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Registration number:

ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27

Bsc Economics - I SEMESTER

SEMESTER EXAMINATION: OCTOBER 2021

(Examination conducted in March 2022)

**ECS 1221 – Mathematics for Economics**

Time- 3 hrs Max Marks-100

This question paper contains two printed pages and three parts

**Part A**

**Answer any 10 questions 3\*10 = 30 Marks**

1. Given 2\*2 matrix, A = , B =
2. 4A + B,
3. B – A
4. Find the product of A and B where, A = 2 4 and B = - 2 4 .

3 -2 1 -2

1. The MR function of a firm is given by: MR = 15 – 3x2. What would be the demand curve of the firm in the market?
2. Given y = (u + 4)(3u + v), find fu  and fv when (u,v) = (2,1).
3. Given y = (2x3 + 3x2)3, find dy/dx using Chain Rule of differentiation.
4. Find the second and third derivatives of the function: f(x) = 3x/(1 – x).
5. Assume the demand function as: p + q = 1. Find the total revenue function. Find the total revenue if 1/3 unit is sold. Find the marginal revenue function.
6. Given y = 2x13 - 11 x12 x2 + 3 x22 , check Young’s theorem when x1 = 1 and x2 = 2.
7. Given the demand and supply equations as: Qd = 24 – 2P and Qs = - 5 + 7P, find the equilibrium price and quantity (P\*,Q\*).
8. Test the geometric shape of the function y = 3x2 (for x>0).
9. Obtain dy/dx for xy = yx.
10. Given u’ = [ 3 8 7 ], v’ = [5 2 6 ] and w’ = [ 7 5 8 ], find uv’ and w’u.

**Part B**

**Answer any 5 questions 5\*5 = 25 Marks**

1. The demand function for a commodity is given by: X1 = 300 – 0.5p1 2 + 0.02p2 + 0.05y. Find the income elasticity of demand when p1 = 12, p2 = 10 and y = 200. Comment on the nature of the commodity.

1. Suppose demand and supply curves of a commodity are: Pd = 10 – q and Ps = q + 2. Find Consumer’s Surplus (C.S.) at the equilibrium price and quantity.
2. Given the production function, Q = 96K0.3 L0.7, find MPk and MPl functions. Is MPk a function of K alone, or of both K and L? what about MPl ?
3. Check the homogeneity of the function: f(x,y) = x3 – xy + y3.
4. Show that the demand curve: P = (a/x+b) – c [given, a,x,b,c > 0] is downward sloping and convex from below.
5. Find the extrema of the function: y = 3x – 12x2.
6. Solve the equation 5dy – (25y + 75)dt = 0 given the condition that y(t = 0) = 2.

**Part C**

**Answer any 3 questions 15\*3 = 45 Marks**

1. Given the production function Q = K1/2 L1/2 and prices per unit of K and L are Rs. 4 and Rs. 8 respectively and total cost is Rs. 400. Determine the maximum output subject to the cost constraint.
2. Consider the following national income determination model:

Y = C + I + G; C = a + b (Y – T); T = d + tY,

where, Y (national income), C (consumption) and T (tax collection) are endogenous variables; I (investment) and G (government expenditure) are exogenous variables; t is the income tax rate. Solve for the endogenous variables, using Cramer’s rule.

22. Assume that in a duopoly market, the demand and cost functions of the duopolists (Firm A and B) are:

P = 100 – 0.5(X1 + X2), C1 = 5X1, C2 = 0.5X22

1. Find the equilibrium price and quantity combination, if the two firms follow Cournot behaviour.
2. Find the profit maximising price and quantity combination if both the firms form a Cartel and maximise joint profit.
3. Compare the profit maximising quantities and also the amount of profit in the previous two scenarios.

1. A monopolist produces his product using the cost function C = X2 + 10X. He sells his output in two markets and the demand functions in these markets are: X1 = 32 – 0.4p1, X2 = 18 – 0.1p2.
2. The monopolist is able to price-discriminate between the two markets. Determine his price-quantity combination in each market. What is his total profit?

b. Determine the price, output and profit if price discrimination is prohibited and the monopolist charges the same price in both markets.

24. What would be the demand for x and y if the utility function is given as U = 4xy - x2 and the budget line is given as 6 = 2x + y.