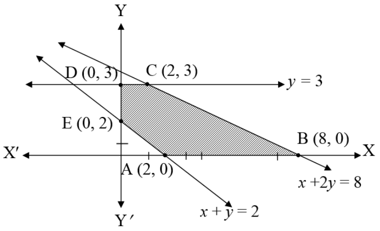
Maths

Q.1 C	Q.2 B	Q.3 B	Q.4 A	Q.5 C	Q.6 C	Q.7 C	Q.8 C
Q.9 A	Q.10 C	Q.11 B	Q.12 A	Q.13 D	Q.14 B	Q.15 A	Q.16 A
Q.17 B	Q.18 C	Q.19 B	Q.20 D	Q.21 B	Q.22 C	Q.23 A	Q.24 A
Q.25 C							

Maths

Q.1 The solution for minimizing the function z = $x + y$ under an L.P.P. with constraints $x + y \geq 2$, $x + 2y \leq 8$, $y \leq 3$, $x, y \geq 0$ is

Correct option: (C)



The corner points of the feasible region are A (2, 0), B (8, 0), C (2, 3), D (0, 3) and E (0, 2).

At A (2, 0), z = 2 + 0 = 2

At B (8, 0), z = 8 + 0 = 8

At C (2, 3), z = 2 + 3 = 5

At D (0, 3), z = 0 + 3 = 3

At E (0, 2), z = 0 + 2 = 2

∴ z has minimum values at A (2, 0) and E (0, 2)

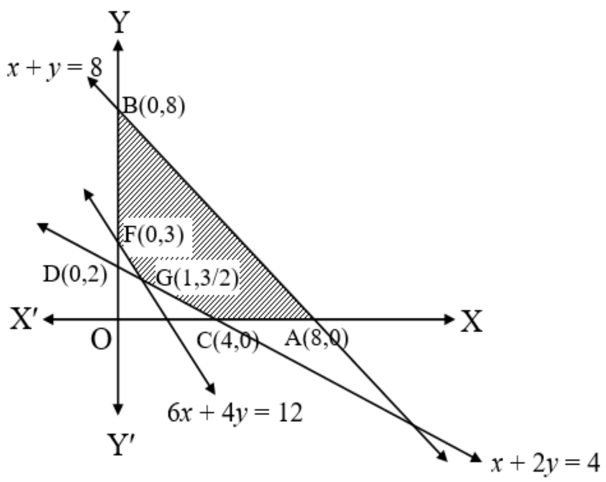
∴ z has infinite solutions on seg AE.

Q.2 The L.P.P. , minimize $z = 30x + 20y$, $x + y \leq 8$, $x + 2y \geq 4$, $6x + 4y \geq 12$, $x \geqslant 0, y \geqslant 0$ has

Correct option: (B)

The feasible region lies on the origin side of $x + y = 8$, on the non-origin side of $6x + 4y = 12$ and $x + 2y = 4$, and it is in the first quadrant.

The corner points of the feasible region are A(8,0), B(0, 8), F(0, 3), G $\left(1, \frac{3}{2}\right)$ and C(4, 0).



At A (8, 0), z = 30 (8) + 20(0) = 240

At B (0, 8), z = 3(0) + 20 (8) = 160

At F(0, 3), z = 30(0) + 20(3) = 60

At G(1, 3/2), z = 30(1) + 20(3/2) = 30 + 30 = 60

At C (4, 0), z = 30 (4) + 20(0) = 120

∴ z has minimum value at F (0, 3) and G $\left(1, \frac{3}{2}\right)$

.

∴ z has infinite solutions on seg FG.

Q.3

For the data given in the table, the constraints are

	Diet 1 (x_1)	Diet (x_2)	Minimum requirement
Proteins	2	15	30
Fats	12	6	48
Vitamins	5	10	20

Correct option: (B)

The required constraints are:

$2x_1 + 15x_2 \geq 30$, $12x_1 + 6x_2 \geq 48$, $5x_1 + 10x_2 \geq 20$, $x_1 \geq 0$, $x_2 \geq 0$

Q.4 A dealer wishes to purchase toys A and B. He has ₹ 580 and has space to store 40 items. A costs ₹ 75 and B costs ₹ 90. He can make profit of ₹ 10 and ₹ 15 by selling A and B respectively. Assuming that he can sell all the items that he can buy, formulate this as L.P.P. to maximize the profit.

Correct option: (A)

Let the number of toys A and B sold by the dealer be x and y respectively.

∴ $x \geq 0, y \geq 0$ …[∵ number of toys cannot be negative]

∴ objective function is Maximize z = $10x + 15y$.

Also, constraints are $x + y \leq 40$, $75x + 90y \leq 580$

Q.5 The maximum value of z = $50x + 15y$ subject to the constraints $x + y \leq 60$; $5x + y \leq 100$; $x \geq 0, y \geq 0$ is ______ at the point _____.

Correct option: (C)

The feasible region lies on the origin side of $x + y = 60$ and $5x + y = 100$, and it is in the first quadrant.

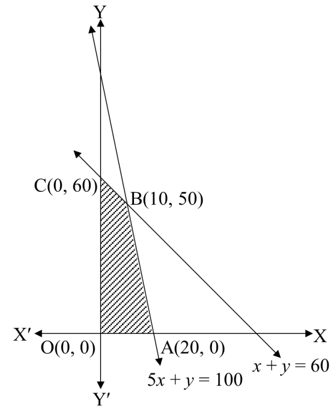
The corner points of the feasible region are O(0, 0), A(20, 0), B(10, 50) and C(0, 60).

At A(20, 0), z = 50(20) + 15(0) = 1000

At B(10, 50), z = 50(10) + 15(50) = 1250

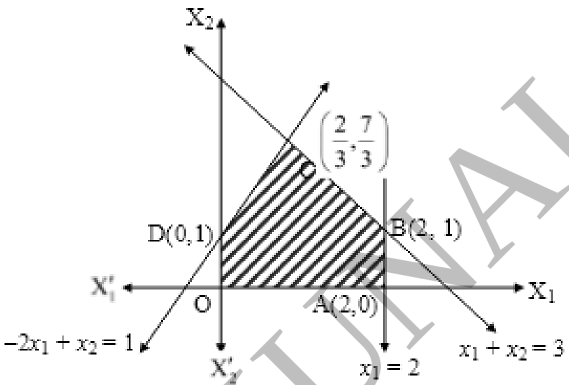
At C(0, 60), z = 50(0) + 15(60) = 900

∴ Maximum value of z is 1250 at B(10, 50).



Q.6 The LPP problem Max. z = $x_1 + x_2$ such that $-2x_1 + x_2 \le 1$, $x_1 \le 2$, $x_1 + x_2 \le 3$ and $x_1, x_2 \ge 0$ has

Correct option: (C)



Objective function z = $x_1 + x_2$

The corner points of feasible region are

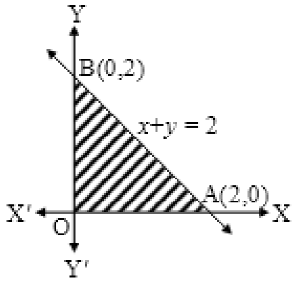
O(0, 0), A(2, 0), B(2, 1), C$\left(\frac{2}{3}, \frac{7}{3}\right)$ and D(0, 1)

At B(2, 1) and C$\left(\frac{2}{3}, \frac{7}{3}\right)$, z is maximum. Max z = 3

∴ Infinite number of solutions exists along BC.

Q.7 The point at which, the maximum value of Z = (3x + 2y) subject to the constraints $x + y \le 2$, $x \ge 0$, $y \ge 0$ obtained, is

Correct option: (C)



The feasible region lies on origin side of $x + y = 2$

The corners of feasible region are

A (2, 0), B (0, 2) and O (0, 0).

At (2, 0), Z = 3(2) + 2(0) = 6

At (0, 2), Z = 3(0) + 2(2) = 4

∴ The maximum value of Z is 6 at (2, 0)

Q.8 A printing company prints two types of magazines A and B. The company earns ₹ 10 and ₹ 15 on each magazine A and B respectively. These are processed on three machines I, II and III and total time in hours available per week on each machine is as follows:

	Magazine A (x)	Magazine B (y)	Time available
Machine I	2	3	36
Machine II	5	2	50
Machine III	2	6	60

The number of constraints is

Correct option: (C)

From the given table the constraints are $2x + 3y \le 36$; $5x + 2y \le 50$; $2x + 6y \le 60$

Also, $x \ge 0$, $y \ge 0$ …[∵ number of magazines cannot be negative]

∴ The number of constraints are 5.

Q.9 Maximum value of z = 4x + 5y subject to $y \le 2x$, $x \le 2y$, $x + y \le 3$, $x \ge 0$, $y \ge 0$ is

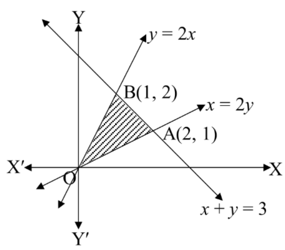
Correct option: (A)

The corner points of the feasible region are O(0, 0), A(2, 1) and B(1, 2).

At A(2, 1), z = 4(2) + 5(1) = 13

At B(1, 2), z = 4(1) + 5(2) = 14

∴ Maximum value of z is 14.



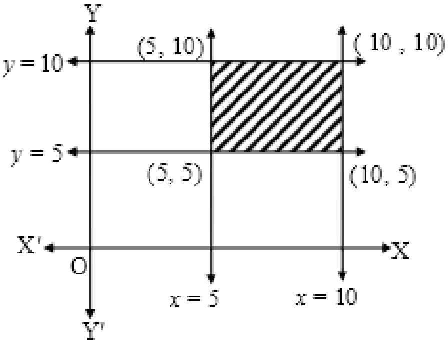
Q.10 The constraints of an LPP are $5 \le x \le 10$, $5 \le y \le 10$.

Determine the vertices of the feasible region formed by them

Correct option: (C)

Converting the given inequalities into equations, we get $x = 5$, $x = 10$, $y = 5$ and $y = 10$

The feasible region is as shown in the figure



∴ The vertices of the feasible region are (5, 5), (10, 5), (10,10) and (5, 10)

Q.11 The feasible region for the constraints $x-2 \leqslant y, x \geqslant y-1, x \geqslant 2, y \leqslant 4$,

$x, y \geqslant 0$**, is ______**

Correct option: (B)

The feasible region lies on the origin side of the lines $x - 2 = y$, $x = y - 1$, $y = 4$, and on the non-origin side of the line $x = 2$, in the first quadrant.

∴ Option (B) is the correct answer.

Q.12 The corner points of the feasible region determined by the system of linear constraints are (0, 2), (1, 1), (3, 3), (0, 4). Let z = px + qy, where p, q > 0. Condition on p and q so that the maximum of z occurs at both the points (3, 3) and (0, 4) is

Correct option: (A)

At (3, 3), z = 3p + 3q

At (0, 4), z = 4q

Since maximum occurs at (3, 3) and (0, 4),

3p + 3q = 4q

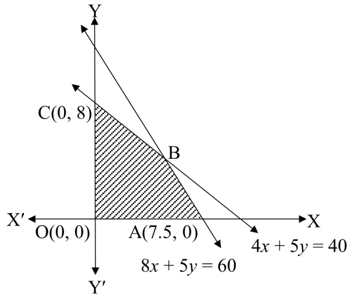
⇒ 3p = q

Q.13 The feasible region of L.P.P. Maximize Z = 70x + 50y subject to 8x + 5y ≤ 60, 4x + 5y ≤ 40 and x ≥ 0, y ≥ 0 is

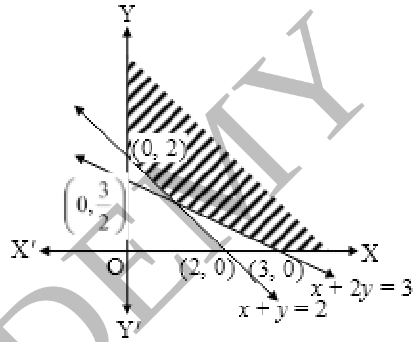
Correct option: (D)

The feasible region lies on the origin side of $8x + 5y = 60$ and $4x + 5y = 40$, and it is in the first quadrant.

∴ Feasible region is a quadrilateral.



Q.14 Maximize z = 2x + 3y, subject to the constraints x + y ≥ 2, x + 2y ≥ 3, x, y ≥ 0. The feasible region is shaded in the following graph



Correct option: (B)

The feasible region is unbounded. x and y can take arbitrary large values.

Hence, the problem has unbounded solution.

Q.15

The solution set of 2(x – 2) > x – 5 is given by

Correct option: (A)

Consider,

$2(x-2)>(x-5)$

$2x-4>x-5$

$x>-1$

The correct option is the graph that represents x > -1 which is shaded region to the right of -1 on the number line.

Q.16 The feasible region of the constraints (inequalities) x + y ≤ 5, 0 ≤ x ≤ 4 and 0 ≤ y ≤ 2 is

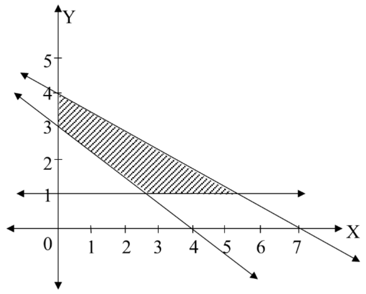
Correct option: (A)

Given inequations are $x + y \leq 5$, $x \leq 4$ and $y \leq 2$ which includes region towards origin.

Also, $x \geq 0$, $y \geq 0$ shows the first quadrant.

∴ option [A] is the correct answer.

Q.17 If feasible region is as shown in the figure, then related inequalities are



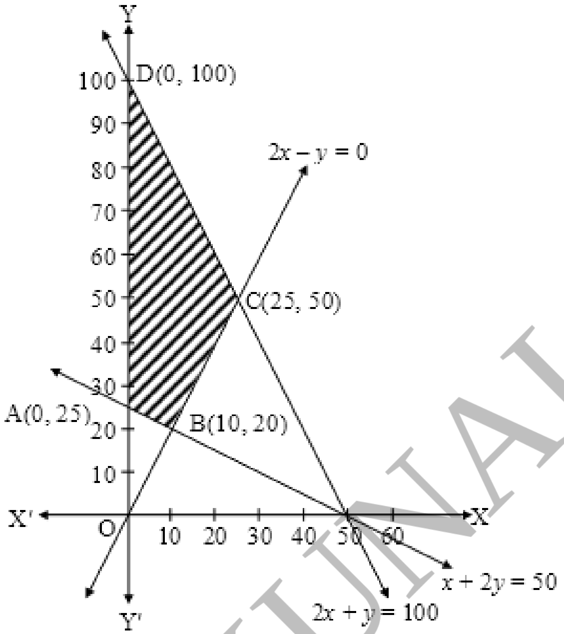
Correct option: (B)

The shaded region lies on the origin side of $4x + 7y = 28$ and above the line $y = 1$, and on the non-origin side of $3x + 4y = 12$.

$\therefore$ $3x + 4y \geq 12$, $4x + 7y \leq 28$, $y \geq 1$, $x \geq 0$, $y \geq 0$

Q.18 Minimize $Z = x + 2y$ subject to $x + 2y \geq 50$, $2x - y \leq 0$, $2x + y \leq 100$, $x \geq 0$, $y \geq 0$ has

Correct option: (C)



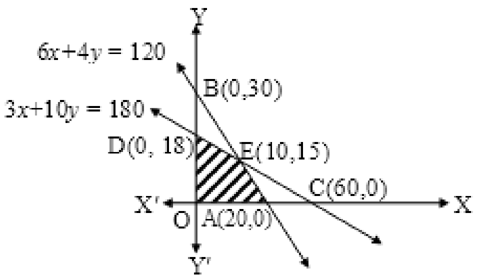
At A (0, 25), $Z = 0 + 2(25) = 50$

At B (10, 20), $Z = 10 + 2(20) = 50$

$\therefore$ Z has infinite solutions.

Q.19 The point which provides the solution of the linear programming problem, Max. $(45x + 55y)$ subject to constraints $x, y \geq 0$, $6x + 4y \leq 120$, $3x + 10y \leq 180$, is

Correct option: (B)



The feasible region lies on the origin side of the lines $6x + 4y = 120$ and $3x + 10y = 180$

The corner points of feasible region are O (0, 0), A (20, 0), E (10, 15) and D (0, 18)

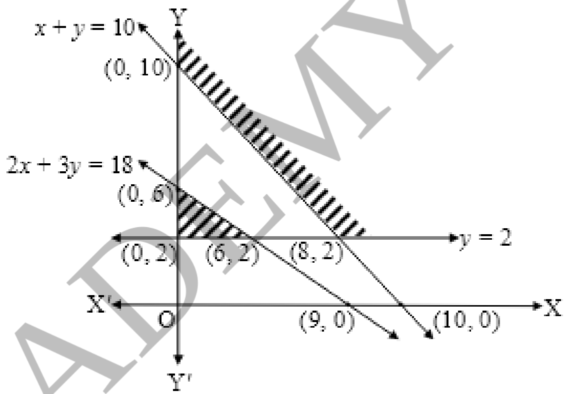
$\therefore$ The maximum value of $45x + 55y$ is at E (10, 15)

$\text{Max } (45x + 55y) = 45(10) + 55(15)$

$= 1275$

Q.20 The maximum value of $f = 4x + 3y$ subject to constraints $x \geq 0$, $y \geq 2$, $2x + 3y \leq 18$, $x + y \geq 10$ is

Correct option: (D)



The feasible regions are is disjoint. Hence, there is no point in common.

$\therefore$ There is no optimum value of the objective function.

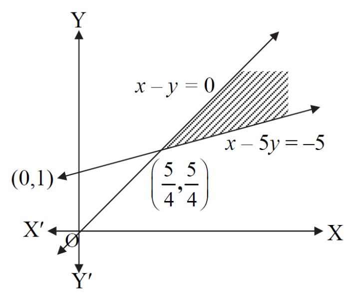
Q.21 The minimum value of the objective function $z = 2x + 10y$ for linear constraints $x \geq 0$, $y \geq 0$, $x - y \geq 0$, $x - 5y \leq -5$ is

Correct option: (B)

The feasible region is unbounded whose vertex is $\left(\frac{5}{4}, \frac{5}{4}\right)$.

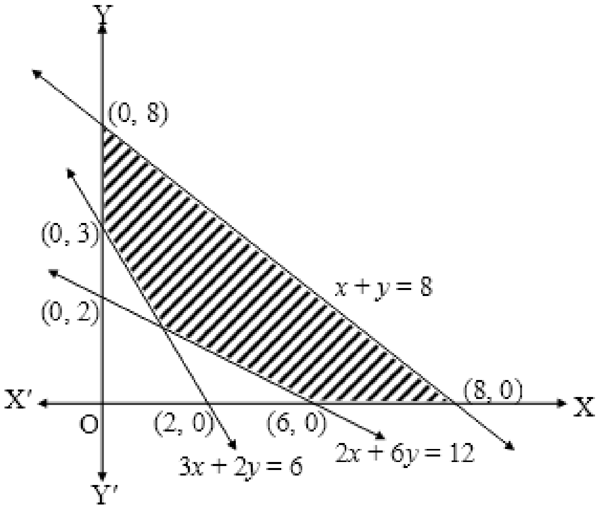
$\therefore$ Minimum $z = 2x + 10y$ is at $\left(\frac{5}{4}, \frac{5}{4}\right)$.

$\therefore$ $z = 2\left(\frac{5}{4}\right) + 10\left(\frac{5}{4}\right) = 15$



Q.22 The common region represented by the inequalities $3x + 2y \geq 6$, $2x + 6y \geq 12$, $x + y \leq 8$, $x \geq 0$, $y \geq 0$ is a

Correct option: (C)



Q.23 The maximum value of $2x + y$ subject to $3x + 5y \leq 26$ and $5x + 3y \leq 30$, $x \geq 0$, $y \geq 0$ is

Correct option: (A)

The feasible region lies on the origin side of $5x + 3y = 30$ and $3x + 5y = 26$, and it is in the first quadrant.

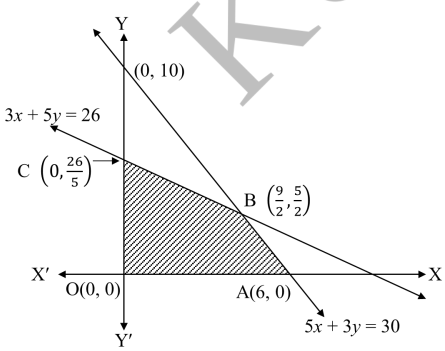
The corner points of the feasible region are O(0, 0), A(6, 0), B$\left(\frac{9}{2}, \frac{5}{2}\right)$ and C$\left(0, \frac{26}{5}\right)$.

At A(6, 0), z = 2(6) + 0 = 12

At B$\left(\frac{9}{2}, \frac{5}{2}\right)$, $z = 2\left(\frac{9}{2}\right) + \frac{5}{2} = 11.5$

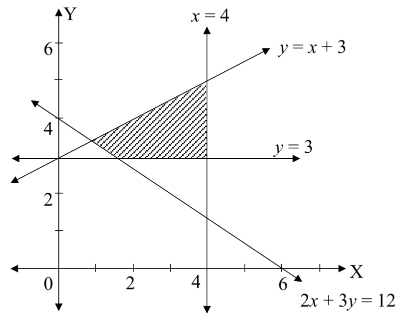
At C$\left(0, \frac{26}{5}\right)$, z = 2(0) + $\frac{26}{5}$ = 5.2

$\therefore$ Maximum value of z is 12.



Q.24 The shaded area in the figure given below is a solution set of a system of inequations.

The minimum value of objective function $3x + 5y$, subject to the linear constraints given by this system of inequations is



Correct option: (A)

Let the corner points of the feasible region be A, B, C, D.

Solving equations $y = 3$ and $2x + 3y = 12$, we get A = (1.5, 3)

Similarly, B = (4, 3), C = (4, 7), D = $\left(\frac{3}{5}, \frac{18}{5}\right)$

Let Z = $3x + 5y$

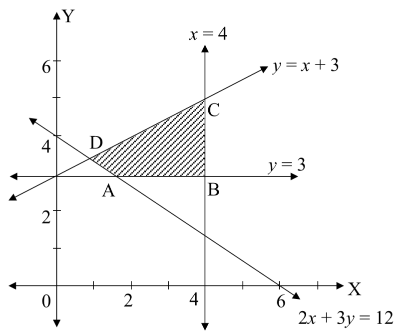
$\therefore$ Value of Z at point A = 19.5

Value of Z at point B = 27

Value of Z at point C = 47

Value of Z at point D = $\frac{99}{5}$

$\therefore$ Minimum value of Z is 19.5.



Q.25 The minimum value of $Z = 5x + 8y$ subject to $x + y \geq 5$, $0 \leq x \leq 4$, $y \leq 2$, $x \geq 0$.

Correct option: (C)

The feasible region lies on the origin side of $x = 4$ and $y = 2$, on the non-origin of $x + y = 5$, and it is in the first quadrant.

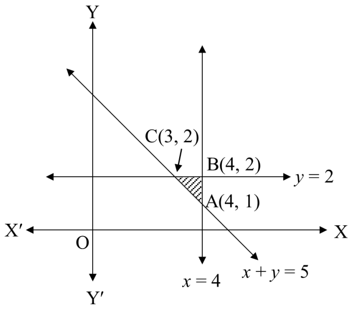
The corner points of the feasible region are A(4, 1), B(4, 2) and C(3, 2).

At A(4, 1), Z = 5(4) + 8(1) = 28

At B(4, 2), Z = 5(4) + 8(2) = 36

At C(3, 2), Z = 5(3) + 8(2) = 31

$\therefore$ Minimum value of Z is 28.


Y
C(3, 2)
B(4, 2)
y = 2
A(4, 1)
X′
X
O
x = 4
x + y = 5
Y′