MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

LINEAR PROGRAMMING

Solved Examples

1. Graph the solution set of the inequatin $2x - y \geq 1$.

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2. Draw the graph of the solution set of the system of inequations $2x + 3y \leq 4, x \geq 0$ and $y \geq 0$.

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3. Exhibit graphically the solution set of the system of lineear inequations

$x + y \geq 1, 7x + 9y \leq 63, y \leq 5, x \leq 6, x \geq 0$ and $y \geq 0$.

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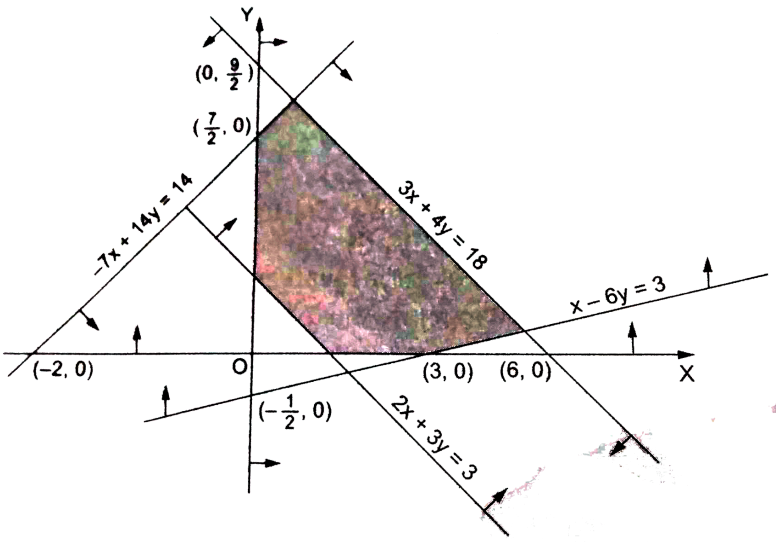
4. Find the linear constraints for which the shaded area in the figure below is the solution set.



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5. Solve the following problem graphically :

Minimise and Maximise $Z = 3x + 9y \ldots (1)$

subject to the constraints: $x + 3y \leq 60 \ldots (2)$

$x + y \geq 10 \ldots (3)$

$x \leq y \ldots (4)$

$x \geq 0, y \geq 0 \ldots (5)$

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6. A faniture dealer deals in only two itmes - tables and chairs. He has 'Rs. 50000 invest and has storage place of at most 60 pieces. A table costs Rs. 2500 and chair Rs. 500. He estimates that from the sale of one table, he can make a perfect Rs. 250 and that from the sale of one chair a profit of Rs. 75. How many table and chair he should buy from the available money so as to maximise his total profit assuming that he can sell all the items which he buys.

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

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8. Suppose every gram of wheat provides 0.1 g of proteins and 0.25 g of carbohydrates, and the corresponding values for rice are 0.05 g and 0.5 g respectively. Wheat costs Rs.5 and rise Rs.20 per kilogram. The minimum daily requirements of proteins and carbohydrates for an average man are 50 g and 200 g respectively. In what quantities should wheat and rice be mixed in hte daily diet to provide the minimum daily requirements of proteins and carbohydrates at minimum daily requirements of proteins and carbohydrates at minimum cost, assuming that both wheat and rice are to be taken in the diet?

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9. A firm manufactures two types of products, A and B, and sells them at a profil of 3 per unit to type B product and 5 perunit of type A product. Both product is processed on two machines M1and M2 One unit of type A requires one minute of processing time on M1 and two minutes of processing time on M2i whereas one unit of type B requires one minute of processing time on M1 and one minute on M Machines sells them at a profit of 5 per unit of type A and M, and M, are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product the firn should produce a day in order to maximize the profit. Solve the problem graphically [CHSE 2000]

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10. 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 Rs 600 is made on each economy class ticket. The airline reserves at least 20 seats for executive class. However, at least 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 maximize the profit for the airline. What is the maximum profit?

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11. A chemicla industry produces two compounds, A and B. The following table gives the units of ingredients C and D (per kg) of compounds A and B as well as minimum requirements of C and D, and costs per kg of A and B.

	Compound (in units)		Minimum requirement (in units)
	A	B	
Ingredient C (per kg)	1	2	80
Ingredient D (per kg)	3	1	75
Cost per kg (in ₹)	4	6	

Find the quantities of A and B which would minimize the cost.

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12. A company makes two kinds of leather belts, A and B. Belt A is high quality belt, and B is of lower quality. The respective profits are Rs. 40 and Rs. 30 per belt. Each belt of type A requires twice as much time as a belt of type B, and if all belts were of type B, the company could make 1000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle, and only 400 buckles per day are available. There are only 700 buckles available for belt B. What should be the daily production of each type f belt? Formulate the problem as a LPP.

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13. A company has factories located at each of the two places P and Q. From these locations, a certain commondity is delivered to each of the three depots situated at A, B and C. The weekly requirements of the depots are respectively 7, 6 and 4 units of the commodity while the weekly production capacities of the factories at P and Q are respectively 9 and 8 units. The cost of transportation per unit is given below.

From \ To	Cost (in ₹)		
	A	B	C
P	16	10	15
Q	10	12	10

How many units should be transported from each factory to each depot in order that the tranporatin cost is minimum ? formulate the above LPP mathematically and then slove it.

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14. A factory owner purchase two types of machines A and B for his factory. The requirements and the limitations for the machines are as follows :

Machine	Area occupied	Labour force on each machine	Daily output (in units)
A	1000 m^2	12 men	60
B	1200 m^2	8 men	40

He has maximum area of $9000m^2$ available and 72 skilled laborer's who can operate both the machines. How many machines of each type should he buy to maximize the daily output ?

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15. A retired person has Rs 70,000 to invest and two types of bonds are available in the in the market investment. First type of bond yields an annual income of 8% on the amount investment invested and second type of bond yields 10% per annum. As per norms, he has to invest minimum in the first type and not more than 30,000 in the second type. How should investment, so as to get maximum returns, after one year of investment?

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Exprcise 33 A

1. Graph the solution sets of the following inequations:

$x + y \geq 4$

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2. Graph the solution sets of the following inequations:

$x - y \leq 3$

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3. Graph the solution sets of the following inequations:

$x + 2y > 1$

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4. Graph the solution sets of the following inequations:

$2x - 3y < 4$

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5. Graph the solution sets of the following inequations:

$x \geq y - 2$

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6. Graph the solution sets of the following inequations:

$y - 2 \leq 3x$

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7. Solve each of the folowing systems of simultaneous inequations:

$2x + y > 1$ and $2x - y \geq -3$

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8. Solve each of the folowing systems of simultaneous inequations:

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

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9. Solve each of the folowing systems of simultaneous inequations:

$3x + 4y \geq 12, x \geq 0, y \geq 1$ and $4x + 7y \leq 28$

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10. Show that the solution set of the following linear inequations is empty set: $x - 2y \geq 0,\ 2x - y \leq -2,\ x \geq 0,\ y \geq 0$

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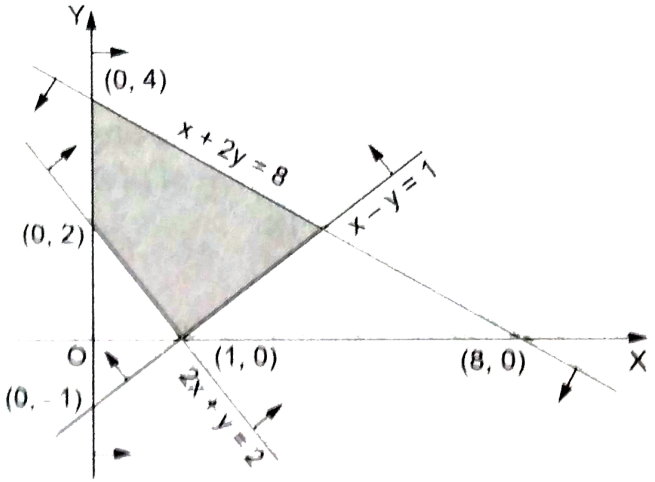
11. Solve each of the folowing systems of simultaneous inequations:

Find the linear constraints for which the shaded area in the figure given

is the solution set.



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Exprcise 33 B

1. Find the maximum vlue of $Z = 7x + 7y$, subject ot the constrainst $x \geq 0, y \geq 0, x + y \geq 2$ and $2x + 2y \leq 6$.

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2. Maximize $Z = 4x + 9y$, subject to the constraints $x \geq 0, y \geq 0, x + 5y \leq 200, 2x + 3y \leq 134,$

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3. Find the minimum value of $Z = 3x + 5y$, subject to the constraints $-2x + y \leq 4, x + y \geq 3, x - 2y \leq 2, x \geq 0$ and $y \geq 0.$

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4. Minimize $Z = 2x + 3y.$ subjeft ot the constraints $x \geq 0, y \geq 0, x + 2y \geq 1$ and $x + 2y \leq 10.$

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5. Maximize $Z = 3x + 5y,$ subject to the constraints $x + 2y \leq 2000, x + y \leq 1500, y \leq 600, x \geq 0$ and $y \geq 0.$

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

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7. Mr Dass wants to invest 12000 in Public Provident Fund (PPF) and inNational bonds. He has to invest at least 1000 in PPF and at least 2000 in bonds. If the rate of interest on PPF is 12% per annum and that on bondsis 15% per annum, how should he invest the money to earn maximum annual income? Also find the maximum annual income.

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8. A small firm manufactures necklaces and bracelets. The total number of necklaces and bracelets that it can handle per day is at most 24. It takes 1

hour to make a bracelet and half an hour to make a necklace. The maximum number of hours available per day is 16. If the profit on a necklace is Rs 100 and that on a bracelet is Rs 300, how many of each should be produced daily to maximize the profit?

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9. A Man has 1500 to purchase rice and wheat. A bag of rice and a bag of wheat cost 180 and 120 respectively. He has a storage capacity of 10 bags only. He earns a profit or 11 and 8 per bag of rice and wheat respectively. How many bags of each must he buy to make maximum profit?

A. 7 bags of each

B. 6 bags of each

C. 5 bags of each

D. 8 bags of each

Answer: C

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10. 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 Rs 17.50 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 maximize his profit , if he operates his machines for at the most 12 hours a day?

A. maximum profit $= Rs.78.50$

B. maximum profit $= Rs.53.50$

C. maximum profit $= Rs.73.50$

D. maximum profit $= Rs.63.50$

Answer: C

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11. Two tailors, A and B, earn 300 and 400 per day respectively. A can stitch 6 shirts and 4 pairs of trousers while B can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce at least 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.

A. 4 days and 4 days

B. 5 days and 3 days

C. 6 days and 2 days

D. 7 days and 1 days

Answer: B

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12. A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5,760 to invest and has a space for at most 20 items. A fan costs him Rs. 360 and a sewing machine Rs. 240. His expectation is that he

can sell a fan at a profit of Rs. 22 and a sewing machine at a profit of Rs. 18. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize the profit? Formulate this as a linear programming problem and solve it graphically.

A. 6 fans 18 sewing machines

B. 7 fans 14 sewing machines

C. 8 fans 12 sewing machines

D. 9 fans 13 sewing machines

Answer: C

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13. A firm manufactures two types of products, A and B, and sells them at a profil of 3 per unit to type B product and 5 perunit of type A product. Both product is processed on two machines M1and M2 One unit of type A requires one minute of processing time on M1 and two minutes of processing time on M2i whereas one unit of type B requires one minute

of processing time on M1 and one minute on M Machines sells them at a profit of 5 per unit of type A and M, and M, are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product the firn should produce a day in order to maximize the profit. Solve the problem graphically [CHSE 2000]

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14. A manufacture produces two types of soap bars using two machines, A and B.A is operated for 2 minutes and B for 3 minutes to manufacture the first type, while it takes 3 minutes on machine A and 5 minutes on machine B to manufacture the second type. Each machine can be operated at the most for 8 hours per day. The two types of soap bars are sold at a profit of R. 0.25 and Rs 0.50 each. Assuming that the manufacture can sell all the soap bars he can manufacture, hwo many bars of soap of each type should be manufactured per day so as to maximize his profit ?

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15. A manufacturer of patent medicines is preparing a production plan on medicines A and B. There are sufficient row material available to make 20000 bottles of A and 40000 bottles of B, but there are 45000 bottles into which either of the medicines can be put. Further, it takes 3 hours to prepare enough material to fill 1000 bottles of A, it takes 1 hours to prepare enough material to fill 1000 bottles of B and there are 66 hours available for this operation. The profit is Rs. 8 per bottle for A and Rs. 7 per bottle for B. Construct the maximization problem.

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16. A toy company manufacutes two types of dolls, A and B. Each doll of type B takes twice as long to produce as one of type. A and the company would have time to make a maxium of 2000 prr day, if it produces only type.A the supply of plastic is sufficient to produce 1500 dolls per day (both A and B combined). Type B requires a fancy dress of which there are only 600 per day available. If the company makes profits of Rs.3 and Rs5 per doll respectively on dolls A and B, how many of each should be

produced per day in order to mazimize the profit? Also, find the maximum profit.

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17. A small manufacures has employed 5 skilled men and 10 semiskilled men and makes an aritcle in two qualities, a de luxe model and an ordinary model. The making of a de luxe model required 2 hours' work by a skilled man and 2 hours' work by a semiskilld man. The ordinary model requires 1 hour by a skilled man and 3 hours by a semiskilled man. By union reles, no man can work more than 8 hours per day. The manufacturer gains Rs. 15 on the de luxe model and Rs 10 on the ordinary model. How many of each type should be made in order to maximize his total daily profit? Also, find the maximum daily profit.

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18. A company producing soft drinks has a contract which requires a minimum of 80 units of chemical A and 60 units of chemical B to go in

each bottle of the drink. The chemicals are available in a prepared mix from two different suppliers.Suppleer X has a mix of 4 units of A and 2 units of B that costs Rs.10, and the supplier Y has a mix of 1 unit of A and 1 unit of B that costs Rs4. How many mixes from X and Y should the company purchase to honour the contract requirement and yet minimize the cost ?

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19. A small firm manufactures gold rings and chains. The total number of rings and chains manufactured per day is atmost 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 Rs. 300 and that on a chain is Rs. 190, find the number of rings and chains that should be manufactured per day, so as to earn the maximum profit. Make it as an L.P.P. and solve it graphically.

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20. A manufactures makes two products, A and B. Product A sell at Rs. 200 each and takes $\frac{1}{2}$ hours to make. Product B shell at Rs. 300 each and takes 1 hour to make. There is a permanent order for 14 of product A and 16 of product B.A working week consists of 40 hours of production and the weekly turnover must not be less than Rs. 10000. If the profit on each of the product A is Rs.20 and on product B, it is Rs.30 then how many of each should be produced so that the profit is maximum? Asso, find the maximum profit.

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21. A man owns a field of area 1000 sq.m. He wants to plant fruit trees in it. He has a sum of Rs. 1400 to purchase young trees. He has the choice of two types of trees. Type A requires 10 sq.m. of ground per tree and costs Rs. 20 per tree and type B requires 20 sq.m. of ground per tree and costs Rs. 25 per tree. When fully grown type A produces an average of 20 kg. of fruit which can be sold at a profit of Rs. 2/ - per kg and type B produces an average of 40 kg of fruit which can be sold at a profit of Rs. 1.50/ - per kg.

How many of each type should be planted to achieve maximum profit when the trees are fully grown ?

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22. A publisher sells a hardcover editin of a book for Rs. 72 and a paperback edition of the same for Rs.40. Costs to the publisher are Rs. 56 and Rs. 28 respectively in addition to weekly costs of Rs. 9600. Both types require 5 minutes of printing time although the hardcover edition requires 10 minutes of binding time and thre paperback editin requires only 2 minutes. Both the printing and binding operations have 4800 minutes available each week. How many of each type of books should be produced in order to maximize the profit? Also find the maximum profit per week.

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23. A gardener has a supply of fertilizer of type I which consists of 10% nitrogen and 6% phosphoric acid and type II fertilizer which consists of

5% nitrogen and 10% phosphoric acid. After testing the soil conditions, he finds that he needs at least 14 kg of nitrogen and 14 kg of phosphoric acid for his crop. If the type I fertilizer costs 60 paise per kg and type II fertilizer costs 40 paise per kg, determine how many kilograms of each fertilizer should be used, so that nutrient requirements are met at a minimum cost. What is the minimum cost?

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24. 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 3500L 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 Re 1 per km,

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

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25. A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. To ensure certain nutrient constituents X,Y and Z, It is necessary to mix two types of feeds A and B . One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X,Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs. 20/unit and product B costs Rs 40/unit. Formulate this problem sa a linear programming problem to minimize the total cost.

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26. A dietician wishes to mix two types of foods in such a way that the vitamin contents of the mixture contains at least 8 units of vitamin A and

10 units of vitamin C. Food I contains 2 units/kg of vitamin A and 1 units/kg of vitamin C while Food II contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs.5 per kg to purchase Food I and Rs.7 per kg to purchase Food II. Determine the minimum cost of such a mixture. Formulate the above as a LPP and solve it graphically.

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27. A diet of a stic person must contain atleast 4000 unit of vitamins, 50 unit of proteins and 1400 calories. Two foods A and B are available at cos of Rs. 4 and Rs. 3 per unit respectively. If one unit of A contains 200 unit of vitamis, 1 unit of protein and 40 calories, while one unit of food B contains 100 unit of vitamins, 2 unit of protein and 40 calories. Formulate the problem, so that the diet be cheapest.

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28. A firm manufactures two types of products, A and B, and sells them at a profit of Rs.5 per unit of type A and Rs.3 per unit of type B.Each product

is processed on two machines, M_1 and M_2. One unit of type A requires one minute of processing time on M_1 and one minute on M_2. Machines M_1 and M_2. are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product the fiem should produce a day in order to maximize the profit. Solve the problem graphically.

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29. A small firm manufactures items A and B. The total number of items that it can manufacture in a day is at the most 24 Item A takes on hour to make while item B takes only half an hour. The maximum time available per day is 16 hours. If the profit on one unit of item A be 300 and that on one unit of item B be 160, how many of each type of item should be produced to maximize the profit? Solve the problem graphically

A. Z is maximum at (9,18) and its maximum value is Rs. 3898.

B. Z is maximum at (7,17) and its maximum value is Rs. 4998.

C. Z is maximum at (9,15) and its maximum value is Rs. 4860.

D. Z is maximum at (8,16) and its maximum value is Rs. 4960.

Answer: D

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30. A manufacture produceds two types of steel trunks. He has two machines, A and B. The first type of book case requires 3 hours on machine A and 3 hours on machine B for completion whereas the second type required 3 hours on machine A and 2 hours n machine B. Machines A and B can work at most for 18 hours and 15 hours per day respectively. He earns a profit of Rs.30 and Rs.25 per trunk of the first type and second type respectively. How many trunks of each type must he make each day to make the maximum profit?

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31. A copany manufactures two types of toys, A and B. Type A requires 5 minutes each for cutting and 10 minutes each for assembling. Type B

requires 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. The profit is Rs.50 each on type A and Rs.60 each on type B. How many toys of each type should the company manufacture in a day to maximize the profit?

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32. Kellogg is a new cereal formed of a mixture of bran and rice, that contains at least 88 grams of protein and at least 36 milligrams of iron. Knowing that bran contains 80 grams of protein and 40 milligrams of iron per kilogram, and that rice contains 100 grams of protein and 30 milligrams of iron per kilogram, find the minimum cost of producting this new cereal if bran costs Rs.5 per kilogram and rice costs Rs.4 per kilogram.

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33. A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5760.00 to invest and has space for at most 20 items. A fan costs him Rs.360.00 and a sewing machine Rs. 240.00. His expectation is that he can sell a fan at a profit of Rs. 22.00 and sewing machine at a profit of Rs. 80.00. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize his profit? Translate this problem mathematically and then solve it.

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34. Anil wants to invest at the most Rs.12000 in bonds. A and B. According to rules, he has to invest at least Rs.2000 in Bond A is 8% per annum and on Bond B, it is 10% per annum, how should he invest his money for maximum interest ? Solve the problem graphically.

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35. maximize $z = 60x + 15y$, subject to the constraints $x + y \leq 50, 3x + y \leq 90, x, y \geq 0.$

A. The maximum value of z is at $C(40, 0)$.

B. The maximum value of z is at $C(30, 0)$.

C. The maximum value of z is at $C(50, 0)$.

D. The maximum value of z is at $C(60, 0)$.

Answer: B

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36. A company manufactures two types of toys A and B. Type A requires 5 minutes each for cutting and 10 minutes each for assembling. Type B requires 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours available for cutting and 4 hours available for assembling in a day. He earns a profit of Rs.50 each on type A and Rs.60

each on type. B. How many toys of each type should the company manufacture in a day to maximize the profit ?

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37. 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 that 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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38. A manufacturing company makes two types of teaching aids A and B . Each type of A requires 9 labour hours for fabricating and 1 labour hours for finishing.Each type of B requires 12 labour hours for fabricating and 3 labour hours for finishing.For fabricating and finishing, the maximum labour hours abailable per week are 180 and 30 respectively.The company makes a profit of ₹ 80 on each type A and ₹ 120 on each type B. How many

pieces of type A and type B should be manufactured per week to get a maximum profit? Make it as an LPP and solve graphically.What is the maximum profit per week?

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Exprcise 33 B Long Answer Questions

1. A manufacturer makes two types, A and B of teapots. Three machines are needed for the manufacute and the time required for each teapot on the machines is given below.

Type \ Machine	Time (in minutes)		
	I	II	III
A	12	18	6
B	6	0	9

Each mahine is available for amaximum of 6 hours per day. If the profit on each teapot of type A is 75 paise and that on each teapot of type B is 50 paise, show that 15 teaport of type A and 30 of type B should be manufacured in a day to get the maximum profit.

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2. 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 requirements are 60,50 and 40 quintals respectively. The cost of transportation per quintal from the godowns to the shops are given in the following table:.

	Cost of transportation (in ₹ per quintal)	
To \ From	A	B
D	6.00	4.00
E	3.00	2.00
F	2.50	3.00

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

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3. A housewife wishes to mix together two kinds of food, X and Y, in such a way that the mixture contains at least 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C.

The vitamin contents of 1 kg of each food are given below.

One kg of food X costs rs 6 and one kg of food F cost rs 10. Find the least cost of the mixture which will produce the diet.

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Section A

1. If A is a square matrix of order 3 and $|3A| = k|A|$ then find the value of k,

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2. If $*$ is a binary operation on the set R of all real numers difined by $a * b = a + b - 3$ then find the identity element for $*$.

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3. Given an example to show that the releation $R = \{(a, b) : a \leq b^2\}$ on the set R of all real numbers is not reflexive.

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4. If $\vec{a}$ and $\vec{b}$ are two nonzero vectors such that $\left|\vec{a} \times \vec{b}\right| = \vec{a}.\vec{b}$ then find the angle between $\vec{a}$ and $\vec{b}$.

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Section B

1. Prove that each diagonal element of a skew-stmmetric matrix is zero.

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2. If $y = \tan^{-1}\left(\frac{5x}{1-6x^2}\right), where \frac{-1}{\sqrt{6}} < x < \frac{1}{\sqrt{6}}$ then prove that $\frac{dy}{dx} = \left(\frac{}{(1$

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3. Evaluate: $\int e^x \left(\frac{1-x}{1+x^2}\right)^2 dx.$

A. $\frac{e^x}{(1+4x)^2} + C$

B. $\frac{e^x}{(1+3x)^2} + C$

C. $\frac{e^x}{(1+x^2)}$+C

D. $\frac{e^x}{(1+2x)^2} + C$

Answer: C

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4. If $\left|\vec{a}+\vec{b}\right|=60, \left|\vec{a}-\vec{b}\right|=40$ and $\left|\vec{a}\right|=22$ then find $\left|\vec{b}\right|$.

A. $\vec{|b|}=46$

B. $\vec{|b|}=48$

C. $\vec{|b|}=44$

D. $\vec{|b|}=50$

Answer: A

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5. If $P(A)=\frac{2}{5}, P(B)\frac{1}{3}, P(A\cap B)=\frac{1}{5}$ then find $P\left(\overline{A}\mid\overline{B}\right)$.

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6. If x changes from 5 to 5.01 then find the approximate change in $\log_e x$.

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7. Obtain the differential equation of the family of circles passing through the point (a,0) and (-a,0).

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8. Simplify

$$\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right), x < -1$$

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Section C

1. If $A = \begin{bmatrix} 3 & 4 \\ 1 & -1 \end{bmatrix}$ then using A^{-1} solve the following system of equatins: $3x + 4y = 5, x - y = -3.$

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2. Discuss the differentiability of the function

$$f(x) = \begin{cases} 2x - 1 & when x < \frac{1}{2} \\ 3 - 6x & when x \geq \frac{1}{2} \end{cases} at x = \frac{1}{2}.$$

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3. If $x = a\sin(pt), \quad y = b\cos(pt),$ then show that $(a^2 - x^2)y\frac{d^y}{dx^2} + b^2 = 0$

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4. Separate the interval $\left[0, \frac{\pi}{2}\right]$ into sub intervals in which function $f(x) = \sin^4(x) + \cos^4(x)$ is strictly increasing or decreasing.

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5. Evaluate: $\int \frac{\sin x}{(\cos^2 x + 1)(\cos^2 x + 4)} dx.$

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6. A magazine seller has 500 subscribers and collects annual subscription charges of Rs.300 per subscriber. Sh e proposes to increase the annual subscription charges and it is believed that for every increase of Re 1, one subscriber will discontinue. What increase will bring maximum income to her? M solution. Write one important role of magazines in our lives. ake appropriate assumptions in order to apply derivatives to reach the

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7. Solve the differential equation $\left(1+e^{x/y}\right)sx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0.$

Or Find the general solution of the differential equation $(1+\tan y)(dx-dy)+2xdy=0.$

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8. Prove that: $\vec{a}.\left\{\left(\vec{b}+\vec{c}\right)\times\left(\vec{a}+2\vec{b}+3\vec{c}\right)\right\}=\left[\vec{a}\,\vec{b}\,\vec{c}\right].$

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9. If the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-a}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$ are the skew lines then find the value of a.

A. 3

B. 4

C. 5

D. 6

Answer: A

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10. A bag contains 4 green and 6 white balls. Two balls are drawn one by one without replacement. If the second ball drawn is white, what is the probability that the first ball drawn is also white ?

A. $\frac{3}{9}$

B. $\frac{7}{9}$

C. $\frac{5}{9}$

D. $\frac{5}{8}$

Answer: C

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11. two cards are drawn successively with replacement from a pack of 52 cards. Find the probability distribution of the number of diamonds and the mean of the distribution.

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Section D

1. Let Q be the set of all rational numbers and let $*$ be a binary operation on $Q \times Q$ defined by $(a, b) * (c, d) = (ac, b + ad)$.

Determine whether $*$ is commutative and associative. Find the identity element for $*$ and invertible elements of $Q \times Q$.

Or Let $f: [0, \infty) \to R$ be a function defined by $f(x) = 9x^2 + 6x - 5$. Prove that f is not invertible. modify only the condomin of f to make f invertible and then find its inverse.

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2. Using the properties of determinats, prove that

$$\begin{vmatrix} \frac{(a+b)^2}{c} & c & c \\ a & \frac{(b+c)^2}{a} & a \\ b & b & \frac{(c+a)^2}{b} \end{vmatrix} = 2(a+b+c)^3.$$

Or, If $p \neq 0, q \neq 0$ and $\begin{vmatrix} p & q & p\alpha + q \\ q & r & q\alpha + r \\ p\alpha + q & q\alpha + r & 0 \end{vmatrix} = 0$ then using the propetries of eterminants, prove that at least one of the following statements is true:

(a) p,q,r are in GP (b) α is a root of the equation $px^2 + 2qx + r = 0$.

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3. Using integration find area of the region bounded by the curves $y = \sqrt{5 - x^2}$ and $y = |x - 1|$

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4. Evalute: $\int_0^{\pi/2} \frac{x \sin x \cos x}{\sin^4 x + \cos^4 x} dx.$

Or, Eventuate: $\int_0^4 \left(x + e^{2x}\right) dx$ as the limit of a sum.

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5. Find the equation of the plane through the point $(4, -3, 2)$ and perpendicular to the line of intersectin of the planes $x - y2z - 3 = 0$ and $2x - y - 3z = 0$. Find the point of intersectin of the line $\vec{r} = \hat{i} + 2\hat{j} - \hat{k} + \lambda\left(\hat{i} + 3\hat{j} - 9\hat{k}\right)$ and the plane obtained above.

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6. In a mid-day meal porogramme, an NGO wants to provide vitamin-rich diet to the students of an MCD school. The dietician of the NGO wishes to mix two types of dood in such a way that vitamin contents of the mixture contains at least 8 units of vitamin A and 10 units of vitamin C. Food 1 contains 2 units per kg of vitamin A and 1 unit per kg of vitamin C. Food 2 contains 1 units per kg of vitamin A and 2 units per kg of vitamin C. It costs Rs.50 per kg to purchase Food 1 and Rs.70 per kg to purchase Food 2. Formulate the problems as LPP and solve it graphically for the imnimum cost of such a mixture ?

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