



# MATHS

## NCERT - FULL MARKS MATHS(TAMIL)

### LINEAR PROGRAMMING

#### Example Type

1. Solve the following linear programming problem graphically:

$$\text{Maximise } Z = 4x + y \dots\dots\dots 1$$

subject to the constraints:

$$x + y \leq 50 \text{ .....2}$$

$$3x + y \leq 90 \text{ .....3}$$

$$x \geq 0, y \geq 0 \text{ .....4}$$



[Watch Video Solution](#)

2. Solve the following linear programming problem graphically.

$$\text{Minimize } Z = 200x + 500y$$

subject to the constraints:

$$x + 2y \geq 10$$

$$3x + 4y \leq 24$$

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



[Watch Video Solution](#)

3. Minimise and maximise  $Z = 3x + 9y$  subject to the constraints.

$$x + 3y \leq 60$$

$$x + y \geq 10$$

$$x \leq y$$

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



[Watch Video Solution](#)

4. Determine graphically the minimum value of the objective function

$$Z = -50x + 20y \dots\dots\dots 1$$

subject to the constraints:

$$2x - y \geq -5 \dots\dots\dots 2$$

$$3x + y \geq 3 \dots\dots\dots 3$$

$$2x - 3y \leq 12 \dots\dots\dots 4$$

$$x \geq 0, y \geq 0 \dots\dots\dots 5$$



[Watch Video Solution](#)

5. Minimise  $Z = 3x + 2y$

Subject to the constraints

$$x + y \geq 8$$

$$3x + 5y \leq 15$$

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



[Watch Video Solution](#)

6. A dietician wishes to mix two types of foods in such a way that vitamin contents of the mixture contain atleast 8 units of vitamin A and 10 units of vitamin C. Food I' contains 2 units/kg of

vitamin A and 1 unit/kg of vitamin C. Food 'II' contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs 50 per kg to purchase food T and Rs 70 per kg to purchase food I'. Formulate this problem as a linear programming problem to minimise the cost of such a mixture.



[Watch Video Solution](#)

7. (Allocation problem) 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 pre 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?



**Watch Video Solution**

8. A manufacturing company makes two models A and B of product. Each piece of model A requires 9 labour hours for fabricating and 1 hour labour for finishing. Each piece of model B requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs. 8,000 on each piece of model A and Rs 12,000 on each piece of model B. How many pieces of model A and B should be



manufactured per week to realise a maximum profit ? What is the maximum profit per week ?



[Watch Video Solution](#)

## Miscellaneous Examples

1. (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 cholester. How many packets of each food should be used to minimise the maount of vitamin A in the diet? What is the minimum amount of vitamin A?



[Watch Video Solution](#)

**Exercise 12 1 Solve The Following Linear Programming Problems Graphically**

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



[Watch Video Solution](#)

2. Minimise  $Z = -3x + 4y$  subject to  $x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0, y \geq 0$



[Watch Video Solution](#)

3. Maximise  $Z = 5x + 3y$  subject to  $3x + 5y \leq 15, 5x + 2y \leq 10, x \geq 0, y \geq 0$



Watch Video Solution

4. Minimize  $Z = 3x + 5y$  such that  
 $x + 3y \geq 3, x + y \geq 2, x, y \geq 0.$



Watch Video Solution

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



Watch Video Solution

6. Solve the following linear programming problem graphically :

$$\text{Minimize } Z = x + 2y$$

$$\text{subject to } 2x + y \geq 3, x + 2y \geq 6, x, y \geq 0.$$



[Watch Video Solution](#)

## Exercise 12 1 Show That The Minimum Of Z Occurs At More Than Two Points

1. Minimise and maximise  $Z = 5x + 10y$  subject to

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



Watch Video Solution

2. Minimise and maximise  $Z = x + 2y$  subject to

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

.



Watch Video Solution

3. Maximise  $Z = -x + 2y$ , subject to the constraints.

$$x \geq 3, x + y \geq 5, x + 2y \geq 6, y \geq 0.$$



Watch Video Solution

4. Maximise  $Z = x + y$  subject to

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



Watch Video Solution

## Exercise 12 2

1. 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 cost 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 vitamin A and 2 units/kg of vitamin B. Determine the minimum cost of the mixture .



[Watch Video Solution](#)

2. One kind of cake requires 200 g of flour and 25 g of fat and another kind of cake requires 100 g flour and 50g of fat. Find the maximum number of cakes which can be made from 5 kg



of flour and 1 kg of fat assuming that there is not shortage of the other ingredients used in making the cakes.



[Watch Video Solution](#)

**3.** 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 hours 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.

(i) What number of rackets and bats must be made if the factory is to work at full capacity ?

(ii) If the profit on a racket and on a bat is Rs 20 and Rs. 10 respectively, find the maximum profit of the factor when it works at full capacity.



[Watch Video Solution](#)

4. 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.



Watch Video Solution

5. A cottage industry manufactures pedestal lamps and wooden shades, each requiring the use of a grinding/ cutting machine and a spayar. It takes 2 hours on grinding/cutting machine and 3 hours on the sprayer to manufacture a pedstal 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 his daily production in order to maximise his profit ?



[Watch Video Solution](#)

6. A merchant plans to sell two types of personal computers - a desktop model and a portable model that will cost Rs. 25,000 and Rs. 40,000 respectively. He estimates that the total monthly demand of computers will not exceed

250 units Determine which the merchant should stock to get maximum profit merchant should stock to get maximum profit if he does not want to invest more than Rs. 70 laksh and if his profit on the desktop model is Rs 4500 and on portable model is Rs. 5000



[Watch Video Solution](#)

7. The corner points of the feasible region determined by the following system of linear inequalities:

$$2x + y \leq 10, x + 3y \leq 15, x, y \geq 0 \text{ are } (0,0),$$

$(5,0), (3,4)$  and  $(0,5)$ . Let  $Z = px + qy$  where  $p, q \geq 0$ . 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:**



**Watch Video Solution**

## Miscellaneous Exercise

1. An aeroplane can carry a maximum of 200 passengers. A profit of Rs 1000 is made on each executive class ticket and a profit of 600 is made on each economy class ticket. The airline reserves atleast 20 seats for executive class. However, atleast 4 times as many passengers prefer to travel by economy class than by the executive class. Determine how many tickets of each type must be sold in order to maximise the profit for the airline. What is the maximum profit?





## Watch Video Solution

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

<b>Transportation cost per quintal (in ₹)</b>		
<b>From/To</b>	<b>A</b>	<b>B</b>
<b>D</b>	6	4
<b>E</b>	3	2
<b>F</b>	2.50	3

How should the supplies be transported in order that transportation cost is minimum ?

What is the minimum cost ?



[Watch Video Solution](#)

**3.** An oil company has two depots A and B with capacities of 7000 L and 4000 L respectively. The company is to supply oil to three petrol pumps, D, E and F whose requirements are 4500L, 3000L and 3500 L respectively, the distances(in km) 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 cost of 10 litres of oil is 1 per km, how should the delivery be scheduled in order that the transportation cost is minimum? What is the minimum cost?



[Watch Video Solution](#)

4. 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



[Watch Video Solution](#)

5. 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

utmost 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 utmost 600 units . If the company makes profit Rs 12 Rs. 16 per doll respectively on dolls a and B, how many of each should be produced weekly in order to maximise the profit ?



**Watch Video Solution**