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1 SEM TDC ECOH (CBCS) C2

2019

(December)

ECONOMICS

(Core)

Paper : C-2

(Mathematical Methods for Economics-I)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct option / Answer the following: 1×8=8

(a) $A \cap A' =$

(i) Ω

(ii) A

(iii) ϕ

(iv) A'

(2)

(b) If the AR function is $AR = 100 - 3x$, identify the MR function.

(i) $MR = 100x - 3x^2$

(ii) $MR = 100x + c$

(iii) $MR = -6x + 10$

(iv) $MR = -6x + 100$

(c) $\int a^x dx =$

(i) $\log a^x + c$

(ii) $ax + c$

(iii) $\frac{a^x}{\log_e a} + c$

(iv) $a^x + c$

(d) Define limit of a function.

(e) The solution of the differential equation

$$\frac{dy}{dx} = 6 \text{ is}$$

(i) $y = Ae^{6x}$

(ii) $y = Ae^{6x} + c$

(iii) $y = 6x$

(iv) $y = 6x + c$

$$(f) \int_a^b f(x) dx =$$

$$(i) \int_b^a f(x) dx$$

$$(ii) -\int_b^a f(x) dx$$

$$(iii) \int_0^b f(x) dx$$

$$(iv) \int_a^0 f(x) dx$$

(g) Distinguish between rational number and irrational number.

(h) A consumer has a utility function $U = u(Q) = \alpha Q^\beta$. His/her marginal utility function is

$$(i) MU = \alpha Q^{\beta-1}$$

$$(ii) MU = \beta Q^{\alpha-1}$$

$$(iii) MU = \alpha \beta Q^{\alpha-1}$$

$$(iv) MU = \alpha \beta Q^{\beta-1}$$

2. Answer any four of the following : $4 \times 4 = 16$

(a) Distinguish between relations and functions with examples.

(b) Evaluate

$$\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1}$$

(c) Given the consumption function

$$C(y) = 1000 - \frac{200}{5 + y}$$

Find the marginal propensity to consume at $y = 10$.

(d) Find

$$\int e^x x^2 dx$$

(e) Briefly explain the uses of differential equations in economics.

3. (a) (i) Given the following sets :

$$S_1 = \{a, b, c, d\}$$

$$S_2 = \{1, 2, 3, 4\}$$

Find the Cartesian product P . Also graph the Cartesian product. $3+2=5$

(ii) Define set. Illustrate the operations of sets with the help of Venn diagram. $1+4=5$

(5)

Or

- (b) (i) Define the following with examples : $1 \times 4 = 4$
Null set; Disjoint set; Convex set; Intersection of sets
- (ii) Find the power sets of the following sets :
 $A = \phi, B = \{1\}$ $1 + 1 = 2$
- (iii) Define proper subset. Write the proper subsets of $A = \{1, 2, 3\}$. $2 + 2 = 4$
4. (a) (i) Define continuity of a function. Check the continuity for $f(x) = |x|$ at $x = 0$. $2 + 3 = 5$
- (ii) Draw the graph of $y = x^{-1.3}$. 6

Or

- (b) Define function. Explain with diagram different types of functions. $2 + 9 = 11$
5. (a) (i) Given the production function $Q = -\frac{2}{3}L^3 + 10L^2$, where L is labour employed. Show that diminishing marginal product of labour operates when employment of labour is 6 or more. 5

(ii) Find $\frac{d}{dx} \log(x^2 + 2x)$. 3

(iii) If the AR function is $AR = 100 - 3Q$, find the elasticity of demand at $Q = 5$. 4

Or

(b) (i) Given the total cost function

$$TC = 10000 + 100x - 10x^2 + \frac{x^3}{3}$$

Find the marginal cost function and its slope. 3+2=5

(ii) If the demand function is $Q = \sqrt{10 - p^2}$, find the elasticity of demand at $p = 2$. 4

(iii) Find

$$\frac{d}{dx} \frac{x^2}{e^x} \quad 3$$

6. (a) (i) The marginal cost of a firm is given by $MC = 3 + 7e^x$, where x is output. Find the average cost function, if the fixed cost is ₹ 650. 5

(ii) Evaluate $\int \log x \, dx$. 3

(iii) Briefly illustrate the use of definite integrals in economics. 4

(7)

Or

- (b) (i) Given the producer's supply function $Q = \sqrt{-4+4p}$ and the market price ₹ 10, find the producer's surplus. 5

- (ii) Given

$$MC = \frac{\alpha}{\sqrt{\alpha x + \beta}}$$

If the total cost of zero output (x) is zero, find TC as a function of x . 4

- (iii) Evaluate

$$\int \frac{(y-2)^2}{\sqrt{y}} dy \quad 3$$

7. (a) (i) Analyze the following market model for stability : 9

$$Q_d = 14 - 3p$$

$$Q_s = -10 + 2p$$

$$\frac{dp}{dt} = 4(Q_d - Q_s)$$

- (ii) Distinguish between homogeneous linear differential equation and non-homogeneous linear differential equation. 2

(8)

Or

(b) Given the market model

$$Q_d = a - bp + \delta \frac{dp}{dt}$$

$$Q_s = -c + dp$$

$$\frac{dp}{dt} = \lambda(Q_d - Q_s)$$

$$[a, b, c, d, \lambda > 0]$$

Obtain the time path of price p_t . What restriction will you put on δ to ensure dynamic stability?

9+2=11
