MATHS

BOOKS - BETTER CHOICE PUBLICATION

LINEAR PROGRAMMING

Solved Examples Section I Long Answer Questions

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

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

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

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4. 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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5. 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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6. 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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7. Maximise $Z = -x + 2y$, subject to the constraints $x \geq 3, x + y \geq 5, x + 2y \geq 6, y \geq 0$

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8. Maximise $Z = x + y$, subject to $x - y \leq -1, -x + y \leq 0, x, y \geq 0$

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9. 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 'I' and Rs 70 per kg to purchase Food 'II'. Formulate this problem as a linear programming problem to minimise the cost of such a mixture.

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10. Find the following differential equation ; $\frac{dy}{dx} = \frac{1+x^2}{1+y^2}$

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11. 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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12. 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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13. 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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14. 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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15. Solve the following differential equation ; $(x - y)dy - (x + y)dx = 0$

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16. 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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17. 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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Assignment Most Important Questions For Practice Long Answer Type Question Section I

1. Solve the following differential equation ; $\frac{dy}{dx} = \frac{x+1}{2-y}$

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2. Solve the following linear programming problem graphically : Maximize : $z = 4x + y$ Subject to the constraints : $x + y \leq 503x + y \leq 90x \geq 0, y \geq 0$

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3. Solve the following differential equation ; $\frac{dy}{dx} + \left(\frac{4x}{1+x^2}\right)y = \frac{1}{(1+x^2)^2}$

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4. 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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5. Solve the following linear programming problems graphically

Minimise $z = 3x + 2y$ subject to

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

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6. Solve the following linear programming problems graphically

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

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

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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 differential equation ; $\frac{dy}{dx} + 2\left(\frac{y}{x}\right) = 2x^2$

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9. 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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10. Solve the following linear programming problem graphically : Minimize $Z = 200x + 500y$ subject to constraints

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

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

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12. 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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13. 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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14. Solve the following linear programming problems graphically

Minimize $Z = 3x + 2y$ subject to the constraints $x + y \leq 8, 3x + 5y \geq 15, x, y \geq 0$

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15. Solve the following linear programming problems graphically

Minimize $Z = 5x + 7y$ subject to the constraints $2x + y \geq 8, x + 2y \geq 10, x, y \geq 0$

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16. 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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Assignment Most Important Questions For Practice Long Answer Type Question Section Ii

1. Solve the following linear programming graphically

Maximise z = 3x + 4y , subject to the constraints

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

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2. Solve the following linear programming problem graphically

Minimise Z = 3x + 5y subject to constraints

$x + y = 6, x \leq 4, y \leq 5, x \geq 0, y \geq 0$

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3. Solve the following linear programming problem graphically

Maximise z = 4x + y subject to constraints $x + y \leq 50, 3x + y \leq 90, x, y \geq 0$

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4. (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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5. Solve the following linear programming problem graphically

Minimise Z = 3x + 2y subject to constraints

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

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6. Solve the following linear programming problem graphically

Minimise Z = -3x + 4y subject to constraints

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

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7. An oil company requires 13000, 20000 and 15000 barrels of high grade medium grade and low grade oil respectively. Refinery A produces 100, 300 and 200 barrels per day of high, medium and low grade oil

respectively whereas the Refinery B produces 200, 400 and 100 barrels per day respectively. If A costs Rs 400 per day and B costs Rs 300 per day to operate, how many days should each be run to minimise the cost of requirement?

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8. A manufacturer produces two products A and B. Both the products are processed on two different machines. The available capacity of the first machine is 12 hours and that of second machine is 9 hours. Each unit of product A requires 3 hours on both machines and each unit of product B requires 2 hours

on first machine and 1 hour on the second machine. Each unit of product A is sold at a profit of Rs 5 and B at a profit of Rs 6. FInd the production level for maximum profit graphically.

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9. 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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10. 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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Previous Years Board S Questions For Practice

1. Minimize and Maximize $Z = 2x + 6y$ subject to the constraints $x + 2y \leq 10, x + y \leq 7, x \geq 2, x, y \geq 0$

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2. 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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3. Maximize $Z = 17x + 7y$ subject to the constraints

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

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4. Evaluate $\int \frac{1}{\sqrt{9-25x^2}}$

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5. Evaluate the following integral $\int (4x+2)\sqrt{x^2+x+1}dx$

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6. Evaluate the following integral $\int \frac{\cos x dx}{\sqrt{4-\sin^2 x}}$

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7. 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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8. Maximize $Z = 15x + 5y$ subject to the constraints $2x + 3y \leq 12, 3x + 2y \leq 12, x, y \geq 0$

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9. Maximize $Z = 11x + 3y$ subject to the constraints

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

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

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

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