

D 32545

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Name.....

Reg. No.....

**FIRST SEMESTER M.A. (CBCSS) REGULAR/SUPPLEMENTARY DEGREE
EXAMINATION, NOVEMBER 2022**

Econometrics

ECM1CO1—MATHEMATICAL METHODS FOR ECONOMIC ANALYSIS

(2020 Admission onwards)

Time : Three Hours

Maximum Weightage : 30

Part A (Multiple Choice Questions)*Answer all questions.**Each question carries 1/5 weightage.*

1. Find the value(s) of k if the quadratic equation $3x^2 + kx + 2 = 0$ has equal roots.
- (a) $\pm\sqrt{12}$. (b) $\pm\sqrt{24}$.
(c) $\pm\sqrt{10}$. (d) $\pm\sqrt{20}$.
2. Which of the following values of x and y make the following pair of matrices equal ?
- $$\begin{pmatrix} 10x & 0 \\ y+1 & 10-2x \end{pmatrix} = \begin{pmatrix} 5 & y-2 \\ 3 & 9 \end{pmatrix}$$
- (a) $x = 5, y = 2$. (b) $x = 1, y = 3$.
(c) $x = \frac{1}{2}, y = 2$. (d) $x = \frac{1}{2}, y = 3$.
3. Suppose $H(t) = 10\sqrt{t} + 2t + 1$. Find $\lim_{t \rightarrow 4} H(t)$:
- (a) 25. (b) 10.
(c) 29. (d) 15.
4. If $A = \{1, 2, 3\}$. Which of the following is correct ?
- (a) $1 \subseteq A$. (b) $\phi \in A$.
(c) $\{3\} \in A$. (d) $\{2\} \subseteq A$.
5. Which out of the following is a monotonically increasing function ?
- (a) $y = x^2$. (b) $y = 4 - 3x$.
(c) $y = \frac{1}{x}$. (d) $y = 3x + 4$.

Turn over

6. Solve the following integral

$$\int 15\gamma d\gamma:$$

- (a) 15. (b) 0.
(c) $15\gamma + c$. (d) $7.5\gamma^2 + c$.

7. Suppose the price of a product increases from £30 to £50 and the quantity demand falls from 60 a day to 20. What is the price elasticity of demand?

- (a) -1. (b) -1.5.
(c) -2. (d) -2.5.

8. Find the $|C|$:

$$C = \begin{pmatrix} 2 & 15 \\ 1 & 10 \end{pmatrix}$$

- (a) -5. (b) 5.
(c) 10. (d) 15.

9. If $A = \{p, q, r\}$, then the number of subsets are:

- (a) 2. (b) 3.
(c) 6. (d) 8.

10. $y = \frac{k}{x}$ for $k > 0$ is a:

- (a) Ellipse. (b) Rectangular hyperbola.
(c) Circle. (d) None of the above.

11. If $f(x) = \frac{10}{x} + 25x^2$, find $f'(x) = ?$

- (a) $-\frac{10}{x} + 25x$. (b) $\frac{10}{x} + 50x$.
(c) $-\frac{10}{x^2} + 50x$. (d) None of the above.

12. Find a_{11} for the Arithmetic Progression, $A = 4, 8, 12, \dots$

- (a) 40. (b) 44.
(c) 48. (d) 52.

13. If $A = \{1, 2, 3, 4\}$ and $B = \{x : x \in \mathbb{R} \text{ and } x^2 - 7x + 12 = 0\}$, then which of the following is true?

- (a) $A = B$.
 (b) $A \subset B$.
 (c) $B \subset A$.
 (d) A is equivalent to B.

14. Find Marginal Utility (MU) of good x , when the utility function is given by :

$$U(x, y) = x^5 + 10y^3 + 5xy + 5000$$

- (a) $x^5 + 5xy$.
 (b) $5x^4 + 5y$.
 (c) $5x^4 + 10y^3 + 5y$.
 (d) $10y^3 + 5000$.

15. The simple interest when rate of interest ($r = 3\%$), time ($t = 8$) and principle amount ($P = 1000$) is :

- (a) 180.
 (b) 200.
 (c) 240.
 (d) 300.

(15 × 1/5 = 3 weightage)

Part B (Very Short Answer Questions)

Answer any five questions.

Each question carries a weightage of 1.

16. Find the total profit when $q = 100$ with the total cost function as $C(q) = q^2$ and total revenue function as $r(q) = q^3 + 5q$.

17. Write the following in set notations : "The set of all integers greater than 950 but less than 1000".

18. Is the function $f(x) = |x + 50|$ differentiable at $x = -50$? If yes or no, state the reason.

19. Find the sum of first 14 numbers of the following arithmetic progression, $A = 1.5, 2.5, 3.5, \dots$

20. Find the Compound Interest (CI) with the following specification :

- Time period, $t = 3$.
- Rate of interest, $r = 2.5\%$.
- Principle amount, $P = 1500$.

21. Compute the first difference (i.e., $\Delta y = y_t - y_{t-1}$) of the following equation :

$$y_t = a + bx_t + cy_t + \epsilon_t$$

22. Find the order and degree of the following differential equation :

$$\left(\frac{d^2y}{dx^2}\right)^5 + x\left(\frac{d^5y}{dx^5}\right)^2 = 0.$$

23. Give an example of an utility function for which at optimum the consumer may not spend all his income ? Specify the budget line equation with prices of good 1 and 2 given as Rs. 13, Rs. 15 and income Rs. 250.

(5 × 1 = 5 weightage)

Part C (Short Answer Questions)

Answer any seven questions.

Each question carries a weightage of 2.

24. Find the optimal utility of the consumer when the consumers problem is given by :

$$\max_{x_1, x_2} u(x_1, x_2) = x_1^\alpha x_2^{1-\alpha}$$

$$\text{s.t. } p_1x_1 + p_2x_2 = M \\ x_1, x_2 \geq 0.$$

25. Find the profit maximizing output and price for the monopolist with total cost function $c(q) = 500q + 20$ and inverse demand function $p = 1000 - 30q$.

26. Find the derivative of the following function :

$$y = x \ln(1+x)$$

27. Define rank of a matrix. Determine the rank of matrix X.

$$X = \begin{pmatrix} 1 & 2 & 4 \\ 1 & 2 & 4 \\ 1 & 2 & 4 \end{pmatrix}.$$

28. Graph the indifference curve that passes through the point $(x, y) = (1, 1)$ that corresponds to the following utility function (i.e. $x, y > 0$) :

$$u(x, y) = \max(x, y).$$

29. Suppose that $10x^2 + 20xy + 5y^2 = c$ for some constant c . Find dy/dx .

30. Find the following limit :

$$\lim_{t \rightarrow 1} \frac{5t^4 - 4t^2 - 1}{10 - t - 9t^3}.$$

31. Solve the following differential equation :

$$(x^2 + 100) \frac{dx}{xy} = xy.$$

32. Find the following (for $x \neq 0$):

(a) $\int 200x^{-2} dx.$

(b) $\int 55e^{-5x} dx.$

33. Solve the following definite integral,

$$\int_1^5 \frac{1}{x} dx.$$

(7 × 2 = 14 weightage)

Part D (Long Essay Questions)

Answer any **two** questions.

Each question carries a weightage of 4.

34. Solve the following set of linear equations using inverse method :

$$\begin{aligned} 5x + 15y + 56z &= 35 \\ -4x - 11y - 41z &= -26 \\ -x - 3y - 11z &= -7. \end{aligned}$$

35. Show that the following function is not differentiable at the indicated value of x :

$$f(x) = \begin{cases} -x + 2, & x \leq 2 \\ 2x - 4, & x > 2 \end{cases}; x = 2.$$

36. When Average Variable Cost $AVC = 100 - 50Q + 10Q^2$. What will be output at minimum marginal cost when fixed cost is 50 ?
37. For good X, the supply curve is the typical upward-sloping straight line, and the demand curve is that typical downward-sloping straight line. A tax of \$15 per unit is imposed on good X. The tax reduces equilibrium quantity in the market by 300 units. The dead-weight loss from the tax is.

(2 × 4 = 8 weightage)