MATHS

BOOKS - PRADEEP PUBLICATION

LINEAR PROGRAMMING

Example

1. Draw the graph of the inequalities $2x + 3y \geq 6$

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2. Show graphically, that the solution set of the following system of inequalities is empty:

$x - 2y \geq 0, 2x - y \leq -2, x \geq 0$ and $y \geq 0.$

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3. Find the maximum value of Z=2x+3y subject to $x + y \leq 4, x \geq 0, y \geq 0$ using graphical method.

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4. Determine the maximum value of z=11x+7y subject to the constraints.

$2x + y \leq 6, x \leq 2, x \geq 0, y \geq 0.$

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

$x + y \geq 8, 3x + 5y \leq 15, x \geq 0, y \geq 0$

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6. A company manufactures two articles A and B. there are two departments through which these articles are processed,

assembly and

finishing departments. The maximum capacity of the assembly department is 60 hours a week and that of finishing department is 48 hours a week. production of each unit of article A requires 4 hours in assembly and 2 hours in finishing and that of each unit of articel B requires 2 hours in assembly and 4 hours in finishing. if profit is Rs.6 for each unit of A and Rs.8 for each unit of B, find out the number of units A and B to be produced every week to give maximum profits.

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7. Minimize $f = 6x + 7y$ subject to $10x + 4y \geq 20, 5x + 5y \geq 20, 2x + 6y \geq 12$ and $x, y \geq 0.$

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8. Find graphically, the maximum value of Z=2x+5y, subject to constraints given below:

$2x + 4y \leq 8, 3x + y \leq 6, x + y \leq 4, x \geq 0, y \geq 0.$

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9. Minimise and maximize Z=5x+2y subject to the following constraints:

$x - 2y \leq 2, 3x + 2y \leq 12, \ -3x + 2y \leq 3, x \geq 0, y \geq 0.$

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10. Solve the following problem graphically: Maximise $Z = 3x + 9y$ 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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11. Determine graphically the minimum value of the objective function $Z = -50x + 20y$ subject to the constraints: $2x - y \geq -5, 3x + y \geq 3, 2x - 3y \leq 12, x \geq 0, y \geq 0$

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12. A cooperative society of farmers has 50 hectare of land to grow two crops X and Y. The profit from crops X and Y per hectare are estimated as Rs 10,500 and Rs 9,000 respectively. To control weeds, a liquid herbicide has to be used for crops X and Y at rates of 20 litres and 10 litres per hectare. Further, no more than 800 litres of herbicide should be used in order to protect fish and wild life using a pond which collects drainage from this land. How much land should be allocated to each crop so as to maximise the total profit of the society?

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13. (Diet problem)A dietician has to develop a special diet using two foods P and Q. Each packet (containing 30 g) of food P contains 12 units of calcium, 4 units of iron, 6 units of cholesterol and 6 units of vitamin A. Each packet of the same quantity of food Q contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of vitamin A. The diet requires atleast 240 units of calcium, atleast 460 units of iron and at most 300 units of cholesterol. How many packets of each food should be used to minimise the amount of vitamin A in the diet? What is the minimum amount of vitamin A?

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14. A dietician wishes to mix two types of food in such a way that the vitamin contents of the mixture contains atleast 8 units of vitamin A and 10 units of vitamin C. Food I contains two units/kg of vitamin A and one unit /kg of vitamin C while Food II contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It cost Rs 5 per kg to purchase Food I and Rs 7 per

kg to purchase food II. Formulate the problem for minimum of such a mixture. Formulate tha above as a LPP and solve it graphically.

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15. A dealer in rural area wishes to purchase a number of sewing machines. He has only Rs 5670 to invest and has a space for at most 20 items. An electronic sewing machine costs him Rs 360 and manually operated sewing machine Rs 240. He can sell electronic sewing machine at a profit of Rs 22 and a manually operated sewing machine at a profit of Rs 18. Assumning that he can sell all the items that he can buy, how should he invest his money in order to maximize his profit. Make it a linear programming problem and solve it graphically. Keeping the rural background in mind justify the values to be promoted for the selection of the manually operated machine.

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16. A company makes 3 model of calculator: A,B and C at factory 1 and factory II. The company has orders for at least 6400 calculators of model A, 4000 calculator of model B and 4800 calculator of model c. At factory I, 50 calculators of model A, 50 model of B and 30 of model C are made everday, at factory II, 40 calculators of model A, 20 model of B and 40 of model C are made everyday. it costs $Rs.12000$ and `Rs.15000 each day to operated factory I and II respectively. find the number of days each factory should operate to minimise operate the costs and still meet the demand.

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17. A soft drinks firm has two bottling plants, one located at P and the other located at Q. each plant produces three different soft drinks A, B and C. The capacities of two plants in number of bottles per day, are as follows:

Product	Plant P	Plant Q
A	3000	1000
B	1000	1000
C	2000	6000

A market survey indicates that during the month of April, there will be a demand of 24000 bottles of A, 16000 bottles of B and 48000 bottles of C. The cost of running the two plants P and Q are respectively Rs.6000 and Rs.4000 per day. find graphically, the number of days for which either of the two plants P and Q should be run in the month of April so as to minimize production cost while still meeting the market demand.

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18. Find the maximum and minimum values of $Z = 2x + y$ subject to the constraints :

$x + 3y \geq 6, x - 3y \leq 3, 3x + 4y \leq 24, -3x + 2y \leq 6, 5x + y \geq 5, x, y \geq$

.

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19. In order to supplement daily diet, a person wishes to take some X and Y tablets. The contenst of iron, calcium and vitamins in X and Y are given as below:

Tablets	Iron	Calcium	Vitamin
X	6	3	2
Y	2	3	4

The person needs atleast 18 miligrams of iron, 21 miligrams of calcium and 16 miligram of vitamins. the price of each tablet of X and Y is Rs.2 and Rs. 1 respectively. how many tablets of each should be person take in order to satisfy the above requirement at the minimum cost?

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20. Evaluate $\int \frac{dx}{\sec x - \tan x}$

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Exercise

1. Exhibit graphically the solution set of the following system of inequalities

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

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2. Exhibit graphically the solution set of the following system of inequalities

$x \leq -2, y \geq 3.$

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3. Exhibit graphically the solution set of the following system of inequalities

$2x + 3y \leq 36, x \geq 3, y \geq 2.$

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4. Exhibit graphically the solution set of the following system of inequalities

$x + 4y \leq 4, 2x + 3y \leq 6, x \geq 0, y \geq 0.$

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5. Exhibit graphically the solution set of the following system of inequalities

$x + y \geq 1, x \leq 5, y \leq 4, 2x + 3y \leq 12, x \geq 0, y \geq 0.$

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6. Exhibit graphically the solution set of the following system of inequalities

$x + y \leq 5, x + y \geq 4, x + 5y \geq 5, x \leq 4, y \leq 3.$

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7. Minimize f=6x+16y, subject to $x \leq 40, y \geq 20$ and $x, y \geq 0$.

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8. Maximize the function Z=11x++7y subjects to constraints $x \leq 3y, y \leq 2, x \geq 0, y \geq 0$

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9. Maximize Z=8x+3y subject to constrains $x + y \leq 3, 4x + y \leq 6, x \geq 0, y \geq 0.$

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10. Minimize 6x+21y, subject to $x + 2y \geq 3, x + 4y \geq 4$ and $x \geq 0, y \geq 0$

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11. 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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12. Maximize Z=3x+4y subject to constrains $x + y \leq 1, x \geq 0, y \geq 0.$

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13. Maximize graphically f=x+5y subject to the constraints

$x + 4y \leq 24, 3x + y \leq 21, x + y \leq 9$ and $x \geq 0, y \geq 0.$

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14. Solve the following linear programming problems graphically

Minimize $Z = 3x + 5y$ subject to constraints

$-2x + y \leq 4, x + y \geq 3, x - 2y \leq 2, x, y \geq 0$

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15. Minimize Z=3x+5y subject to constrains

$x, y \geq 0, x + 2y \geq 10, x + y \geq 6, 3x + y \geq 8$

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16. Minimize Z=13x-5y subject to constraints

$x \geq 0, y \geq 0, x + y \leq 7, 2x - 3y + 6 \geq 0.$

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17. A producer has 30 and 17 units of labour and capital respectively which he can use to produce two goods X and Y. To produce one unit of X, 2 units of labour and 3 units of capital are required. Similarly, 3 units of labour and one unit of capital is required to produce a unit of Y. If X and Y are priced at Rs.100 and Rs.120 per uint respectively, how should be producer use his resources to maximize the total revenue.

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18. If a man rides his motor cycle at 25 km/hr, he has to spend Rs 2 per km on petrol, if he rides at a faster speed of 40 km/hr, the petrol cost increases to Rs 5 perkm. He has Rs 100 to spend on petrol and wishes to find maximum distance he can travel within one hour. Express this as a linear programming problem and then solve it graphically.

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19. A man rides his motorcylcle at the speed of 50 km/hour. He has to spend Rs.2 per km on petrol. If the rides it as a faster speed of 80 km/hour, the petrol cost increases to Rs.3 per km. he has atmost Rs.120 to spend on petrol and one hour's time, He wishes to find the maximum distance that he can travel

Express this problem as a linear programming problem and solve it graphically to find the maximum distance he can travel.

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20. Every gram of wheat provides 0.1 g of protien and 0.25 g of carbohydrates. The corresponding values for rice are 0.05 g and 0.5 g respectively. Wheat costs Rs 4 per kg and rice Rs 6 per kg. The minimum daily requirements of protien and carbohydrates for an average child are 50 g and 200 g respectively. In what quantities should wheat and rice be mixed in the daily diet so as to provide the maximum daily requirements of protien and carbohydrates at minimum cost? Frame a LPP and solve it graphically.

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21. Kellogg is a new cereal formed of a mixture of bran and rice that contians atleast 88 gm of protein and atleast 36 miligram of iron per kg. Knowing that bran contains 80 gm of protein and 40 miligram of iron per kilogram, and that rice contains 100 gm of protein and 30 miligram of iron per kilogram, find the minimum cost of producing this new cereal if bran costs Rs.5 kilogram and rice costs Rs. 4 per kilogram.

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22. A pharmaceutical company requires everyday 10,12,12 units of chemicals C_1, C_2 and C_3 respectively. A liquid product contains 5,2,and 1 units of chemicals C_1, C_2 and C_3 respectively per bottle and its cost is Rs.300 per bottle. A dry product contains 1,2 and 4 units of chemicals C_1, C_2 and C_3 respectively per box and it costs Rs.200 per box. how much quantitiy of either of the two products should be purchased daily in order to minimize the cost.

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23. A soft drinks manufacturing company is preparing a production plan on two types A and B of soft drinks. There is sufficinet materail available to make 20000 bottles of drink A and 40000 bottles of drink B but there are only 45000 empty bottles into either hte drinks can be filled. Further, it takes 3 hours to fill 1000 bottles of drink A and one hour to fill 1000 bottles of drink B. there are only 66 hours available for filling. The profit is Rs.2 per bottle for drink A and Rs.1 per bottle of drink B.

Set up this problem as a linear programming problem and find graphically the production scheduled in order to maximize the profit.

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24. A manufacturing company makes two types of teaching aids A and B of Maths for class XII. Each type of A requires 9 labour hours for fabricating and 1 labour hour for fininshing. Each type of B requires 12 labour hours for fabricating and 3 labour hours for fininshing. For

fabricating and finishing , the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs 80 and each type of A and Rs 120 on each type of B. How many pieces of type A and type B should be manufactured per week to realise a maximum profit? What is the maximium profit per week?

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25. A manufacturing company makes two models A and B of a product. Each pice of model a requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of model of B requires 12 labour hours for fabricating and 3 hour for finishing. For fabricating and finishing, the maximum labour hours avaibale are 180 and 30 respectively. the company makes a profit of Rs.8000 on each piece of model A and Rs.12000 on each piece of model B. How many pieces of model A and model B should be manufactured per week to realise a maximum profit? what is the maximum profit per week?

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26. A company manufactures two types of novelty souvenirs made of plywood. Souvenirs of type A require 5 minutes each for cutting and 10 minutes each for assembling. Souvenirs of type B require 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours 20 minutes available for cutting and 4 hours for assembling. The profit is Rs 5 each for type A and Rs 6 each for type B souvenirs. How many souvenirs of each type should the company manufacture in order to maximise the profit?

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27. A small firm manufactures gold rings and chains. The total number of rings and chains manufactured per day is almost 24. it takes 1 hour to make a ring and 30 minutes to make a chain. The maximum number of hours available per day is 16. If the profit on a ring is ₹ 300 and that on a chain is ₹ 190, find the number of rings and chains that should be manufactured per day, so as to earn the maximum profit. Makes it is an L.P.P and solve it graphically.

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28. A manufacture of electronic circuits has a stock of 200 resistors, 120 transistors and 150 capacitors and is requried to produce two types of circuits A and B. Type A requires 20 resistors, 10 transistors and 10 capacitors. Type B requires 10 resistors, 20 transisitros and 30 capacitors. if the profit on type A circit is Rs.50 and that on type B circuit is Rs.60, formulate this problem as an LPP so that the manufacture can maximize his profit. also solve this LPP graphically to find the maximum profit.

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29. A firm has to transport 1200 packages using large vans which can carry 200 packages each and small vans which can take 80 packages each. The cost for engaging each large van is Rs.400 and each small vans is Rs.200 not more than Rs.3000 is to be spend on the job and the number of large vans can not exceed the number of small vans. formulate the

problem as a LPP given that the objective is to minimise cost. also solve this LPP graphcially to find the minimum cost.

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30. A company manufactures two types of screws A and B. All the screw have to pass through a threading machine and a slotting machine. A box of type A screws requires 2 minutes on the threading machine and 3 minutes on the slotting machine. A box of type B screws requires 8 minutes of threading on the threading machine and 2 minutes on the slotting machine. in a week, each machine is available for 60 hours. On selling these screws, the company gets a profit of Rs.100 per box n type A screws and Rs.170 per box on type B screws.

Formulate this problem as an LPP given that the obejctives is to maximize profit. also solve this LPP graphically to find the maximum profit.

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31. A company manufactures two types of sweaters type A and type B. If costs Rs. 360 to make a type A screws Rs.120 to make a type B sweater. The company can make if at most 300 sweaters and spend at most Rs.72000 a day. The number of sweaters of type B cannot exceeds number of sweater of type A by more than 100. the company makes it a profit of Rs.200 for each sweater of type A and Rs.120 for every sweater of type B. formulate this problem as an LPP to maximise to profit to the company. also solve this LPP to find the maximum profit.

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32. A retired person wants to invest an amount of Rs 50000. His broker recommends investing in two types of bonds A and B yeilding 10% and 9% return respectively on the invested amount. He decides to invest at least Rs 20000 in bond A and at least Rs 10000 in bond B. He also wants to invest at least as much in bond A as in bond B. Slove this linear programming problem graphically to maximize his returns.

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33. Number of atoms per unit cell in fcc and bcc unit cells are 4 and 2 respectively.

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34. A shopkeeper deals in two items: thermoflasks and airtight containers. A flask costs him Rs.120 and an airtight container costs him Rs.60. he has atmost Rs.12000 to invest and has space to store a maximum of 150 items. The profit on selling a flask is Rs.20 and that on airtiht container is Rs.15. assumint that he will be the able to sell all things to buys, how many of each item should be buy to maximise his profit? solve the problem graphically.

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35. A company sells two different products A and B. The two products in a common production process which has a total capacity of 500 man hours.

It takes 5 hours to produce a unit of A and 3 hours to produce to unti of B. the demand in the market shows that the maximum number of unit of A that can be sold is 70 that for B is 125. Profit on each unit of A is Rs.20 and that on B is Rs.15. How many units of A and B should be produced to maximize the profit? solve it graphically.

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36. A factory owner wants to purchase two types of machines A and B, for his factory. The machine A requries an area of $1000m^2$ and 12 skilled men for running it and its daily output is 50 units. Whereas the machine B are requries $1200m^2$ area and 8 skilled man, and its daily output is 40 units. if an area of $7600m^2$ and 72 skilled men be availabe to operate the machines,how many machines of each type should be brought to maximize the daily output.

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37. A manufacturer has three machines I, II and III installed in his factory. Machines I and II are capable of being operated for at most 12 hours whereas machine III must be operated for at least 5 hours a day. She produces only two items M and N each on the three machines are given in the following table:

Items	Number of hours required on machines		
	I	II	III
M	1	2	1
N	2	1	1-25

SHe makes a profit of Rs 600 and Rs 400 on items M and N respectively. How many of each item should she produce so as to maximise her profit assuming that she can sell all the items that she produced? What will be the maximum Profit?

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38. An oil company requires 12000, 20000 and 15000 barrerls of high grade, medium grade and low grade oil respectively. Refinary A produces

100,300 and 200 barrerls per day of high, medium and low grade oil respectively whereas refinary B produces 200,400,100 barrels per day respectively.If A costs Rs.400 per day and B Rs.300 costs per day to operate, how many days should each refinery be run to minimize the cost of meeting requirements.

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39. Solve the following LPP graphically:

minimize Z=x-5y+20 subjects to constrains

$x - y \geq 0, \ -x + 2y \geq 2, x \geq 3, y \leq 4, x \geq 0, y \geq 0.$

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40. Maximize Z=x+y subject to

$x + 4y \leq 8, 2x + 3y \leq 12, 3x + y \leq 9, x \geq 0, y \geq 0.$

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41. Find the maximum and minimum values of 4x+3y subject to constraints $x \leq 6, y \leq 5, x \geq 0, y \geq 0, -x - y \leq -1$ and $7x + 9y \leq 63.$

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42. Find the maximum and minimum values of 5x+2y subject to constraints $2x + 3y \geq 6, x - 2y \leq 2, 6x + 4y \leq 24, -3x + 2y \leq 3$ and $x, y \geq 0.$

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43. Maximize and minimize Z=3x-4y subject to $x - 2y \leq 0, x - y \leq 6, -3x + y \leq 4, x \geq 0, y \geq 0.$

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44. A manufacturing company makes two types of television sets, one is black and white and the other is colcoured. The company has resources to make atmost 300 sets a week. It takes Rs.1800 to make a black and white set and Rs.2700 to make a colured set. The company can spend not more thatn Rs.648000 a week to make television sets. if it makes a profit of Rs.510 per black and white set and Rs.675 per coloured set. how many sets of each type should be produced so that the company has maximum profit?

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45. A doll manufacturing company manufatures two types of dolls, type A and type B. Each doll of type A takes twice as long as to produce of type B. The company has enough time to manufacture as maximum of 2000 dolls per day if it produces only type B dolls. The supply of plastic is sufficient enough to manufacture a total of 1500 dolls every day. The type A dolls requires fancy dress of which only 550 are available daily. If the company makes a profit of Rs.8 on each type of doll A and Rs.5 on each type of doll

B. how many of each type of dolls should the company manufacture everyday so as to get a maximum profit. Also find the maximum profit.

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46. Rajiv has two courses to prepare for final examination. Each hour of study, he devotes to course A is expected to return Rs.600 in terms of long range job benefits. Each hour devoted to course B Is expected to return Rs.300 in terms of long range job benefits. the stores are closed and Rajiv has only 15 chewing gums. He finds that he consumes one chewing gum every 20 minutes while studying course B and every 12 minutes while studying course A. Time is running short only four hours are left to prepare. Rajiv feels that he must devote atleast two hours to study. using linear programming, determine an optimal policay for Rajiv that would maximise his returns in terms of long range job benefits.

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47. A manufacture makes two products A and B. product A sells at Rs.200 per unit and takes 30 minute to make. Product B sells at Rs.300 per unit and takes 1 hour to make. There is a permanent order of 14 units of product A and 16 unit of product B. A working week consists of 40 hours of production and the weekly turnover must not be less than Rs.10,000. if he profit on each unit of product A is Rs.20 and on product B is Rs.30, then find how many units of each product should be produced to get maximum profit. also find the maximum profit. solve the problem graphically.

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48. Solve the following linear programming problem graphically, minimize Z=x-7y+190 subject to constraints $x + y \leq 8, x \leq 5, x + y \geq 4$ and $x \geq 0, y \geq 0.$

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49. Solve the following L.P.P graphically: maximize $Z = 8x + 7y$subject to constraints $3x + y \leq 66, x + y \leq 45, x \leq 20, y \leq 40$ and $x \geq 0, y \geq 0.$

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50. State whether the region represented by $x \geq 0, y \geq 0$ is convex or not.

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51. State whether the region represented by $x^2 + y^2 \geq 1, x^2 + y^2 \leq 4$ is convex or not.

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52. State whether the region represented by $x \geq 0, y \geq 0, x + y \geq 1$ bounded or unbounded.

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53. Is the region represented by $2x + 3y \leq 18, x + y \geq 10, x \geq 0, y \geq 0$ an empty set?

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54. What are non-negativity constraints?

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55. Draw the region represented by $x \geq 0, y \geq 0, x \leq 2, y \leq 3.$

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56. What is the region represented by the inequalities $x \leq 0, y \leq 0$?

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57. Which of the following constraints is redundant? $x \geq 3, y \geq 4, x + 2y \geq 10.$

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58. The optimal solution of an L.P.P. occurs at two distinct points (x_1, y_1) and (x_2, y_2) of the feasible region. Will this solution occur at some other point also.

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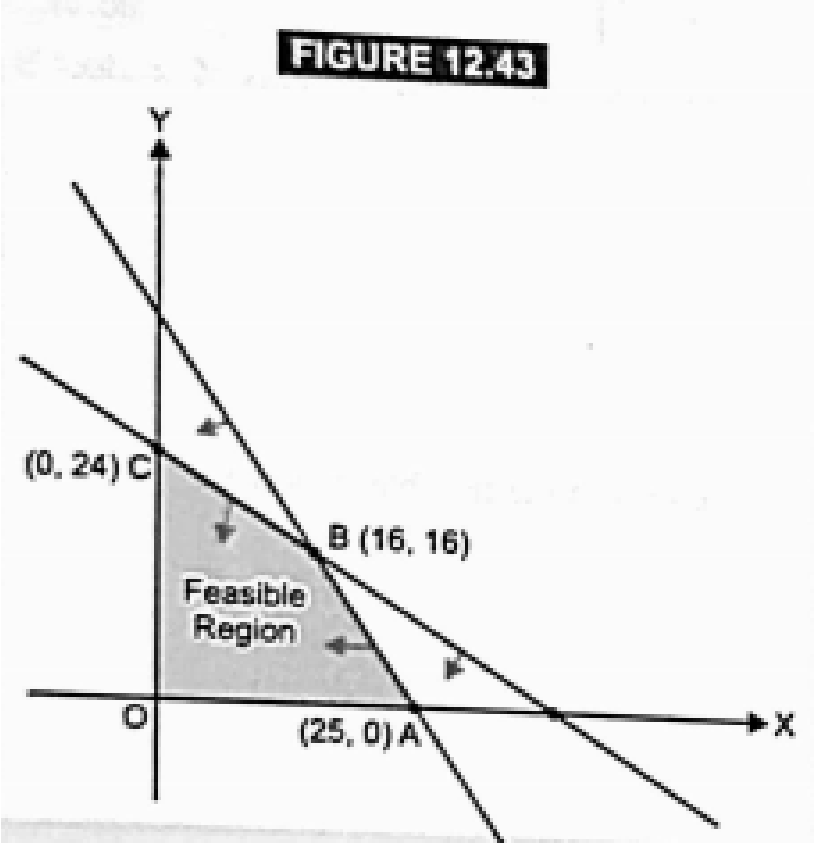
59. Determine the maximum value of z=4x+3y if the feasible region of an L.P.P is shown shaded in the figure 12.43:



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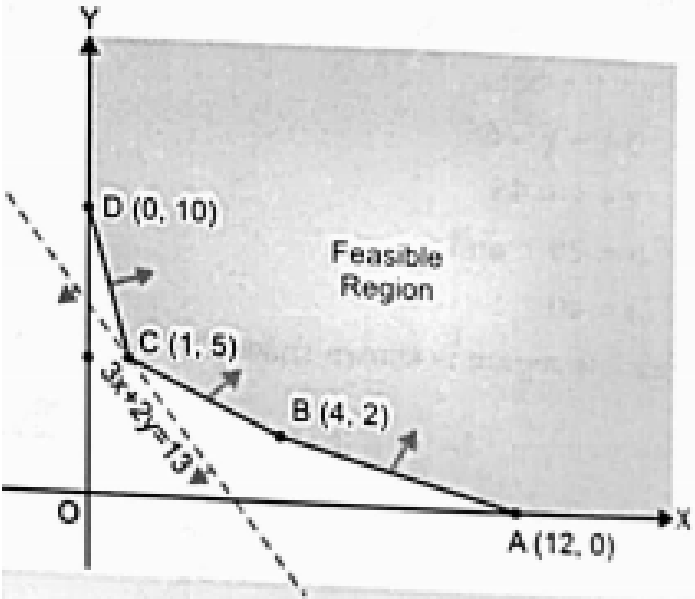
60. Determine the minimum value of Z=3x+2y, if the feasible region is show shaded in the figure 12.44.

FIGURE 12.44



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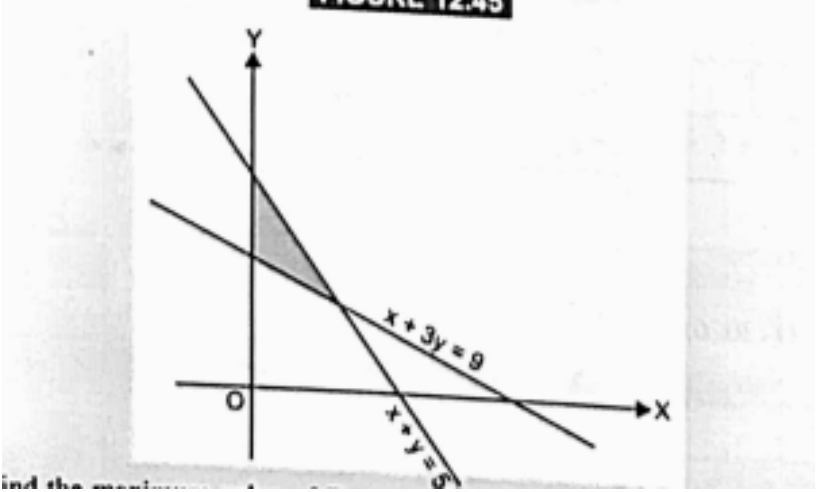
61. The feasible region for an LPP is show shaded in the figure 12.45 find the minimum value of the objective function Z=11x+7y.



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62. Refer Q.12.Find graphically, the minimum value of Z=200(2x + y), subject to constraints given below: x/6 + y/15 ≥1 ,x/15/2 + y/15 ≤ 1,y=x. find the minimum value of Z.

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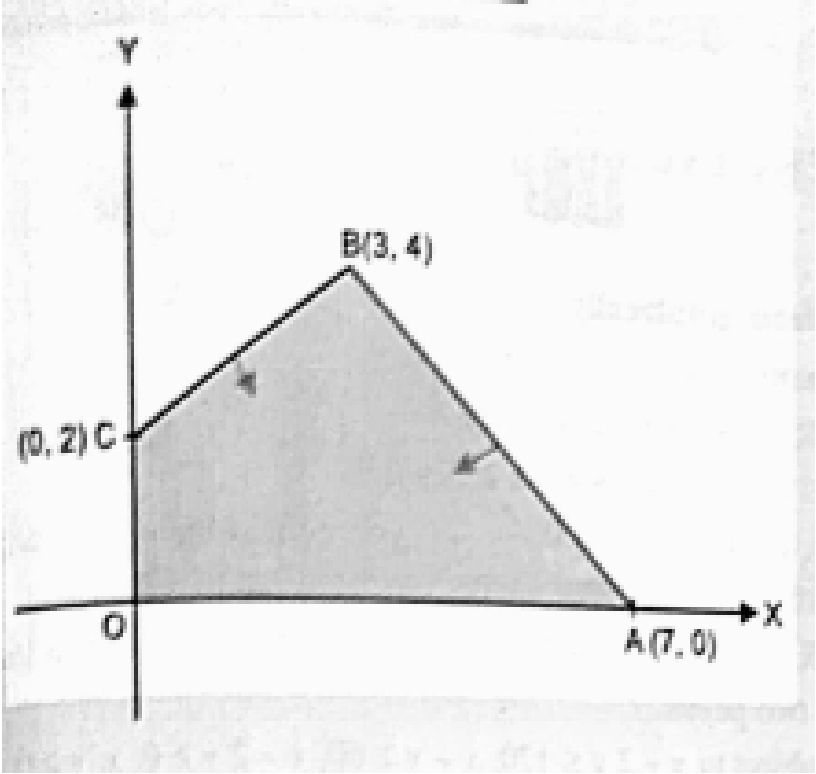
63. Feasible region for an LPP is shown shaded in the figure 12.46. Maximize the objective function Z=5x+7y.



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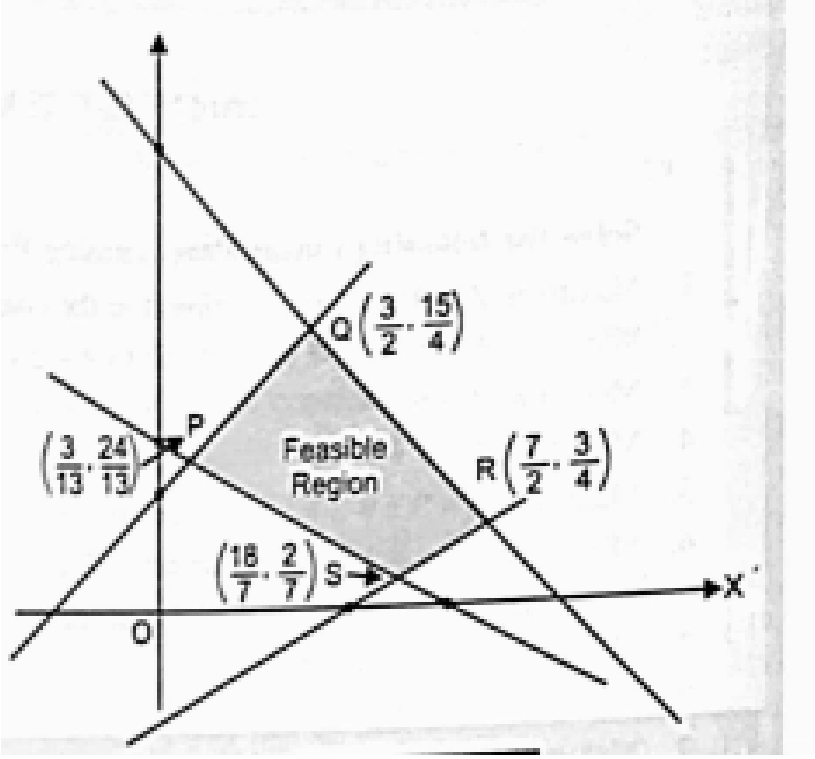
64. The feasible region for an LPP is shown shaded in the figure 12.47. Determine the maximum and minimum values of Z=x+2y.



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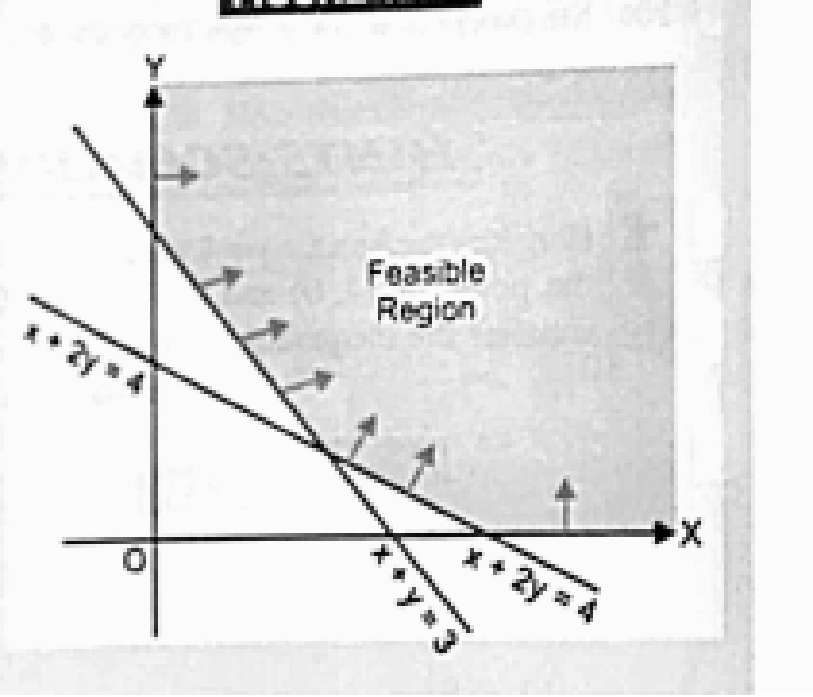
65. The feasible region for an LPP is shown shaded in the figure 12.48 find the minimum value of Z=4x+y.



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66. Solve the following linear programing problems graphically :

Maximize $Z = 3x + 4y$

subject to the constraints

$x + y \leq 4,$

$x \geq 0,$

$y \geq 0.$

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67. Solve the following linear programming problems graphically

Minimize $Z = -3x + 4y$ subject to

$x + 2y \leq 8, 3x + 2y \leq 12, x, y \geq 0$

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68. Maximise $Z = 5x + 3y,$ subject to

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

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69. Solve the following Linear Programming Problem graphically: Minimise

$Z = 3x + 5y$ such that: $x + 3y \geq 3, x + y \geq 2, x, y \geq 0$

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70. Solve the following linear programming problems graphically

Maximise Z = 3x + 2y subject to $x + 2y \leq 10, 3x + y \leq 15, x, y \geq 0$

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71. Solve the following Linear Programming Problem graphically: Minimise

$Z = x + 2y$ subject to : $2x + y \geq 3, x + 2y \geq 6, x, y \geq 0$

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72. Maximise $Z = 5x + 10y$ subject to:

$x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0, x, y \geq 0$

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73. Minimize and Maximize $Z = x + 2y$ subject to the constraints

$x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0$

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74. Maximise $Z = x + 2y$ subject to:

$x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0$

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75. Maximise $Z = x + y,$ subject to

$x - y \leq -1, -x + y \leq 0, x, y \geq 0$

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76. Reshma wishes to mix two types of food P and Q in such a way that the vitamin contents of the mixture contain at least 8 units of vitamin A and 11 units of vitamin B. Food P costs Rs 60/kg and food Q costs Rs 80/kg. Food P contains 3 units/kg of vitamin A and 5 units/kg of vitamin B while food Q contains 4 units/kg of vitamin A and 2 units/kg of vitamin B. Determine the minimum cost of the mixture.

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77. One kind of cake requires 200g of flour and 25g of fat, and another kind of cake requires 100g of flour and 50g of fat. Find the maximum number of cakes which can be made from 5kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes.

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78. A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 hours of machine time and 3 hours of craftman's time in its making while a cricket bat takes 3 hour of machine time and 1 hour of craftman's time. In a day, the factory has the availability of not more than 42 hours of machine time and 24 hours of craftsman's time. What number of rackets and bats must be made if the factory is to work at full capacity?

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79. A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 hours of machine time and 3 hours of craftman's time in its making while a cricket bat takes 3 hour of machine time and 1 hour of craftman's time. In a day, the factory has the availability of not more than 42 hours of machine time and 24 hours of craftsman's time. If the profit on a racket and on a bat is Rs 20 and Rs 10 respectively, find the maximum profit of the factory when it works at full capacity.

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80. A manufacturer produces nuts and bolts. It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts. He earns a profit of Rs17.50 per package on nuts and Rs 7.00 per package on bolts. How many packages of each should be produced each day so as to maximise his profit, if he operates his machines for at the most 12 hours a day?

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81. A factory manufactures two types of screws, A and B. Each type of screw requires the use of two machines, an automatic and a hand operated. It takes 4 minutes on the automatic and 6 minutes on hand operated machines to manufacture a package of screws A, while it takes 6 minutes on automatic and 3 minutes on the hand operated machines to manufacture a package of screws B. Each machine is available for at the most 4 hours on any day. The manufacturer can sell a package of screws A at a profit of Rs 7 and screws B at a profit of Rs 10. Assuming that he can sell all the screws he manufactures, how many packages of each type should the factory owner produce in a day in order to maximise his profit? Determine the maximum profit

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82. A cottage industry manufactures pedestal lamps and wooden shades, each requiring the use of a grinding/cutting machine and a sprayer. It takes 2 hours on grinding/cutting machine and 3 hours on the sprayer to

manufacture a pedestal lamp. It takes 1 hour on the grinding/cutting machine and 2 hours on the sprayer to manufacture a shade. On any day, the sprayer is available for at the most 20 hours and the grinding/cutting machine for at the most 12 hours. The profit from the sale of a lamp is Rs 5 and that from a shade is Rs 3. Assuming that the manufacturer can sell all the lamps and shades that he produces, how should he schedule his daily production in order to maximise his profit?

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83. A company manufactures two types of novelty souvenirs made of plywood. Souvenirs of type A require 5 minutes each for cutting and 10 minutes each for assembling. Souvenirs of type B require 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours 20 minutes available for cutting and 4 hours for assembling. The profit is Rs 5 each for type A and Rs 6 each for type B souvenirs. How many souvenirs of each type should the company manufacture in order to maximise the profit?

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84. A merchant plans to sell two types of personal computers – a desktop model and a portable model that will cost Rs 25000 and Rs 40000 respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine the number of units of each type of computers which the merchant should stock to get maximum profit if he does not want to invest more than Rs 70 lakhs and if his profit on the desktop model is Rs 4500 and on portable model is Rs 5000.

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85. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two food F1 and F2 are available. Food F1 costs Rs. 4 per unit food and F2 costs Rs. 6 per unit. One unit of food F1 contains 3 units of vitamin A and 4 units of minerals. One unit of food F2 contains 6 units of vitamin A and 3 units of minerals. Formulate this-as linear programming problem. Find the minimum cost for diet that consists of mixture of these two foods and also meets the minimal nutritional requirements.

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86. There are two types of fertilisers F_1 and F_2 . F_1 consists of 10% nitrogen and 6% phosphoric acid and F_2 consists of 5% nitrogen and 10% phosphoric acid. After testing the soil conditions, a farmer finds that she needs atleast 14 kg of nitrogen and 14 kg of phosphoric acid for her crop. If F_1 costs Rs 6/kg and F_2 costs Rs 5/kg, determine how much of each type of fertiliser should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost?

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87. The corner points of the feasible region determined by the following system of linear inequalities: : $2x + y \leq 10, x + 3y \leq 15, x, y \geq 0$ are $(0, 0), (5, 0), (3, 4)$ and $(0, 5)$. Let $Z = px + qy,$ where $p, q > 0,$ Condition on p and q so that the maximum of Z occurs at both (3, 4) and (0, 5) is:

A. p=q

B. p=2q

C. p=3q

D. q=3p

Answer:

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88. (Diet problem)A dietician has to develop a special diet using two foods P and Q. Each packet (containing 30 g) of food P contains 12 units of calcium, 4 units of iron, 6 units of cholesterol and 6 units of vitamin A. Each packet of the same quantity of food Q contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of vitamin A. The diet requires atleast 240 units of calcium, atleast 460 units of iron and at most 300 units of cholesterol. How many packets of each food should be used to minimise the amount of vitamin A in the diet? What is the minimum amount of vitamin A?

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89. A farmer mixes two brands P and Q of cattle feed. Brand P, costing Rs 250 per bag, contains 3 units of nutritional element A, 2.5 units of element B and 2 units of element C. Brand Q costing Rs 200 per bag contains 1.5 units of nutritional element A, 11.25 units of element B and 3 units of element C. The minimum requirements of nutrients A,B and C are 18 units, 45 units and 24 units respectively. Determine the number of bags of each brand which should be mixed in order to produce a mixture having a minimum cost per bag? What is the minimum cost of the mixture per bag?

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90. A dietician wishes to mix together two kinds of food X and Y in such a way that the mixture contains exist 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. The vitamin contents of one kg food is given below:

Food	Vitamin A	Vitamin B	Vitamin C
X	1	2	3
Y	2	2	1

One kg of food X costs Rs.16 and one kg of food Y costs Rs.20. Find the least cost of mixture which will produce the required diet?

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91. A manufacture make two types of toys A and B. three machines are needed for this purpose and the time required for each toy on the machines is given below:

Types of Toys	Machines		
	I	II	III
A	12	18	6
B	6	0	9

Each machine is available for a maximum of 6 hours per day. if hte profit on each type A is Rs.7.50 and that on each toy of type B is Rs.5. show that 15 toys of type A and 30 of type B should be manufactured in a day to get maximum profit.

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92. An aeroplane can carry maximum of 200 passengers, A profit of ₹ 400 is made on each first class ticket and a profit of ₹ 300 is made in each second class ticket. The airline reserves at least 20 seates for first class. However, at least four times as many passengers prefer to travel by second class than first class. Determine how many tickets of each type must be sold to maximise profit for the airline. Form an L.P.P. and solve it graphically.

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93. Two godowns A and B have grain capacity of 100 quintals and 50 quintals respectively. They supply to 3 ration shops D, E and F whose requriments are 60,50 and 40 quintals respectively. The cost of transportation per quintals from the godowns to the shops are given in the following table:

From / To	A	B
D	6	4
E	3	2
F	2.50	3

How would the supplies be transported in order that the transportation cost is minimum. what is the minimum cost?

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94. An oil company has two depots A and B with capacities of 7000 l and 4000 l respectively. The company is so supply oil to three petrol pumps, D,E and F whose requirements are 4500 l, 3000 l and 3500 l respectively. The distance between the depots and the petrol pumps is given in the following table:

Distance in (km)

From / To	A	B
D	7	3
E	6	4
F	3	2

Assuming that the transportation of cost of 10 litres of oil is Rs. 1 per km,

how should be the delivery be scheduled in order that the transportation cost is minimum? what is the minimum cost?

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95. A fruit grower can use two types of fertilizer in his garden, brand P and brand Q. The amounts (in kg) of nitrogen, phosphoric acid, potash, and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine. If the grower wants to minimise the amount of nitrogen added to the garden, how many bags of each brand should be used? What is the minimum amount of nitrogen added in the garden?

kg per bag		
	Brand P	Brand Q
Nitrogen	3	3.5
Phosphoric acid	1	2
Potash	3	1.5
Chlorine	1.5	2

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96. A fruit grower can use two types of fertilizer in his garden, brand P and brand Q. The amounts (in kg) of nitrogen, phosphoric acid, potash, and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine. If the grower wants to minimise the amount of nitrogen added to the garden, how many bags of each brand should be used? What is the minimum amount of nitrogen added in the garden?

kg per bag		
	Brand P	Brand Q
Nitrogen	3	3.5
Phosphoric acid	1	2
Potash	3	1.5
Chlorine	1.5	2

If the grower wants to maximize the amount of nitrogen added to the garden, how many bags of each brand should be added? What is the maximum amount of nitrogen added?

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97. A toy company manufactures two types of dolls, A and B. Market tests and available resources have indicated that the combined production level should not exceed 1200 dolls per week and the demand for dolls of type B is at most half of that for dolls of type A. Further, the production level of dolls of type A can exceed three times the production of dolls of other type by at most 600 units. If the company makes profit of Rs 12 and Rs 16 per doll respectively on dolls A and B, how many of each should be produced weekly in order to maximise the profit?

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98. Fill ups

In an LPP, the conditions $x \geq 0, y \geq 0$ are called.....constrains.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

101. Fill ups

If the feasible region for an LPP is unbounded, then the maximum or the minimum of the objective function..... .

Watch Video Solution

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

Watch Video Solution

103. Fill ups

In an LPP, the optimum value of the objective funciton is always.....

Watch Video Solution

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

Watch Video Solution

105. Fill ups

In an LPP, the minimum value of the objective function Z=ax+by is not necessarily..... Even if the origin is one of the corner points of the feasible region.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

108. Fill ups

The optimal value of the objecitve function in an LPP occurs at.....points of the feasible region.

Watch Video Solution

109. Fill ups

If the feasible region for an LPP is .....then the optimal value of the

objective function Z=ax+by may or may not exist.

Watch Video Solution

110. Fill ups

The region represented by the inequalities $x \geq 6, y \geq 2, 2x + y \geq 10$, is convex and..... .

Watch Video Solution

111. Number of ways in which 8 boys can sit in a circle

Watch Video Solution

112. 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.

Watch Video Solution

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

Watch Video Solution

114. True or false

In an LPP, the feasible region is either bounded by a convex polygon or it in unbounded region with straight line boundaries.

Watch Video Solution

115. True or false

In an LPP, the objective function is always a linear function.

Watch Video Solution

116. Fill ups

If the feasible region for an LPP is .....then the optimal value of the objective function Z=ax+by may or may not exist.

Watch Video Solution

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

Watch Video Solution

118. True or false

If the minimum value of the objective function f=4x+6y in an LPP, occurs at two corner points (0,2) and (3,0) then this minimum value occurs at all points of the line segment joining(3,0) and (0,2).

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119. True or false

If the feasible region R for an LPP is bounded, then the objective function Z=ax+by has both the maximum and the minimum values of the region R.

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120. True or false

In an LPP the optimal value of the objective function Z=ax+by is always finite.

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121. True or false

The region represented by $\{(x, y): x^2 + y^2 \leq 9\} \cap \{(x, y): x^2 + y^2 \geq 4)$ is convex.

Watch Video Solution

122. True or false

In an LPP, if region is one of the correct points of the feasible region, then the minimum vlaue of the objective function Z=ax+by is always 0.

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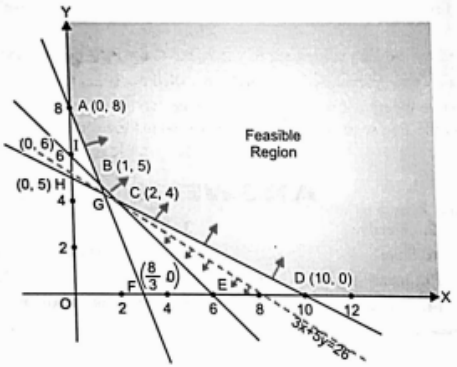
123. Match the statements given in column I with those give in column II.

FIGURE 12.80



Column I	Column II
1. Objective function of the LPP in question is	(p) 26
2. Region above the line CD corresponds to the constraint	(q) unbounded
3. Region above the line AB corresponds to the constraint	(r) (2, 4)
4. Region above the line BC corresponds to the constraint	(s) $x+2y \geq 10$
5. The minimum value of the objective function is	(t) $3x+5y$
6. The minimum value of the objective function occurs at the point	(u) $3x+y \geq 8$
7. Feasible region is	(v) $x+y \geq 6$

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124. State whether the region represented by $x \geq 0, y \geq 0$ is convex or not.

A. first quadrant

B. second quadrant

C. third quadrant

D. fourth quadrant

Answer:

Watch Video Solution

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

A. a constant

B. a function to be optimised

C. a relation between the variables

D. none of these

Answer:

Watch Video Solution

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

A. p=q

B. p=2q

C. q=2p

D. q=3p

Answer:

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127. Match the following :

(*i*) sin (90°–A)	(*a*) Sin A
(*ii*) Cos 0°	(*b*) 0
(*iii*) Sin 0°	(*c*) 1
(*iv*) Cas (90°–A)	(*d*) Cos A

.

A. (0,8)

B. (2,5)

C. (4,3)

D. (9,0)

Answer:

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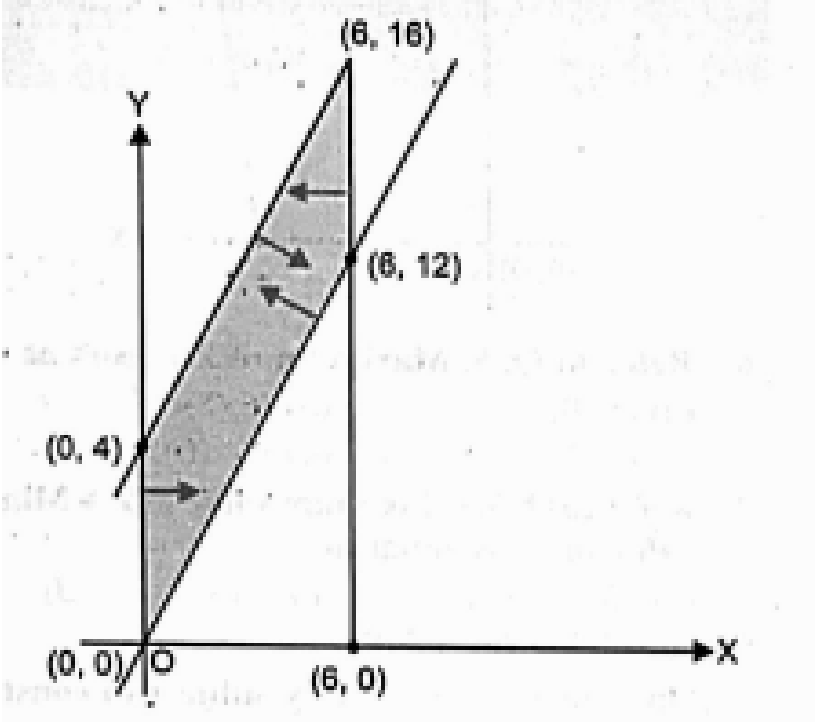
128. The feasible region for an LPP is shown shaded in the figure 12.83. Let f=3x-4y be the objective function, the maximum vlaue of f is



A. (0,0)

B. (0,8)

C. (5,0)

D. (4,10)

Answer:

Watch Video Solution

129. The value of $12C_3$ is equal to:

A. 12

B. 1

C. -13

D. -17

Answer:

Watch Video Solution

130. In solving the L.P.P.:"minimize if f=6x+10y subjects to constrains $x \geq 4, y \geq 2, 2x + y \geq 10, x \geq 0, y \geq 0$" redundant constraints are

A. $x \geq 4, y \geq 2$

B. $2x + y \geq 10, x \geq 0, y \geq 0$

C. $x \geq 4$

D. none of these

Answer:

Watch Video Solution

131. Match the following :

(*i*) sin (90°–A)	(*a*) Sin A
(*ii*) Cos 0°	(*b*) 0
(*iii*) Sin 0°	(*c*) 1
(*iv*) Cas (90°–A)	(*d*) Cos A

.

A. the quantity in column A is greater

B. The quantity of column B is greater

C. The two quantities are equal

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

Answer:

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Watch Video Solution

132. 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:

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133. The region represented by the inequalitites $x \geq 6, y \geq 2, 2x + y \leq 10, x \geq 0, y \geq 0$ is

A. unbounded

B. a polygon

C. exterior of a triangle

D. none of these

Answer:

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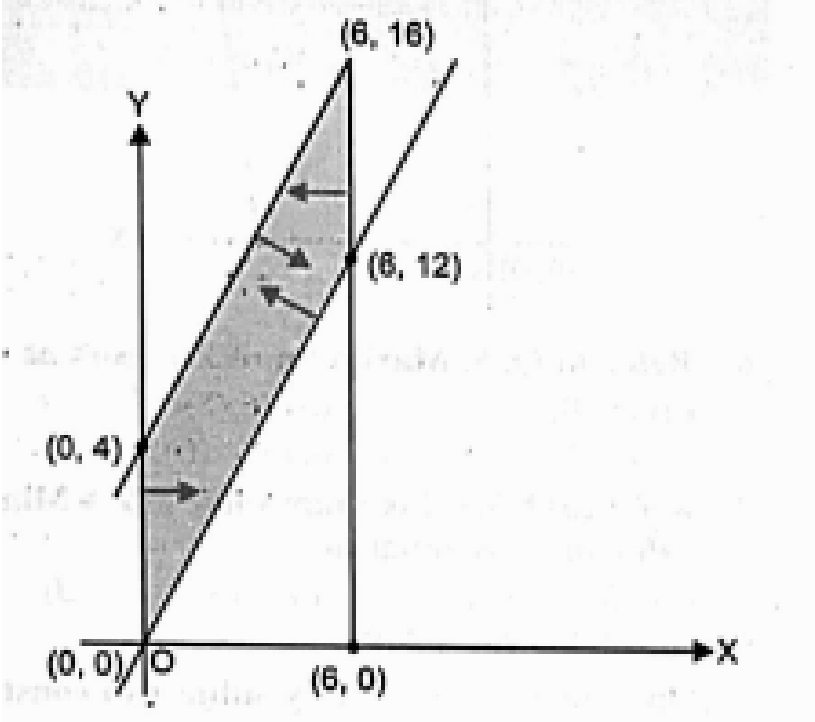
134. The feasible region for an LPP is shown shaded in the figure 12.83. Let f=3x-4y be the objective function, the maximum vlaue of f is



A. 12

B. 8

C. 0

D. -18

Answer:

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135. 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. (3,0) only

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

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

Answer:

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