# MATHS

# BOOKS - MAXIMUM PUBLICATION

# LINEAR PROGRAMMING

## Example

**1.** Solve the following LPP Graphically,

Maximise, $Z = 60x + 15y$

Subject to constriants,

$x + y \leq 50, 3x + y \leq 90, x \geq 0, y \geq 0$

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**2.** Solve the following LPP Graphically,

Minimise, $Z = -3x + 4y$

Subject to constraints,

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

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**3.** Solve the following LPP Graphically,

Minimise, $Z = 3x + 5y$

Subject to constraints,

$x + 3y \geq 3, x + y \geq 2, x \geq 0, y \geq 0$

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**4.** 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 1kg of fat assuming that there is no shortage of the other ingredients,used in making the cake.

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**5.** A factory makes tennis rackets and bats,A tennis racket takes 1.5 hours of machine and 3 hours of craftsman'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 availibilityof not more than 42 hours of machine time and 24 hours of craftman's time. What no of rackets and bats must be produced if the factory is to work at full capacity?

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**6.** A factory makes tennis rackets and bats,A tennis racket takes 1.5 hours of machine and 3 hours of craftsman'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 availibilityof not more than 42 hours of machine time and 24 hours of craftman's time. if the profit on a racket and a bat isRs20 and Rs10 find maximum profit

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**7.** Two godowns A and B have grains capacity of 100 quintals and 50 quintals respectively.They supply to 3 ration shop D,E,F whose requirement are 60,50 and 40 quintals respectively.The cost of transportation per quintal from the godowns to the shops is given in the following table, transportation cost per quintal(in Rs).

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

| From/To | A | B |
|---|---|---|
| D | 6 | 4 |
| E | 3 | 2 |
| F | 2.5 | 3 |

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**8.** Choose the correct answer from the bracket.If an LPP is consistent,then its feasible region is always

A. Bounded

B. Unbounded

C. Convex region

D. Concave region

**Answer:**

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**9.** Maximise $Z = 2x + 3y$ subject to the constraints x+y<4, x>0, y>0`

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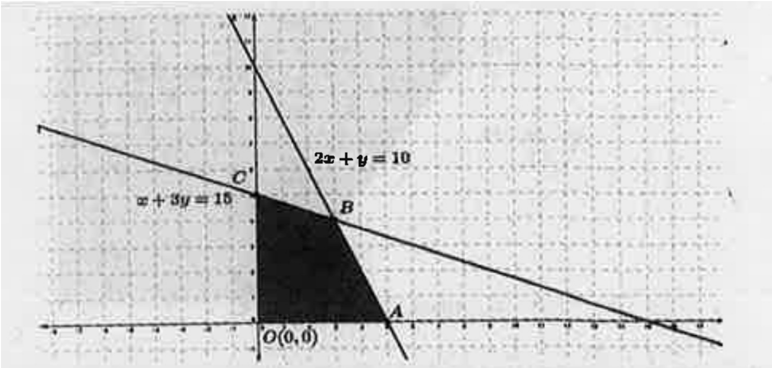
**10.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = px + qy$

What are the co ordinates of the corners of the feasible region.

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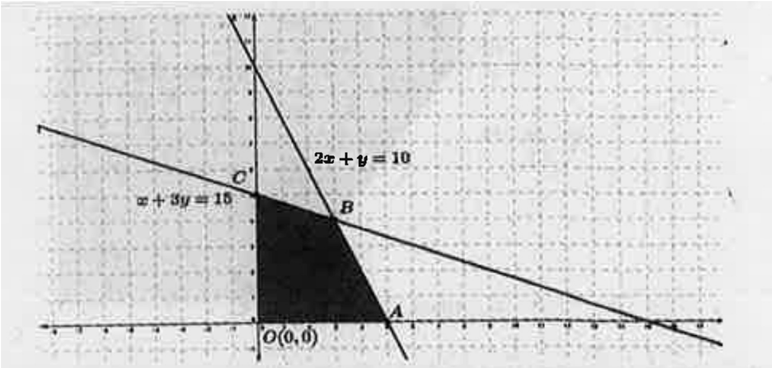
**11.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = px + qy$

Write the constraints.

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**12.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

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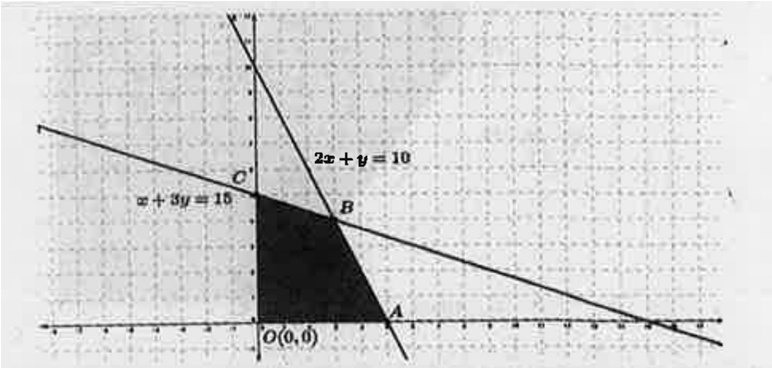
What are the co ordinates of the corners of the feasible region.

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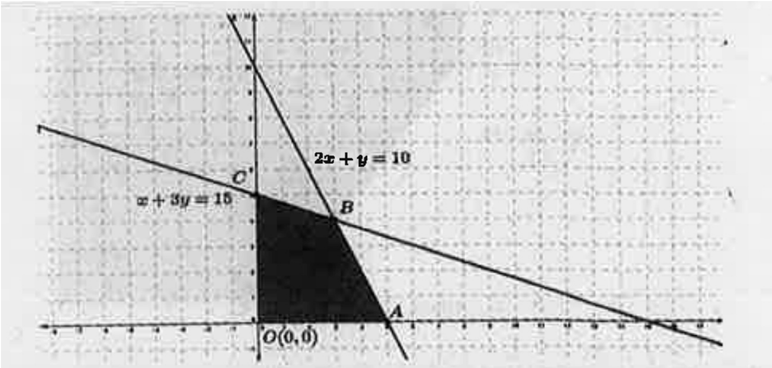
**13.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = px + qy$

Write the constraints.

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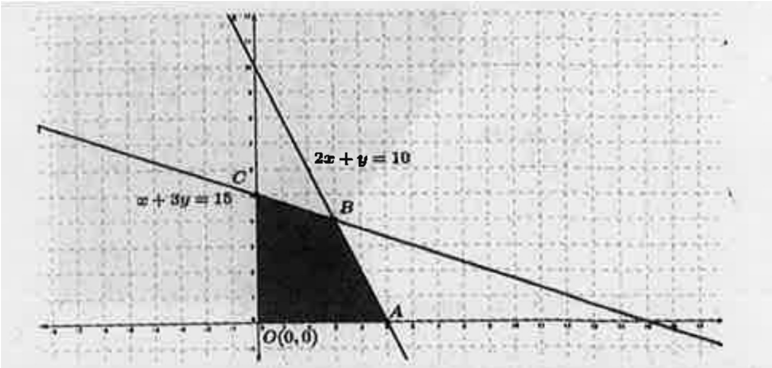
**14.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = 3x + 2y$

Find the Max Z.

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**15.** A diet is to contain atleast 80 units of vitamin A and 100 units of minerals.Two foods 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 unit of of vitamin A and 3 units of minerals.Formulate this as a linear programming problem.Find the minimum costs for diet that consists of misture of these two foods and also meets the minimal nutritional requirements.

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**16.** Consider the linear programming problem,

Maximise, $Z = x + y, 2x + y - 3 \leq 0,$

$x-2y+1\leq 0, y\leq 3, x\geq 0, y\geq 0$

Draw its feasible region.

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17. Consider the linear programming problem,

Maximize, $Z=x+y$, subject to constraints

$2x+y-3\leq 0, x-2y+1\leq 0, y\leq 3, x\geq 0,$

$y\geq 0$

Find the corner points of the feasible region.

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**18.** Consider the linear programming problem,

Maximise, $Z = x + y$, subject to the constraints $2x + y - 3 \leq 0, x - 2y + 1 \leq 0,$ $y \leq 3, x \geq 0, y \geq 0$

Find the corner at which Z attains its maximum.

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**19.** Consider the LPP

Minimise,Z=200x+500y

$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$

Draw the feasible region.

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**20.** Consider the LPP

Minimise,Z=200x+500y

$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$

Find the co-ordinates of the corner points of the feasible region.

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**21.** Consider the LPP

Minimize,Z=200x+500y

$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$

Solve the LPP.

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**22.** Consider the LPP

Maximise, $Z = 5x + 3y$

Subject to, $3x + 5y \leq 15, 5x + 2y \leq 10,$

$x, y \geq 0$

Draw the feasible region.

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**23.** Consider the LPP

Maximise, $Z = 5x + 3y$

Subject to, $3x + 5y \leq 15, 5x + 2y \leq 10,$

$x, y \geq 0$

Find the corner points of the feasible region.

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**24.** Consider the LPP

Maximise, $Z = 5x + 3y$

Subject to, $3x + 5y \leq 15, 5x + 2y \leq 10,$

$x, y \geq 0$

Find the corner at which Z attains its maximum.

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**25.** Consider the linear programming problem:

Minimise $Z = 3x + 9y$

subject to the constraints:

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

Draw its feasible region.

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**26.** Consider the linear programming problem:

Minimise $Z = 3x + 9y$

subject to the constraints:

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

Find the vertics of the feasible region.

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**27.** Consider the linear programming problem:

Minimise $Z = 3x + 9y$

subject to the constraints:

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

Find the minimum value of Z subject to the given constraints.

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**28.** Consider the linear inequalities

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

Mark the feasible region.

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**29.** Consider the linear inequalities

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

Maximise the function $z=4x+5y$ subject to the given constraints.

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**30.** Consider the linear programming problem:

Minimise $Z = \quad - 3x + 4y$

Subject to $x + 2y \leq 8{,}3x + 2y \leq 12$,x,y >.0

Mark its feasible region.

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**31.** Consider the linear programming problem:

Minimise $Z = \quad - 3x + 4y$

Subject to $x + 2y \leq 8{,}3x + 2y \leq 12$,x,y $\geq$ 0`

Find the corner points of the feasible region.

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**32.** Consider the linear programming problem:

Minimise $Z = -3x + 4y$

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

Find the corner at which Z attain its minimum.

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**33.** Consider the linear programming problem:

Maximize $z = 4x + y$

Subject to constraints:

$x + y \leq 50, 3x + y \leq 90, x, y \geq 0$

Draw the feasible region.

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**34.** Consider the linear programming problem:

Maximize $z = 4x + y$

Subject to constrains:

$x + y \leq 50, 3x + y \leq 90, x, y \geq 0$

Find the corner at which 'z' attains its maximum value.

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**35.** Consider the linear programming problem:

Maximize $z = 4x + y$

Subject to constrains:

$x + y \leq 50, 3x + y \leq 90, x, y \geq 0$

Find the corner at which 'z' attains its maximum value.

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**36.** Consider the LPP

Maximise $z = 3x + 2y$

Subject to the constraints

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

Find the corner points of the feasible region.

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37. Consider the LPP

Maximise $z = 3x + 2y$

Subject to the constraints

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

Find the corner points of the feasible region.

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**38.** Consider the LPP

Maximise $z = 3x + 2y$

Subject to the constraints

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

Find the maximum value of Z.

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**39.** Consider the linear programming problem:

Maximum $z = 50x + 40y$

subject to constraints:

$x + 2y \leq 10, 3x + 4y \geq 24, x, y \geq 0$

Draw the feasible region.

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**40.** Consider the linear programming problem:

Maximum $z = 50x + 40y$

subject to constraints:

$x + 2y \leq 10, 3x + 4y \geq 24, x, y \geq 0$

Find the corner points of the feasible region.

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**41.** Consider the linear programming problem:

Maximum $z = 50x + 40y$

subject to constraints:

$x + 2y \leq 10, 3x + 4y \geq 24, x, y \geq 0$

Find the maximum value of z.

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**42.** A furniture dealer sells only tables and chairs.He has Rs.12,000 to invest and a space to store 90 pieces.A table costs him Rs.400 and a chair Rs.100. He can sell a table at a profit of Rs.75 and a chair at a profit of Rs.25. Assume that he can sell all the items.The dealer wants to get maximum profit.By defining suitable variables ,write the objective function.

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**43.** A furniture dealer sells only tables and chairs.He has Rs.12,000 to invest and a space to store 90 pieces.A table costs him Rs.400 and a chair Rs.100. He can sell a table at a profit of Rs.75 and a chair at a profit of Rs.25. Assume that he can sell all the items.The dealer wants to get maximum profit.Write the constraints.

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**44.** A furniture dealer sells only tables and chairs.He has Rs.12,000 to invest and a space to store 90 pieces.A table costs him Rs.400 and a chair Rs.100. He can sell a table at a profit of Rs.75 and a chair at a profit of Rs.25.

Assume that he can sell all the items.The dealer wants to get maximum profit.

Maximise the objective function graphically.

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**45.** A company produces two types of cricket balls A and B.The production time of one ball of type B is double the type A(time in units ).The company has the time to produce a maximum of 2000 balls per day. The supply of raw materials is sufficient for the production of 1500 balls (both A and B) per day. The company wants to make maximum profit by making profit of Rs.3 from a ball type of A and Rs.5 from type B. Then,

By defining suitable variables write the objective function.

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**46.** A company produces two types of cricket balls A and B.The production time of one ball of type B is double the type A(time in units

).The company has the time to produce a maximum of 2000 balls per day.The supply of raw materials is sufficient for the production of 1500 balls (both A and B) per day.The company wants to make maximum profit by making profit of Rs.3 from a ball type of A and Rs.5 from type B.Then,

Write the constraints.

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**47.** A company produces two types of cricket balls A and B.The production time of one ball of type B is double the type A(time in units ).The company has the time to produce a maximum of 2000 balls per day.The supply of raw materials is sufficient for the production of 1500 balls (both A and B) per day.The company wants to make maximum profit by making profit of Rs.3 from a ball type of A and Rs.5 from type B.Then,

How many balls should be produced in each type per day in order to get maximum profit?

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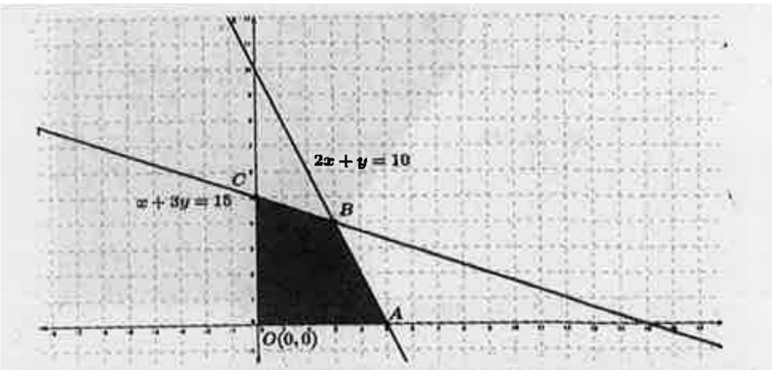
**48.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = px + qy$

What are the co ordinates of the corners of the feasible region.



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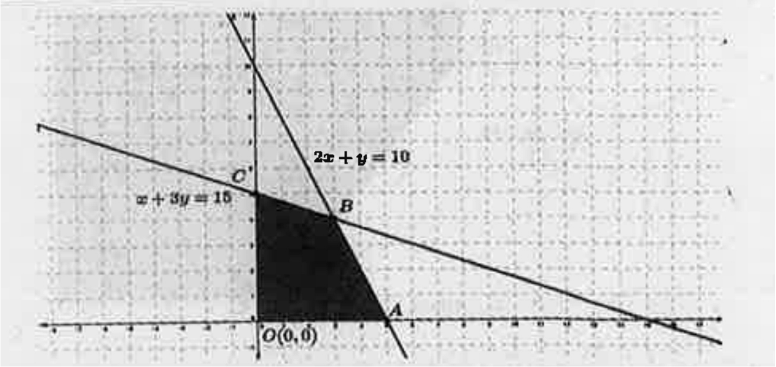
**49.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = px + qy$

Write the constraints.

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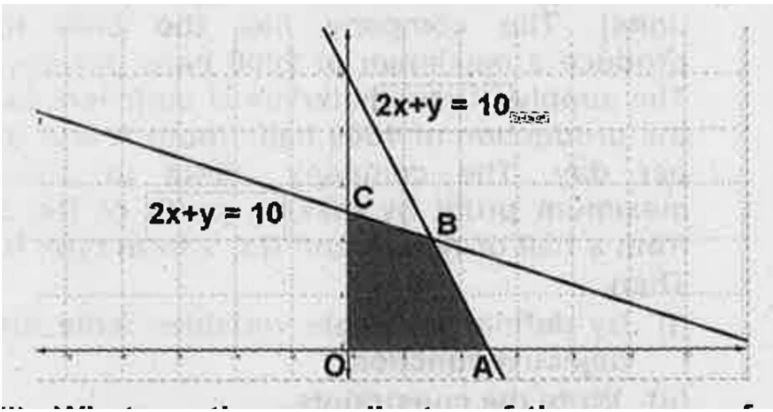
**50.** The graph of linear programming problem is given below.The shaded region is the feasible region.The objective function is Maximise, $Z = px + qy$

` If the Max,Z occurs at A and B,what is the relation between pand q?

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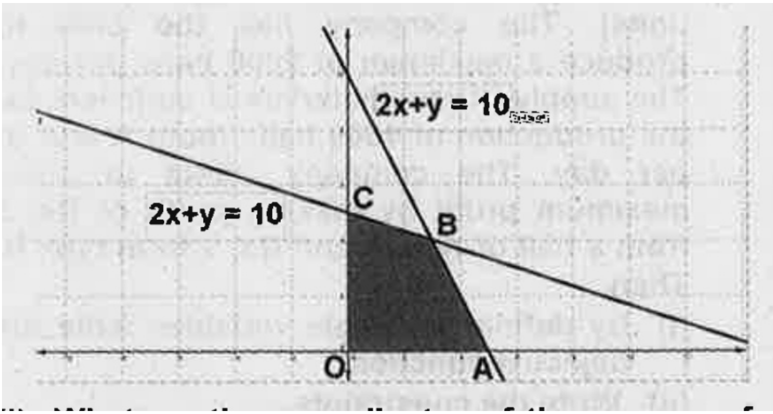
**51.** The graph of linear programming problem is given below.The shaded region is the feasible region.The objective function is

Maximise, $Z = px + qy$

If q=1, write the objective function when maximum of Z occures at A and B.`

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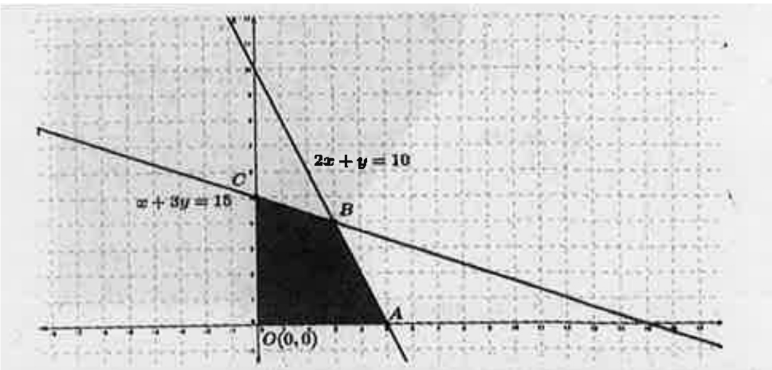
**52.** The graph of linear programing problem is given below.The shaded region is the feasible region.The objective function is

$Z = 3x + 2y$

Find the Max Z.

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**53.** A manufacturur 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 Rs.17.50 per package on nuts and Rs.7 per package on bolts.How many package of each should be produced each day so as to maximise the profit,if he operates his machine for at the most 12 hours a days?

By suitable defining the variables write the objective function of the problem.

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**54.** A manufacturur 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 Rs.17.50 per package on nuts and Rs.7 per package on bolts.How many package of each should be produced each day so as to maximise the profit,if he operates his machine for at the most 12 hours a days?

Formulate the problem as a linear programming problem.

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**55.** A manufacturur 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 Rs.17.50 per package on nuts and Rs.7 per package on bolts.How many package of each should be produced each day so as to maximise the profit,if he operates his machine for at the most 12 hours a days?

Solve the LPP graphically and find the number of packages of nuts and bolts to be manufactured.

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**56.** A bakery owner makes two types of cakes A and B. Three machines are needed for this purpose.The time (in minutes) requried for making each type of cake in each of the machines is given below:

| Machine | Types of cakes | |
|---|---|---|
| | A | B |
| I | 12 | 6 |
| II. | 18 | 0 |
| III | 6 | 9 |

Each machine is available for atmost 6 hours per day. Assume that all cakes will be sold out every day.The bakery owner wants to make maximum profit per day by making 7.50 from type A and 5 from type B.

write the object function

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**57.** A bakery owner makes two types of cakes A and B.There machines are needed for this purpose.The time(in minutes) required for making each type of cakes in each machine is given below,

Each machine is available for atmost 6 hours per day.Assume that all cakes will be sold out everyday.The bakery owner wants to make maximum profit per day by making Rs.7.5 from type A and Rs.5 from type B.

Find the maximum profit graphically.

| Machine | Types of cakes | |
|---|---|---|
| I | 12 | 6 |
| II | 18 | 0 |
| III | 6 | 9 |

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**58.** In factory there are two machines A and B producing toys.They respectively produce 60 and 80 units in one hour.A can run a maximum of 10 hours and B a maximum of 7 hours a day .The cost of their running per hour respectively amount to 2,000 and 2,500 rupee.The total duration of working these machines cannot exceed 12 hours a day.If the total cost cannot exceed Rs. 25,000 per day and the total daily production is atleast 800 units,then formulate the problem mathematically.

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