MATHS

BOOKS - ACCURATE PUBLICATION

LINEAR PROGRAMMING

Example

1. Solve the following linear programming problem graphically:

Maximise Z = 4x+y subject to the constraints :

$x + y \leq 50$

$3x + y \leq 90$

$x \geq 0, y \geq 0$

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2. Solve the following linear programming problem graphically:

Maximise z = 17x+7y subject to the constraints : $x + 3y \leq 12, 3x + y \leq 12, x, y \geq 0$

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3. Solve the following linear programming problem graphically:

Maximise z = $7x + 10y$ subject to the constraints :

$2x + 3y \leq 120, 2x + y \leq 80, x \geq 10, x, y \geq 0$

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4. Solve the following linear programming problem graphically : Minimize $Z = -3x + 4y$ subject to constraints $x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0, y \geq 0.$

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5. Solve the following linear programming problem graphically : Minimize $Z = -3x + 4y$ subject to constraints $x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0, y \geq 0.$

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6. Solve the following linear programming problem graphically:

Miximise $Z = 5x + 3y$ subject to the constraints :

$3x + 5y \leq 15$

$5x + 2y \leq 10$

$x \geq 0, y \geq 0$

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7. Solve the following linear programming problems graphically

Maximize $Z = 6x + 5y$ subject to constraints

$3x + 5y \leq 15, 5x + 2y \leq 10, x, y \geq 0$

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8. Solve the following linear programming problem graphically:

Minimise $Z = 3x + 2y$ subject to the constraints :

$x + 2y \leq 10$

$3x + y \leq 15$

$x, y \geq 0$

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9. Maximize $z = 15x + 5y$, subject to the constraints

$2x + 3y \leq 12$

$3x + 2y \leq 12$

$x \geq 0, y \geq 0$

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10. Solve the following linear programming problems graphically

Maximize $Z = 4x + 7y$ subject to constraints

$x + 2y \leq 20, x + y \leq 15, x \geq 0, y \geq 0$

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11. Solve the following linear programming problem graphically:

Miximise $Z = 10x + 12y$ subject to the constraints :

$2x + 2y \leq 30$

$3x + y \leq 17$

$x, y \geq 0$

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12. Solve the following linear programming problem graphically:

Miximise $Z = 4x + 5y$ subject to the constraints :

$3x + y \leq 9$

$x + 2y \leq 8$

$x, y \geq 0$

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13. Solve the following linear programming problem graphically:

Miximise $Z = 2x + 3y$ subject to the constraints :

$x + 2y \leq 10$

$2x + y \leq 14$

$x, y \geq 0$

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14. Solve the following linear programming problem graphically:

Miximise $Z = 13x + 3y$ subject to the constraints :

$x + y \leq 6$

$3x + 2y \leq 15$

$x \geq 0, y \geq 0$

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15. Solve the following linear programming problem graphically:

Miximise $Z = 10x + 7y$ subject to the constraints :

$3x + y \leq 9$

$3x + 2y \leq 12$

$x \geq 0, y \geq 0$

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16. Solve the following linear programming problem graphically : Maximize : $z = 5x + 7y$ Subject to the constraints : $x + 3y \leq 60, x + y \leq 30, x \geq 0, y \geq 0$

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17. Solve the following linear programming problem graphically : Maximize : $z = 3x + 5y$ subject to the constraints : $x + 4y \leq 80, x + y \leq 50x \geq 0, y \geq 0.$

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18. Solve the following linear programming problem graphically:

Minimise $Z = 5x + 3y$ subject to the constraints :

$x + 2y \leq 8$

$x + 2y \leq 12$

$x \geq 0, y \geq 0$

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19. Solve the following linear programming problem graphically : Maximize : $z = 3x + 2y$ subject to the constraints : $x + 2y \leq 10, 3x + y \leq 15, x \geq 0, y \geq 0$

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20. Maximise and Minimise :

$Z = 4x + 3y - 7$ subject to the constraints:

$x + y \leq 10, x + y \geq 3, , x \leq 8, y \leq 9, x, y \geq 0$

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21. Maximise and Minimise

$z = 3x + 2y - 3$ subject to the constraints:

$x + y \geq 4, x + y \leq 12, , x \leq 9, y \leq 9, x, y \geq 0$

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22. Maximize $Z = 12x + 24y$ subject to the constraints

$x + y \geq 5, 5x + 7y \leq 35, x - y \geq 0, x, y \geq 0$

graphically.

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23. Solve the following linear programming problem graphically:

Minimise $Z = 2x + 3y$ subject to the constraints :

$x + y \leq 100$

$x + y \leq 60$

$x \leq 60$

$y \leq 50$

$x \geq 0, y \geq 0$

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24. Solve the following linear programming problem graphically:

Minimise $Z = 2x + 3y$ subject to the constraints :

$x + y \leq 200$

$x + y \leq 80$

$x \leq 80$

$y \geq 60$

$x \geq 0, y \geq 0$

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25. Solve the following linear programming problem graphically:

Minimise $Z = 2x + 3y$ subject to the constraints :

$x + y \leq 80$

$x + y \leq 40$

$x \leq 40$

$y \geq 60$

$x \geq 0, y \geq 0$

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26. Solve the following linear programming problem graphically: Minimise $Z = 200x + 500y$ subject to the constraints: $x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$

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27. Solve the following linear programming problem graphically:

Miximise $Z = 9x + 10y$ subject to the constraints :

$x + 2y \leq 6$

$x + y \leq 5$

$x \geq 3$

$x \geq 0, y \geq 0$

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28. Solve the following linear programming problem graphically:

Minimise $Z = 8x + 9y$ subject to the constraints :

$x + y \leq 6$

$x + 2y \leq 8$

$x \geq 2$

$x \geq 0, y \geq 0$

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29. Solve the following linear programming problem graphically:

Miximise $Z = 2x + 6y$ subject to the constraints :

$x + y \leq 10$

$x + 2y \leq 7$

$x \geq 2$

$x \geq 0, y \geq 0$

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30. Solve the following linear programming problem graphically:

Miximise $Z = x + 2y$ subject to the constraints :

$x + 2y \geq 100$

$2x - y \leq 0$

$2x + y \leq 200$

$x \geq 0, y \geq 0$

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31. Solve the following linear programming problem graphically:

Miximise $Z = x + 2y$ subject to the constraints :

$7x + 10y \leq 70$

$x - 2y \geq 0$

$2x + y \geq 10$

$x \geq 0, y \geq 0$

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32. Graphically maximize $Z = 3x + 9y$ subject to the constraints

$x + 3y \leq 60, x + y \geq 10, x \leq y, x \geq 0, y \geq 0$

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33. Maximise $z = 22x + 44y$ subject to the constraints

$x + y \geq 3, 3x + 8y \leq 24, x - y \geq 0, x, y \geq 0$

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34. Maximise and minimize $Z = 12x + 18y$ subject to the constraints

$x + y \leq 10, x - y \leq 0, x + 2y \geq 10, x, y \geq 0$

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35. Solve the following linear programming problem graphically:

Miximise $Z = 12x + 24y$ subject to the constraints :

$x + y \geq 5$

$5x + 7y \leq 35$

$x - y \geq 0$

$x, y \geq 0$

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36. Solve the following linear programming problem graphically:

Minimise $Z = 52x + 26y$ subject to the constraints :

$x + y \geq 5$

$5x + 8y \leq 40$

$x - y \geq 0$

$x, y \geq 0$

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37. Maximise and minimize $Z = 15x + 30y$ subject to the constraints

$x + y \leq 8$

$2x - y \geq 8$

$x - 2y \geq 0$

$x, y \geq 0$

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38. Solve the following linear programming problem graphically:

Minimise $Z = 5x + 10y$ subject to the constraints :

$x + 2y \leq 120$

$x + y \geq 60$

$x - 2y \geq 0$

$x, y \geq 0$

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39. Graphically minimise and maximise $z = 7x + 8y$ subject to the constraints

$x + y \geq 50$

$x + 2y \leq 100$

$x - y \geq 10$

$x, y \geq 0$

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40. Solve the following linear programming problem graphically:

Miximise $Z = 9x + 10y$ subject to the constraints :

$9x + 2y \geq 20$

$x - 2y \leq 0$

$x - y \leq 9$

$x \geq 0, y \geq 0$

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41. Solve the following linear programming problem graphically:

Miximise $Z = 12x + 48y$ subject to the constraints :

$7x + 10y \leq 70$

$x - 2y \geq 0$

$2x + y \geq 10$

$x \geq 0, y \geq 0$

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42. Solve the following linear programming problem graphically:

Miximise $Z = 6x + 9y$ subject to the constraints :

$2x - y \geq 0$

$2x - y \geq 8$

$10x + 11y \leq 80$

$x \geq 0, y \geq 0$

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43. Graphically minimize and maximize $z = 3x + 4y$ subject to the constraints: $x + y \leq 40x + 2y \leq 80, x - 2y \geq -20x, y \geq 0$

.

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44. Solve the following linear programming problem graphically:

Minimise $Z = 7x + 4y$ subject to the constraints :

$5x + 2y \geq 100$

$3x + 5y \leq 150$

$9x + 8y \leq -360$

$x \geq 0, y \geq 0$

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45. Solve the following linear programming problem graphically:

Minimise $Z = 4x + 3y$ subject to the constraints :

$3x - y \geq 90$

$x + 5y \leq 100$

$8x + 5y \leq 400$

$x \geq 0, y \geq 0$

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46. Solve the following linear programming problem graphically :

Minimise $Z = 6x + 3y$

subject to the constraints

$$4x + y \geq 80$$
$$x + 5y \geq 115$$
$$3x + 2y \leq 150$$
$$x \geq 0, \quad y \geq 0$$

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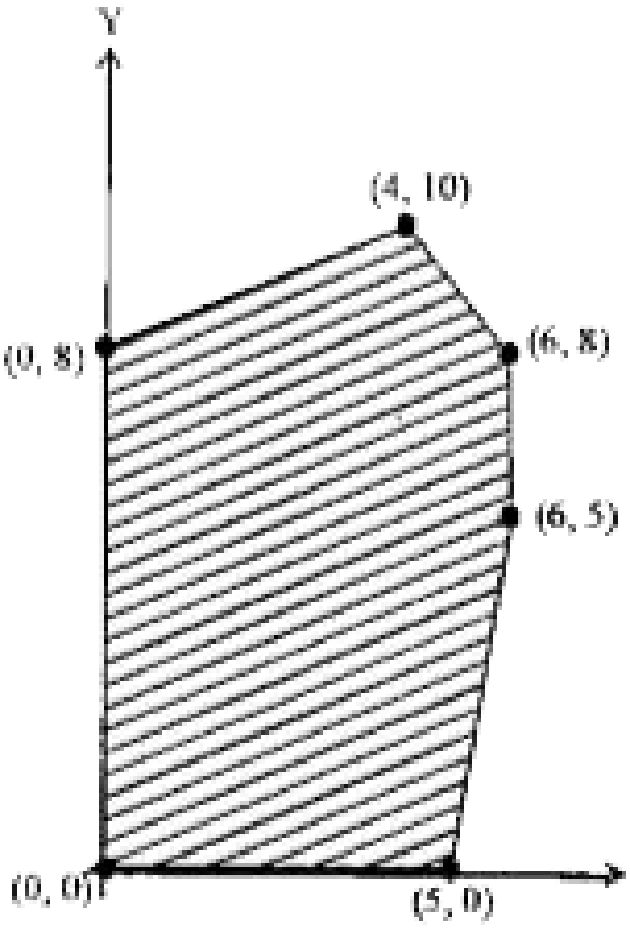
Questions Carrying 1 Mark Type I Multiple Choice Questions

1. The feasible solution for a LPP is shown in Fig. Let. Z = 3x - 4 y be the objective function. Minimum of Z occurs at



A. (0,0)

B. (0,8)

C. (5,0)

D. (4,0)

Answer: B

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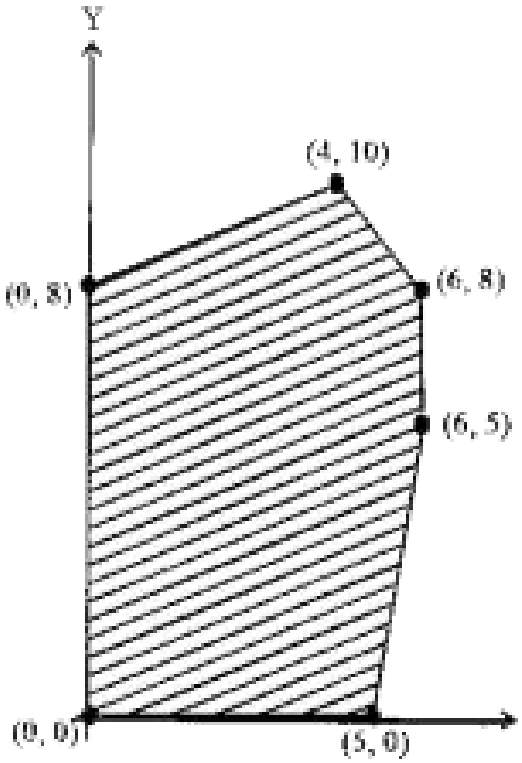
2. The feasible solution for a LPP is shown in Fig. Let. Z = 3x-4 y be the objective function.

Maximum of Z occurs at:



A. (5,0)

B. (6,5)

C. (6,8)

D. (4,10)

Answer: A

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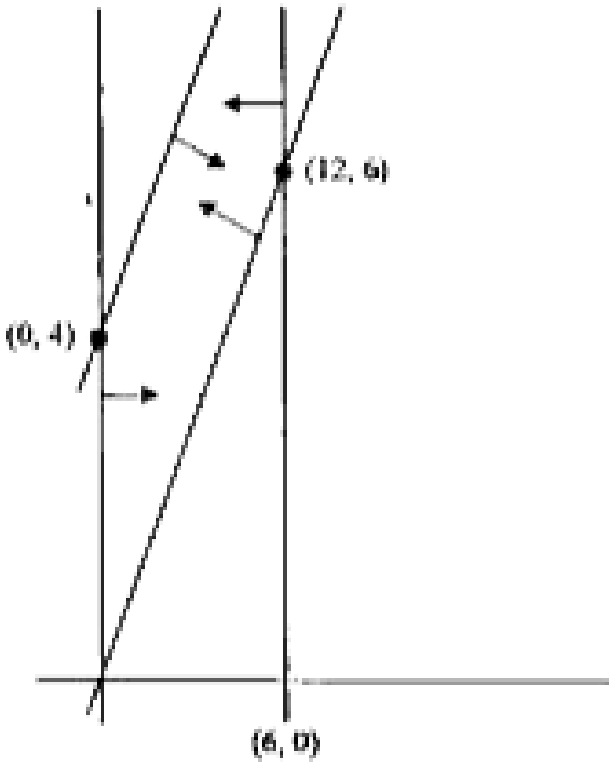
3. The feasible region for an LPP is shown in the figure. Let $F = 3x - 4y$ be the objective

function. Maximum value of F is:



A. 0

B. 8

C. 12

D. -18

Answer: C

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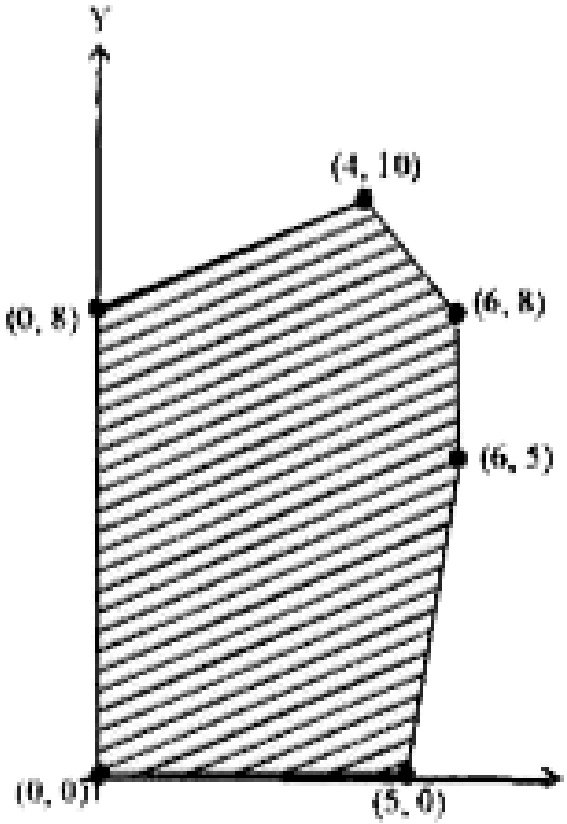
4. The feasible solution for a LPP is shown in Fig. Let. Z = 3x-4 y be the objective function.

Minimum value of F is



A. 0

B. -16

C. 12

D. does not exist

Answer: D

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5. Corner points of the feasible region for an LPP are (0,2), (3,0), (6,0), (6, 8) and (0,5).

Let F = 4x+6 y be the objective function.

The Minimum value of F occurs at

A. (0, 2) only

B. (0, 3) only

C. the mid point of the line segment joining the points (0, 2) and (3,0) only

D. any point on the line segment joining the points (0, 2) and (3,0)

Answer: D

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6. Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let Z = px+qy, where $p, q > 0$. Condition on p and q so that the minimum of Z occurs at (3,0) and (1, 1) is :

A. $p = 2q$

B. $p = \frac{q}{2}$

C. $p = 3q$

D. $p = q$

Answer: B

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7. The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 15), (15, 15), (0 20). Let Z = px + qy, where $p, q > 0$. Condition on p and q so that the maximum of Z occurs at both the points (15, 15) and (0, 20) is

A. $p = q$

B. $p = 2q$

C. $q = 2p$

D. $q = 3p$

Answer: D

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8. The point which does not lie in the half-plane $3x + 7y - 32 \leq 0$ is

A. (3,4)

B. (-3,4)

C. (3,-4)

D. (2,3)

Answer: A

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9. Quadrant represented by the region $x \geq 0, y \leq 0$ is

A. First

B. Second

C. Third

D. Fourth

Answer: D

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10. The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0,40), (20,40), (60, 20), (60, 20), (60,0). The objective function is Z=4x+3 y Compare the quantity in Column A and

Column B

Column A	Column B
Maximum of Z	325

A. The quantity in column A is greater

B. The quantity in column B is greater

C. The two quantities are equal

D. The relationship can not be determined on the basis of the information supplied

Answer: B

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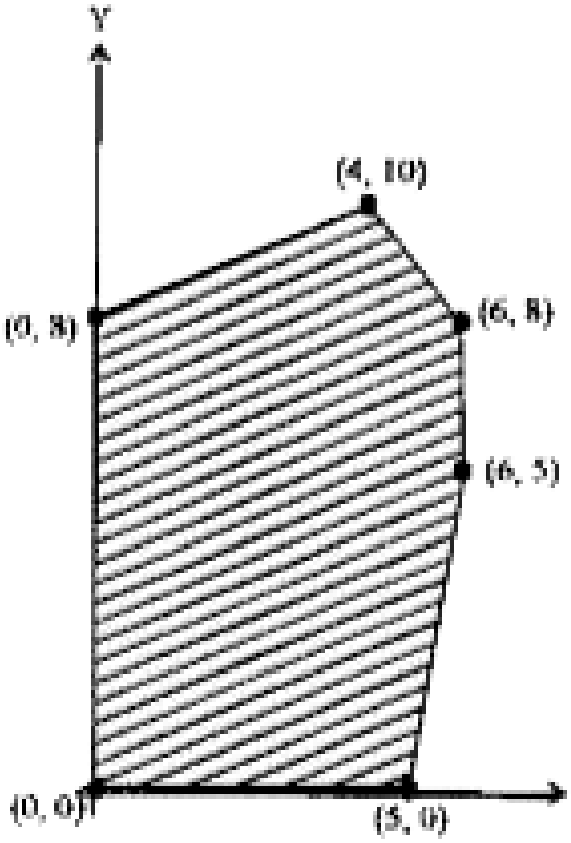
11. The feasible solution for a LPP is shown in Fig. Let, Z=3x-4 y be the objective function. (Maximum value of Z+ Minimum value of Z) is equal to :



A. 13

B. 1

C. -13

D. -17

Answer: D

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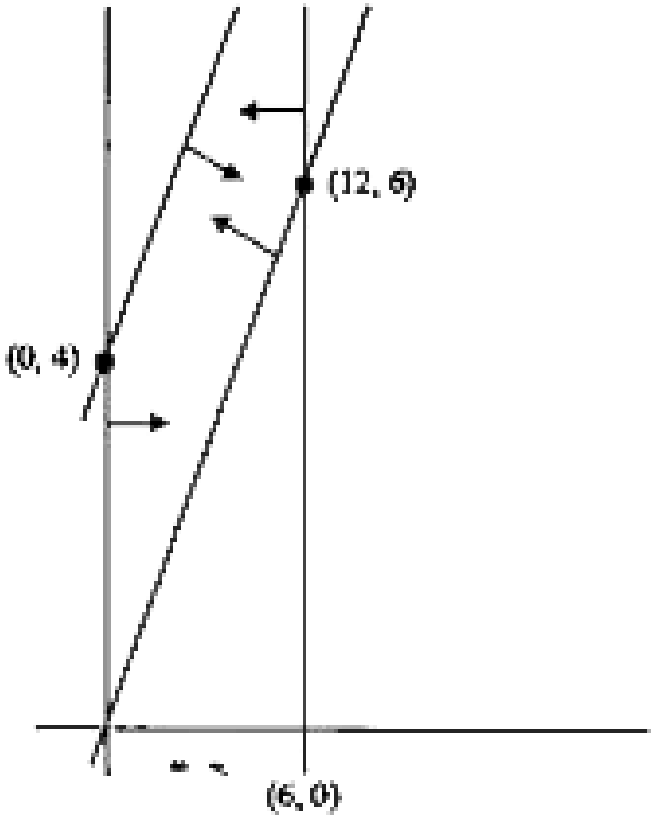
12. The feasible region for an LPP is shown in the figure . Let F = 3 x - 4 y be the objective

function. Minimum value of F is:



A. 0

B. -16

C. 12

D. does not exist

Answer: D

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13. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6,0), (6, 8) and (0,5).

Let $F = 4x + 6$ y be the objective function.

The Maximum of F - Minimum of F =

A. 60

B. 48

C. 42

D. 18

Answer: A

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14. The point which does not lie in the half-plane $4x + 5y - 36 \leq 0$ is

A. (3,4)

B. (-3,4)

C. (3,-4)

D. (4,5)

Answer: D

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15. Quadrant represented by the region $x \geq 0, y \geq 0$ is first.

A. First

B. Second

C. Third

D. Fourth

Answer: A

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Questions Carrying 1 Mark Type Ii Fill In The Blanks Questions

1. In a LPP, the linear inequalities or restrictions on the variables are called .....

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2. In a LPP, the linear function which has to be maximised or minimised is called a linear ..... function.

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3. The common region determined by all the linear constraints of a LPP is called the ..... region.

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4. A corner point of a feasible region is a point I the region which is the ..... Of two boundary lines.

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5. Maximise $Z = 3x + 4y$, subject to the constraints $x + y \leq 4, x \geq 0, y \geq 0$

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6. The point in the half-plane $x + 2y - 7 \geq 0$ is equal to .....

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7. In a LPP, the objective function is always .....

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8. In a LPP if the objective function Z= ax + by has the same maximum value on two comer points of the feasible region, then every point on the line segment joining these two points give the same ..... value.

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9. A feasible region of a system of linear inequalities is said to be ..... If it can be enclosed within a circle.

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10. The feasible region for no. LPP is always a ..... polygon.

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11. The maximum value of $Z = 3x + 5y$ subject to the contraints : $x + y \leq 4, x \geq 0, y \geq 0$ is :

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Questions Carrying 1 Mark Type Iii True Or False Questions

1. If the feasible region for a linear programming problem is bounded, then the

objective function Z = ax+by has both a maximum and a minimum value on R.

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2. The minimum value of the objective function Z = a x + b y in a linear programming problem always occurs at only one comer point of the feasible region.

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3. Maximum value of the objective function $Z = ax + by$ in a LPP always occurs at only one corner point of the feasible region.

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4. In a LPP the minimum value of the objective function Z= ax+by is always 0 if origin is one of the corner point of the feasible region.

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5. In a LPP, the maximum value of the objective function Z-ax+by is always finite.

6. Linear function Z= ax + by, where a, b are constants, which has to be maximised or minimized, is called a linear objective function.

7. The linear inequalities or equations or restrictions on the variables of a linear programming problem are called constraints.

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8. A problem which seeks to maximise or minimise a linear function (say of two variables x and y) subject to certain constraints as determined by a set of linear inequalities is called an optimisation problem.

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9. Any point in the feasible region that gives the optimal value (maximum or minimum) of the objective function is called an optimal solution.

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10. Any point which satisfies $x \geq 0, y \geq 0$ lies in second quadrant.

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Questions Carrying 6 Marks

1. Find the maximum value of f = x+2 y subject to the constraints

$2x + 3y \leq 6$

$x + 4y \leq 4$

$x, y \geq 0$

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2. Maximize $z = 9x + 3y$ subject to the constraints

$2x + 3y \leq 13$

$2x + y \leq 5$

$x, y \geq 0$

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3. Solve the following linear programming problem graphically.

Maximize $z = 11x + 5y$

subject to the constraints

$3x + 2y \leq 25, x + y \leq 10, x, y \geq 0$

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4. Maximize z = 30 x + 19y such that $x + y \leq 24, x + \frac{1}{2}y \leq 16, x \geq 0, y \geq 0$.

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5. Minimize $Z = 2x + 3y$ subject to

$1 \leq x + 2y \leq 10, x, y \geq 0$

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6. Solve the following linear programming problem graphically.

Maximize $Z = 3x + 9y$

subject to the constraints $x + 3y \leq 60$

$x + y \geq 10$

$x \leq y$

$x \geq 0, y \geq 0$

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7. Solve the following linear programming problem graphically:

Miximise $Z = x + 2y$ subject to the constraints :

$x + 2y \geq 100$

$2x - y \leq 0$

$2x + y \leq 200$

$x \geq 0, y \geq 0$

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