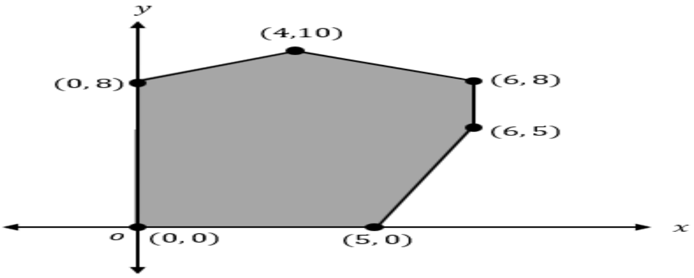
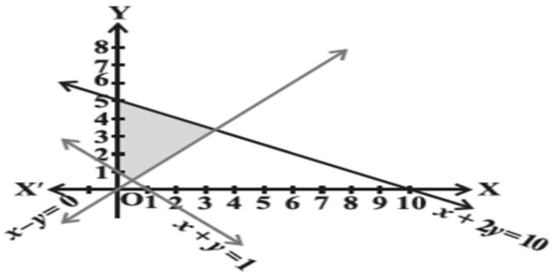
CHAPTER-12
LINEAR PROGRAMMING PROBLEMS
02 MARK TYPE QUESTIONS

<table>
<tr><th>Q. NO</th><th>QUESTION</th><th>MARK</th></tr>
<tr><td>1.</td><td>
The feasible solution for an LPP is shown in given figure. Let, $Z = 3x - 4yZ = 3x - 4y$ be the objective function.

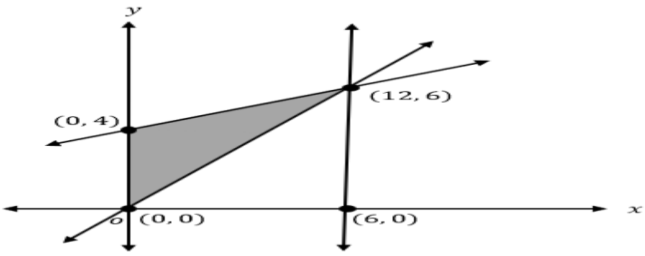
Determine a point in which ZZ attains its minimum value .



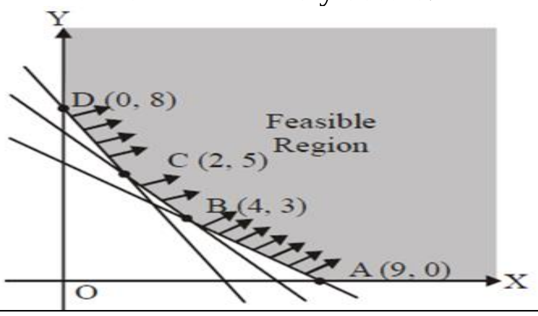
</td><td>2</td></tr>
<tr><td>2.</td><td>
Write the linear inequations for which the shaded area in the following figure is the solution set.



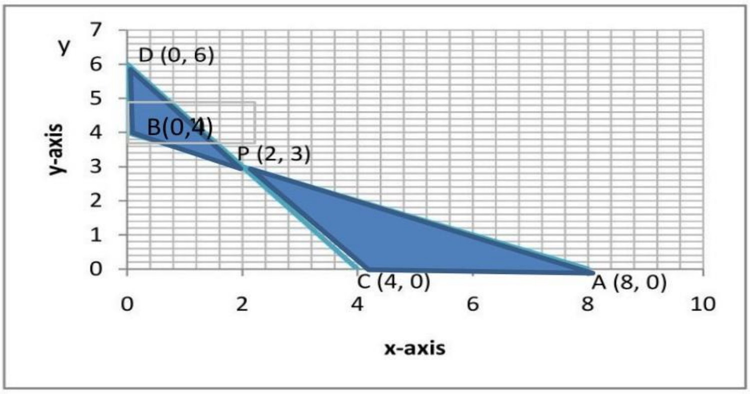
</td><td>2</td></tr>
<tr><td>3.</td><td>
The feasible region for an LPP is shown in the given figure. Let, $F = 3x - 4yF = 3x - 4y$ be the objective function. Find the Maximum value of FF



</td><td>2</td></tr>
<tr><td>4.</td><td>
Determine the minimum value of Z = 6x + 16y, in which the constraints are x $\leq 40 \leq 40$, y $\geq\geq$20 and x, y $\geq\geq$ 0
</td><td>2</td></tr>
<tr><td>5.</td><td>
. Feasible region for an LPP is shown shaded in the following figure. Find the point where minimum of Z = 4 x + 3 y occurs.



</td><td>2</td></tr>
<tr><td>6.</td><td>Maximize $Z = 3x + 4y$ subject to the constraints: $x + y \leq 4, x, y \geq 0$.</td><td>2</td></tr>
<tr><td>7.</td><td>Solve the following LPP graphically:
Minimize $Z = 5x + 10y$ subject to the constraints</td><td>2</td></tr>
</table>

	$x + 2y \leq 120$ $x + y \geq 60,$ $x - 2y > 0$ and $x, y \geq 0$	
8.	Solve the following LPP graphically: Maximize $Z = 40x + 50y$ subject to the constraints $3x + y \leq 9$ $x + 2y \leq 8,$ $x, y \geq 0$	2
9.	Solve the following linear programming problem graphically: Minimize Z = 200 x + 500 y subject to the constraints: $x + 2y \geq 10$ $3x + 4y \leq 24$ $x \geq 0, y \geq 0$	2
10.	Minimize $Z = 3x + 2y$ subject to the constraints $x + y \geq 8, 3x + 5y \leq 15, x \geq 0, y \geq 0$	2
11.	Find the Corner points of the following LPP: To maximize $Z = 2x + 5y$ Subject to $0 \leq x \leq 4,$ $0 \leq y \leq 3,$ $x + y \leq 6$	2
12.	 i) Vertically shaded region is determined by the following constraints: a) $x \geq 0, x + 2y \leq 8, 3x + 2y \geq 12$ b) $x \geq 0, x + 2y \leq 8, 3x + 2y \leq 12$ c) $x \geq 0, x + 2y \geq 8, 3x + 2y \leq 12$ d) None of the above ii) Horizontally shaded region is determined by the following constraints: a) $y \geq 0, 3x + 2y \geq 12, x + 2y \leq 8$ b) $y \geq 0, 3x + 2y \leq 12, x + 2y \leq 8$ c) $y \geq 0, 3x + 2y \geq 12, x + 2y \geq 8$ d) None of the above	2
13.	To minimize $Z = x + 2y$ Subject to $3x + 4y \leq 12$ $5x + 3y \leq 15$ $x, y \geq 0$ Solve the LPP.	2
14.	A manufacturer of bags makes two types of bags A and B. In a factory maximum 48 hours of time per week is available to get the work done. It takes 2 hours to make a bag A and 3	2

	hours to make a bag B. The profit per unit of A and B are Rs. 30 and Rs. 50 respectively. In a week highest 15 units of bag A and 10 units of bag B are to be sold.  Find out the production of each type of bags such that the profit be maximum.	
15.	A soft drink plant has two bottling machines P and Q. It produces and sells 500ml and 800ml bottles.  Weekly productions of the drink can not exceed 40,00,000 ml. and the market can absorb 4000 bottles of 500 ml and 1500 bottles of 800 ml per week. Profit on two types of bottles is 15 paise and 25 paise respectively. The planner wishes to maximize his profit to all the productions and marketing restrictions. Solve it as a LPP.	2
16.	Maximize $Z = 5x+7y$ subject to the constraints $x + y \leq 4$, $3x+8y \leq 24$, $10x+7y \leq 35$ $x,y \geq 0$	2
17.	Minimize $Z = 3x+5y$ subject to constraints $-2x+y \leq 4$, $x+y \geq 3$, $x-2y \leq 2$ $x,y \geq 0$	2
18.	Maximize $Z = 8x+9y$ subject to the constraints $2x + 3y \leq 6$, $3x - 2y \leq 6$, $y < 1$, $x, y \geq 0$	2

19.	Maximize Z =25x+15y subject to constraints 2x+y ≤ 12, 3x+2y ≤ 20, x,y≥ 0 is	2
20.	Minimize Z=4x +6y subject to constraints 4x+3y ≥ 100, 3x+6y ≥ 80, and x, y ≥ 0 is	2

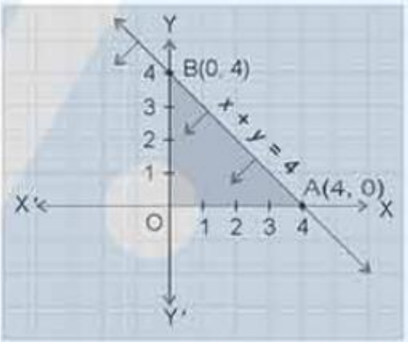
ANSWERS:

<table>
<tr><th>Q. NO</th><th>ANSWER</th><th>MARKS</th></tr>
<tr><td>1.</td><td>$(0,8)(0,8)$</td><td>2</td></tr>
<tr><td>2.</td><td>x + 2y ≤ 10, x + y ≥ 1, x – y ≤ 0, x , y≥ 0</td><td>2</td></tr>
<tr><td>3.</td><td>1212</td><td>2</td></tr>
<tr><td>4.</td><td>320</td><td>2</td></tr>
<tr><td>5.</td><td>(2,5)</td><td>2</td></tr>
<tr><td>6.</td><td>

Table of values for line $x + y = 4$

<table>
<tr><td>x</td><td>0</td><td>4</td></tr>
<tr><td>y</td><td>4</td><td>0</td></tr>
</table>

Feasible region of the LPP is as shown in the figure



Corner point of the LPP is (0,0), (0,4), (4,0)

<table>
<tr><th>Corner Point</th><th>$z = 3x + 4y$</th></tr>
<tr><td>(0,0)</td><td>0</td></tr>
<tr><td>(4,0)</td><td>12</td></tr>
<tr><td>(0,4)</td><td>16= M</td></tr>
</table>

Hence max value of Z is 16 at point (0,4).

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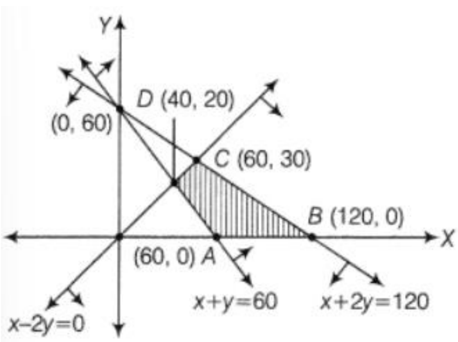
<tr><td>7.</td><td>

The feasible region of the LPP is shown in the figure



<table>
<tr><th>Corner Points</th><th>$Z = 5x + 10y$</th></tr>
<tr><td>(60,0)</td><td>300(minimum)</td></tr>
<tr><td>(120,0)</td><td>600</td></tr>
<tr><td>(60,30)</td><td>600</td></tr>
<tr><td>(40,20)</td><td>400</td></tr>
</table>

Hence the minimum value of the Z is 300 at the point (60,0).

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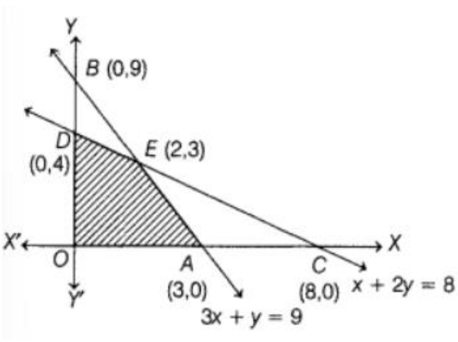
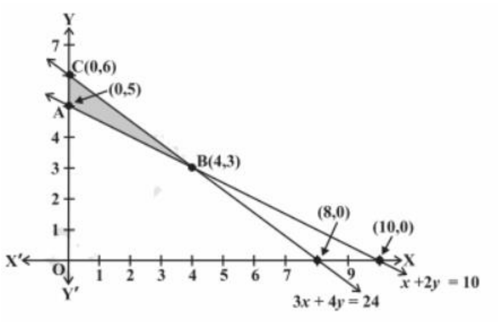
8. The feasible region of the LPP is shown in the figure



Corner Points	$Z = 40x + 50y$
(0,0)	0
(3,0)	120
(2,3)	230
(0,4)	200

Hence the maximum value of Z is 230 at point (2,3).

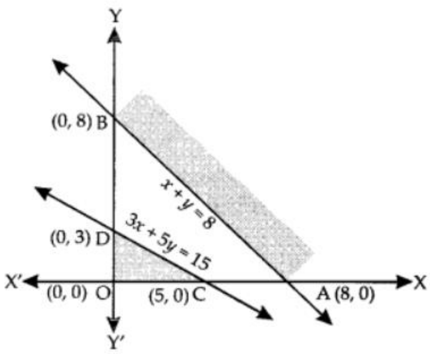
9. The feasible region of the given LPP is as shown below



Corner Points	Z
(0,5)	2500
(4,3)	2300 Minimum
(0,6)	3000

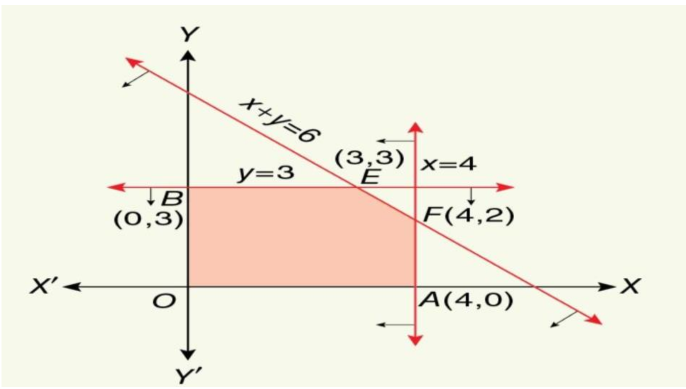
Hence the minimum value of Z is 2300 at point (4,3).

10. The region made by the given linear constrains as given in the figure



It is observed that there is no point which satisfies all the linear constrains simultaneously. Thus, there is no feasible region.
Hence, there is no feasible solution.

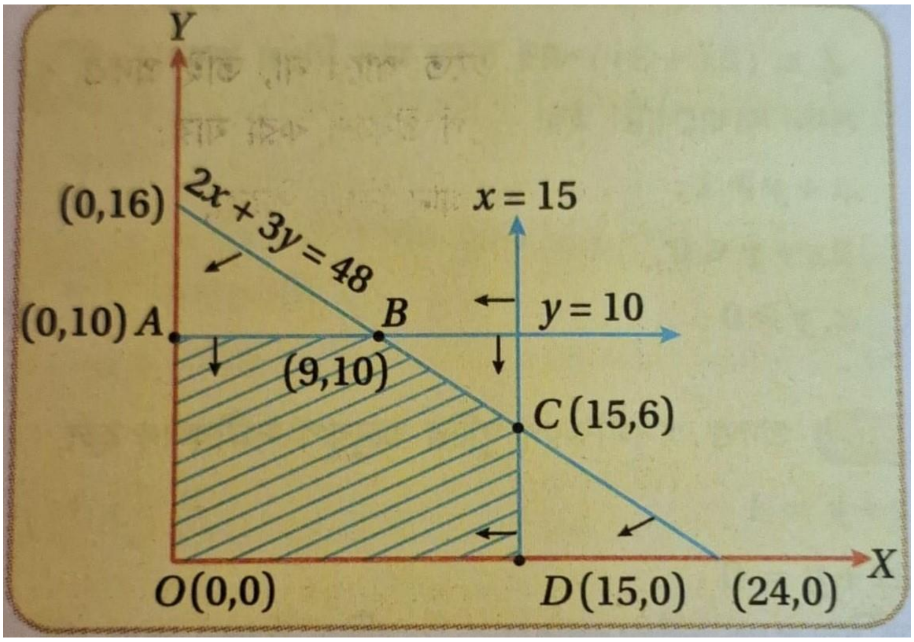
11. (Marks: 2)



In the feasible region OAFEB
The Corner points are O(0,0), A(4,0),F(4,2), E(3,3), B(0,3)

12. (Marks: 2)

i) c)
ii) a)

13.	OX and OY are two axes. $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$ represent the straight lines $5x + 3y = 15$ and $3x + 4y = 12$ respectively. The convex set of the feasible region is OABC where the extreme points O(0,0), A(3,0), B($\frac{24}{11}, \frac{15}{11}$), C(0,3) Now, At O, $Z = 0 + 2 \times 0 = 0$ At A, $Z = 3 + 2 \times 0 = 3$ At B, $Z = \frac{24}{11} + 2 \times \frac{15}{11} = \frac{54}{11}$ At C, $Z = 0 + 2 \times 3 = 6$ Thus Min $Z = 0$ At O(0,0)	2
14.	Let, the number of bag A and bag B are x and y respectively. Then the profit is $30x + 50y$ From the conditions, we get $2x + 3y \leq 48$, Since x and y can not be negative, then, $x, y \geq 0$ Thus the required problem is, Maximize, $Z = 30x + 50y$, Subject to $2x + 3y \leq 48$ $x \leq 15$, $y \leq 10$ and $x, y \geq 0$  In Cartesian Plane, we have drawn three straight lines such that $2x + 3y = 48, x = 15, y = 10$. The convex set of the feasible region is PQRSO. It is a bounded region and the corner points are O(0,0), P(0,10), Q(9,10), R(15,6), S(15,0). Now, At O, $Z = 30 \times 0 + 50 \times 0 = 0$ At P, $Z = 30 \times 0 + 50 \times 10 = 500$ At Q, $Z = 30 \times 9 + 50 \times 10 = 770$ At R, $Z = 30 \times 15 + 50 \times 6 = 750$ At S, $Z = 30 \times 15 + 50 \times 0 = 450$ Thus Max Z= 770 at Q(9,10), Hence, the productions of Bag A and B are 9 and 10 respectively. And maximum profit is Rs. 770	2

15.	Let, x and y be number of 500 ml and 800 ml bottles produced to get over all maximum profit. Then the profit is Rs. $(x \times \frac{15}{100} + y \times \frac{25}{100})$ = Rs. $(0.15x + 0.25y)$ (say) From the market condition, we get $x \leq 4000$ $y \leq 1500$ The amount of soft drinks is $(500x + 800y)$ ml Then $(500x + 800y) \leq 40{,}00{,}000$ Thus the problem is, Maximize, $Z = 0.15x + 0.25y$ Subject to $(500x + 800y) \leq 40{,}00{,}000$ $x \leq 4000$ $y \leq 1500$ and $x, y \geq 0$ Here from the equations $(500x + 800y) = 40{,}00{,}000$, $x = 2500$, $y = 7000$ we get the extreme points. They are O(0,0), C(4000,0), A(4000,2500), B(5600,1500), D(0,1500) Now, At O, $Z = 0.15 \times 0 + 0.25 \times 0 = 0$ At C, $Z = 0.15 \times 4000 + 0.25 \times 0 = 600$ At A, $Z = 0.15 \times 4000 + 0.25 \times 2500 = 1225$ At B, $Z = 0.15 \times 5600 + 0.25 \times 1500 = 1215$ At D, $Z = 0.15 \times 0 + 0.25 \times 1500 = 375$ Thus, Max $Z = 1225$ at $x = 4000, y = 2500$	2
16.	Maximum value of Z = 124/5 at (8/5,12/5)	2
17.	Minimum value of Z =9 at (3,0)	2
18.	Maximum value of Z =22.62 at x= 30/13 and y =6/13	2
19.	Z= 60 at x=4 and y =4	2
20.	Z = 104 when x =24 and y =4/3	2