

[This question paper contains 6 printed pages.]

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Sr. No. of Question Paper : 9570

Unique Paper Code : 12481202

Name of the Paper : Mathematics for Business Economics

Name of the Course : **B.A. (Hons.) Business Economics,  
2018 (CBCS)**

Semester : II

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

Write your Roll No. on the top immediately on receipt of this question paper.

Attempt **all** questions.

Use of simple calculator is allowed.

Attempt any **three** of the following : (5×3=15)

(a) (i) Compute the relative rate of growth for  $x = \ln(t + 1)$

(ii) Find the value of  $x$  in the function  $\log_x e^2 = 2$ .

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(b) Given the function  $y = \frac{1}{1+x^n}$  for  $x \geq 0$ , Show that the above function is discontinuous at  $x = 1$ . Also discuss the nature of discontinuity.

(c) Let  $f$  be defined on  $[0, 1]$  by  $f(x) = 2x^2 - x^4$

(i) Find the range of  $f$

(ii) Show that  $f$  has an inverse function  $g$ , and find  $g$ .

(d) (i) Find the linear approximation to the following functions  $f(x) = (1+x)^5$  about  $x_0 = 0$ .

(ii) Find limit of the function  $f(x) = \frac{3x+2|x|}{5x-3|x|}$  as  $x$  tends to zero.

2. Attempt any **three** of the following : (5×3=15)

(a) (i) Define linear independence of vectors.

(ii) If  $\alpha$ ,  $\beta$  and  $\gamma$  are three independent vectors in  $\mathbb{R}^3$  examine the independence of the set of vectors  $(\alpha + \beta)$ ,  $(\beta + \gamma)$  and  $(\gamma + \alpha)$ .

(b) An economy produces only coal and steel. The two commodities serve as intermediate inputs in each other's production. 0.4 tonnes of steel and 0.7 tonnes of coal are needed to produce 1 ton of steel. Similarly, 0.1

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tonnes of steel and 0.6 tonnes of coal are required to produce 1 tonne of coal. Do you think that the system is viable? Further, the economy needs 100 tonnes of coal and 50 tonnes of steel as final demand. Calculate the output of the two commodities consistent with the model.

- (c) (i) Find the equation for the plane in  $R^3$  passing through  $a = (2, 1, -1)$  with  $p = (-1, 1, 3)$  as a normal.
- (ii) Check if the pair of vector is orthogonal  $(1, -1, 1)$  and  $(-1, 1, -1)$
- (d) (i) Define the conditions for consistency of the system of equations.
- (ii) Find the value of  $k$  such that the following system of equation has a non-trivial solution :
- $$x + ky + 3z = 0$$
- $$2x + ky - 2z = 0$$
- $$2x + 3y - 4z = 0$$

Attempt any **four** of the following :

(5×4=20)

- (a) A company has the demand function  $P + 2Q^2 - 600 = 0$ , and the cost function  $TC - 216Q - 100 = 0$ , where  $P$  is the price of the item (Rs.),  $Q$  is the quantity produced

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and sold, and TC is the total cost (Rs.) of production.

- (i) Determine the price and quantity for maximum sales revenue, and calculate the maximum revenue.
- (ii) Determine the price and quantity for maximum profit, and calculate the maximum profit.
- (b) What do you understand by a convex set? Explain sketching graphs which of the following are convex
- (i)  $\{(x,y) \mid y \geq 13 - x^2\}$
- (ii)  $\{(x,y) \mid xy \leq 1; x > 0, y > 0\}$
- (c) A commodity has a demand curve given by the function
- $$x = \frac{10 - 5p}{p}$$
- Show that demand increases from zero to an indefinitely large amount. Find the price at which demand vanishes. Also show that the Total revenue indefinitely increasing as price falls but remains smaller than a finite value. Find this value.

- (d) Given the demand and supply functions :

$$X_D = 30 - 5P, \text{ and}$$

$$X_S = 10 + 2P$$

Find the equilibrium level of price and output. If a tax at the rate of Rs. 2 per unit is levied, find the new equilibrium level of price and output and the tax revenue for the government.

(e) (i) Find the inflection point for the function  $f(x) = x^4$ .

(ii) Find domain and range of the function  $f(x) = \sqrt{\frac{1-x}{x}}$ .

Attempt any five of the following : (5×5=25)

(a) Suppose utility function for a consumer is given by  $f(x, y) = 100 - e^{-x} - e^{-y}$ . Show that the indifference curves are downward sloping and convex to the origin.

(b) Find equation of the tangent plane at the point (0, 0, 2) to the function  $x - 2y - 3z + z^2 = -2$ .

(c) Define Homogeneous and Homothetic functions. Check for the following functions :

(i)  $Z = a \ln x + b \ln y$

(ii)  $Z = \ln \left( \frac{x^2}{y^2} \right)$