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Reg. No. :

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B.A. (CBCS) DEGREE EXAMINATION, APRIL 2024.

Fourth Semester

Economics – Core

MATHEMATICS FOR ECONOMICS – II

(For those who joined in July 2021-2022)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

A diagonal matrix in which all the diagonal elements are equal is called the _____ matrix.

- | | |
|------------|-----------|
| (a) Scalar | (b) Unit |
| (c) Square | (d) Equal |

$(AB)^T =$

- | | |
|-----------------|-----------------|
| (a) $A^T B^T$ | (b) $B^T A^T$ |
| (c) $A^T + B^T$ | (d) $B^T + A^T$ |

Input-output analysis assumes that firms enjoy

- (a) Increasing returns to scale
- (b) Diminishing returns to scale
- (c) Constant returns to scale
- (d) Profit

In _____ input-output model, final demand does not appear.

- (a) Closed
- (b) Open
- (c) Static
- (d) Dynamic

If $y = ax^n$, $\frac{dy}{dx} =$

- (a) ax^{n-1}
- (b) x^{n-1}
- (c) anx^{n-1}
- (d) $anx^{n-1} + c$

The derivative of the inverse function $y = x^3 + x$ is

- (a) $3x^2 + 3$
- (b) $\frac{1}{3x^2 + 3}$
- (c) $\frac{1}{x^3 + 3x}$
- (d) $\frac{1}{3x^2 + 3x}$

7. If $u = x + y$, $\frac{\partial u}{\partial x} =$

(a) x

(b) y

(c) 1

(d) 0

8. If $\frac{\partial u}{\partial y} = 3x^2 + 3y^2$, find $\frac{\partial^2 u}{\partial y^2}$

(a) $6x$

(b) $6y$

(c) $6x + 6y$

(d) $12xy$

9. $\int e^x dx =$

(a) $e^x + c$

(b) $\frac{1}{x} + c$

(c) $\log x + c$

(d) $x + c$

10. $\int x dx =$

$\int x dx =$

(a) $1 + c$

(b) $x^2 + c$

(c) $x + c$

(d) $\frac{x^2}{2} + c$

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Solve $\begin{bmatrix} a & 2 \\ 3b & 4 \end{bmatrix} + \begin{bmatrix} 5 & c \\ 6 & d \end{bmatrix} = \begin{bmatrix} 11 & 6 \\ 12 & 7 \end{bmatrix}$.

Or

(b) If $A = \begin{bmatrix} 2 & 4 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -3 \\ 1 & 0 \end{bmatrix}$ prove that
 $(2A + 5B)^T = 2A^T + 5B^T$.

12. (a) Write a brief note on Input-Output analysis.

Or

(b) Discuss the significance of input-output analysis.

13. (a) Write any five important rules of differentiation.

Or

(b) Find out marginal utility for the total utility function $U = 7k^5 + \frac{1}{x^4} - 4x^{-3} - 2x^2 - x + 9$.

14. (a) If $z = x^2 y^2 + x^5 + y^6$, verify that
- $$\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}.$$

Or

- (b) Compute marginal utility of x and y at $x = 3$ and $y = 2$ for the total utility function $U = 5x^2 y + 2xy^3 + 3x + 9y$.

15. (a) Examine the applications of integration in economics.

Or

- (b) Evaluate $\int (3x + 5)(2x^2 - 3)dx$.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Prove that the matrix $A = \begin{bmatrix} 4 & 5 \\ 5 & 6 \end{bmatrix}$ satisfies the relation $A^2 - I = 10A$, where I is the unit matrix of order 2×2 .

Or

(b) Using matrices, solve the equations :

$$x + y + z = 6$$

$$x + 2y + 3z = 14$$

$$-x + y - z = -2$$

(a) Analyse the limitations of Input-Output analysis.

Or

(b) The following table gives the supply and the demand position of two industries P and Q in crores of rupees. Determine the output when the final demand changes to 35 for P and 42 for Q.

Production sector	Consumption sector		Final demand	Gross output
	P	Q		
P	10	25	15	50
Q	20	30	10	60

(a) Describe the applications of differentiation in economics.

Or

(b) Find the maximum and minimum values for the function $2x^3 - 21x^2 + 36x - 20$.

19. (a) Show that $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = 4f(x, y)$ for the function $f = 3x^4 - 2xy^3 + y^4$.

Or

- (b) Find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$ for the function

$$U = \frac{x^2 + y^2}{x^2 - y^2}.$$

20. (a) Integrate the following :

(i) $\int \sqrt{x} (x^2 + 3x + 4) dx$

(ii) $\int \left(4x^3 - \frac{3}{x} + 5e^{5x} - 2 \right) dx$

Or

- (b) Given the demand function $P = 8 - 2x$ and the supply function $P = 2 + x$, find the consumer's surplus and the producer's surplus.
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