Paper BCH 4.2: BUSINESS MATHEMATICS

Q1. Mr. X has invested a part of his investment in 10% bond A and a part in 15% bond B. His interest income during first year is Rs. 4,000. If he invests 20% more in 10% bond A and 10% more in 15% bond B, his income during second year increases by Rs. 500. Find his initial investment and the new investment in bonds A and B, using matrix method.

Q2. To control a certain crop disease, it is necessary to use 8 units of chemical A, 14 units of chemical B and 13 units of chemical C. One barrel of spray P contains 1,2,3 units of the chemical, one barrels of sprays Q contains 2,3,2 units and one barrel of spray R contains 1,2,2 units of these chemicals respectively. How much of each type of spray be used to control the disease?

Q 3. A housewife went for shopping to buy 2kg of butter, 1 kg of cheese and 3 kg of sugar. In her local stores these were priced at Rs. 80, Rs. 60, Rs. 18 per kg respectively, but at the super market in a near by town they could be bought at Rs. 75, Rs. 54 and Rs. 14. How much would she save by going to town if her us fare for the return journey was Rs. 20?

Q 4. In a certain city there are 50 colleges and 400 schools. Each school and college has 18 peons, 5 clerks and 1 cashier. Each college, in addition, has 1 section officer and 1 librarian. The monthly salary of each of them is as follows:

Peon-Rs. 3000, Clerk- Rs. 5000, Cashier-Rs. 6000, Section officer- Rs. 7000 and Librarian-Rs, 9000. Using matrix notation, find

(i) The total number of post of each kind in schools and colleges taken together,
(ii) The total monthly salary bill of all the schools and colleges taken together.

Q 5. A firm produces two products P_1 and P_2, passing through two machines M_1 and M_2 before completion. M_1 can produce either 10 units of P_1 or 15 units of P_2 per hour. M_2 can produce 15 units of either products per hour. Find daily production of P_1 and P_2, if time available is 12 hours of machine M_1 and 10 hours of M_2 per day using matrix inversion.

Q 6. One unit of commodity A is produced by combining 1 unit of land, 2 units of labour and 5 units of capital. One unit of B is produced by 2 units of land, 3 units of labour and 1 unit of capital. One unit of C is produced by 3 units of land, 1 units of labour and 2 units of capital, If the price of A,B,C are Rs. 27, Rs. 16 and Rs. 19 respectively, find the rent R, wages W and rate of interest I, by using determinant method.

Q 7. The cost function of a company is given by $C(x) = 100x - 8x^2 + (1/3)x^3$, where x denotes the output. Find the level of output at which (i) marginal cost is minimum, (ii) average cost is minimum.

Q 8. For the demand curve $aQ+bP-K=0$, where a,b and K are positive constants, determine point elasticity of demand when marginal revenue is zero.

Q 9. Suppose the consumers will demand 40 units of a product when the price is Rs. 12 per unit and 25 units when the price is Rs. 18 each. Find the demand function, assuming that it is linear. Also determine the total revenue function, the average revenue function and the marginal revenue function.

Q 10. For a linear demand function, show using calculus, that price elasticity of demand increases with increase in prices and decreases with increase in quantity.

Q 11. The demand x as a function of income y is given by $30x = 10 + 2y$. Obtain the expression for the income elasticity of demand and its value when $y = 250$.

Q 12. Cost function of a company is given by $C(x) = x^3 - 9x^2 + 20x + 8$, where x denotes the output. If the demand function is given by $p = 440 - 3x$. Find the revenue function and profit function. Find the level of output at which profit will be maximum.

Q 13. Calculate the cost of producing certain type of 10 calculators, if the marginal cost (in Rupees per unit) is $C(x) = 0.3x^2 - 2.4x + 30$.

Q 14. Let the marginal revenue function is $7 - 4x - x^2$. Then , find the total revenue function and the demand function.

Q 15. A company determines that the marginal cost of producing x units of a particular commodity during a one-day operation is $16x - 1{,}591$, where the production cost is in rupees. The selling price of a commodity is fixed at Rs. 9 per unit and the fixed cost is Rs. 1,800 per day. What is the maximum profit that can be obtained in a one-day operation?

Q 16. The demand function for a commodity is $p = 20 - 3q$ and the supply function on the market is $p = 2q$. Find the consumer's surplus under pure competition.

Q 17. A firm's annual sales are Rs. 10,000. The sales are continuously increasing at the rate 20% per annum. Find the cumulative sales of first five years using calculus.

Q 18. The demand and supply laws for a commodity are $p = 18 - 2x - x^2$ and $p = 2x - 3$. Find the consumer's surplus and producer's surplus at equilibrium prices.

Q 19 . A person deposited Rs. 10,000 in a bank for 3 years offering interest at the rate of 6% compounded half yearly during first year, at the rate of 12% compounded quarterly during second year and at 10% compounded continuously during third year. Find his balance after three years.

Q 20. Find the amount to which Rs. 100 will accumulate at the rate of 12% per annum compounded quarterly for 10 years.

Q 21. Distinguish between the nominal ad effective rate of interest. Also establish the relationship between nominal and effective rate of interest, when compounded n times a year and when compounded continuously.

Q 22. The total cost C(x) of a firm is $C(x)= 1500 + 30x + x^2$, where x is the output. Determine:

(i) The average cost,
(ii) The marginal cost,
(iii) The marginal cost when 20 units are produced,
(iv) The actual cost of producing twenty-first unit.

Q 23. Find the effective interest rate, if nominal interest rate is 6% and interest is compounded continuously.

Q 24. What is meant by rate of discount? How does it differ from the rate of interest? Bring out the relationship among effective rate of discount, nominal rate of discount and force of discount.

Q 25. A transport company uses 3 types of trucks , to transport 3 types of vehicles .The capacity of each truck in terms of 3 types of vehicles is given below:

Using Matrix method, find

i) The number of trucks of each type required to transport 85, 105 and 110 vehicles of types respectively.

ii) The number of vehicles of each type which can be transported, if company has 10, 20 and 30 trucks of each type respectively.

Q 26. Using calculus, show that profit of a monopolist is maximum, when

Q 27. The marginal cost function of a firm is . Find the total cost of 100 units, if the cost of producing one unit is Rs. 22.

Q 28. After an advertising campaign, a product has a sales rate given by , where t is the number of months since the close of campaign. Find the total sales after three months. (Given: $e^{-1.5} = 0.2231$.)

Q 29. Mr. X took a loan of Rs. 2000 for 6 months. Lender deducts Rs. 200 as interest while lending. Find the effective rate of interest charged by the lender.

Q 30. The demand x as a function of income y is given by 30x = 10 + 2y. Obtain the expression for the income elasticity of demand and its value, when y = 250.