Sub.Code : 4061

NEB-GRADE XII

2081 (2024)

Business Mathematics

(New course)

(For regular and grade increment students whose first two digits of registration number starts from 78, 79 and 80)

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs. **Full Marks: 75**

Attempt **all** the questions.

Group 'A' [11×1=11]

Rewrite the correct option of each questions in your answer sheet.

1. If A is a square matrix then $A - A^T$ is
   A) a diagonal matrix B) Symmetric matrix
   C) Skew-symmetric matrix D) Scalar matrix
2. Two matrices A and B can be multiplied to get AB if
   A) Both matrices are square of different order.
   B) Both matrices are rectangular of same order.
   C) No.of rows of A = no.of columns of B.
   D) No.of columns of A = no.of rows of B.
3. If the matrix of technical coefficients is $A = \begin{bmatrix} 0.1 & 0.2 \\ 0.3 & 0.4 \end{bmatrix}$ then Leontief matrix is

   A) $\begin{bmatrix} 0.1 & 0.2 \\ 0.3 & 0.4 \end{bmatrix}$ B) $\begin{bmatrix} 0.9 & 0.2 \\ 0.3 & 0.6 \end{bmatrix}$

   C) $\begin{bmatrix} 0.9 & -0.2 \\ -0.3 & 0.6 \end{bmatrix}$ D) $\begin{bmatrix} 0.1 & -0.8 \\ -0.7 & 0.4 \end{bmatrix}$
4. The functions f(x) is increasing on a domain D if
   A) $f'(x) < 0$ for all x in D B) $f'(x) = 0$ for all x in D
   C) $f'(x) > 0$ for all x in D D) $f'(x)$ doesn't exist for all x in D
5. Which one of the following differential equation has the solution $xy = c$?
   A) $ydy + xdx = 0$ B) $xdy + ydx = 0$
   C) $xdy - ydx = 0$ D) $ydy - xdx = 0$

Contd...

6. Which one of the following is the sum of the series $1 + \frac{1}{2} + \frac{1}{4} + \ldots$ to ∞

A) $\frac{2}{3}$ B) $\frac{1}{2}$ C) 1 D) 2

7. If a computer costing Rs. 1,00,000 will depreciate to scrap value of Rs. 81,000 in 2 years. The rate of depreciation is

A) 5% B) 10% C) 19% D) 23.45%

8. Which one of the following is the amount of annuity of Rs. 1,400 for a year at 8% p.a. ?

A) *Rs. 1400* B) *Rs. 1512* C) *Rs. 1521* D) Rs. 2511

9. In simplex method, $x + 2y \leq 4$ is written as $x + 2y + k = 4$., What is k known as ?

A) Basic variable B) Slack variable
C) Surplus variable D) Pivot element

10. The Bowley's coefficient of skewness is based on

A) median, standard deviation and mean
B) lower quartile, upper quartile and median
C) quartiles and standard deviation
D) percentile and standard deviation

11. Which one of the following is the value of 'n' in a binomial distribution for which the mean is 4 and variance is 3.

A) *4* B) *12* C) *16* D) *20*

Group 'B'

8×5=40

12. If $A = \begin{bmatrix} 1 & 0 & 2 \\ -2 & 1 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

a) Write the order of A^T. [1]
b) What types does matrix form when $(A + A^T)$? [1]
c) What is the determinate of matrix A, if A is singular ? [1]
d) Write the formula for finding A^{-1}. [1]
e) Under which condition A^{-1} does not exist. [1]

13. (a) Prove that. [3]

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (b^2 - ac)(ax^2 + 2bxy + cy^2)$$

Contd...

(b) Ramesh sells 3 shares of A and buys 2 shares of B, thus increasing his cash by Rs. 300. Prakash sells 1 share of A and buys 3 shares of B, thus decreasing his cash by Rs. 300. Write the equations related to above context. [2]

14. Find the absolute maxima and absolute minima of the function $f(x) = x^3 - 3x^2 + 5$ on [-2, 2]. Also find the point of inflection. [4+1]

15. a) Write the relation between marginal revenue and total revenue. [1]
b) Define stationary point for a function. [1]
c) What is monotonic function ? Write it. [1]
d) For a function $f(x)$, $f''(x) > 0$ at a point and $f'(x) = 0$, identify the value of $f(x)$ at that point. [1]
e) State fundamental theorem of calculus. [1]

16 a) Find the area bounded by the curve $y^2 = 4x$, the x-axis and the line $x = 4$. [2]
b) The demand and supply function in a competitive market are given by the equation $Q_d = 240 - 3p$ and $Q_s = 5P - 150$ respectively. If the rate of change of the price adjustment proportional to the excess of the demand is given by $\frac{dp}{dt} = 0.05(Q_d - Q_s)$. Solve the obtained differential equation given that the initial price (P_0) = Rs 50. [3]

17. Solve the following linear programming problem by Simplex method to maximize $P = 50x + 60y$ subject to $3x + 4y \leq 36$, $9x + 4y \leq 60$, $x, y \geq 0$

18. a) Write multiplicative law of probability for independent events A and B. [1]
b) Write conditional probability of event P given that event Q has already occured. [1]
c) In a factory producing radios, there are three machines producing 500, 1000, 1500 radios per hour respectively. These machines produce 3%, 5%, 8% defective radios. One radio selected random from a hour production of the three machines and found to be defective. What is the probability that the radio is produced from the third machine ? [3]

19. In a college, it has been found that 40% of the students withdraw without completing the mathematics course if there were 10 students have registered for the course of this semester.
a) What is the probability that none will withdraw ? [1]
b) What is the probability that at least one will withdraw ? [2]

c) What is the probability at most one will withdraw ? [2]

Group 'C' [3×8=24]

20. a) Machinery costing Rs 4,50,000 has an estimated life of 15 years. If its cost is reduced by Rs.3,00,000 in 15 years, find the rate of depreciation. [3]

b) Manoj borrows Rs.4368 which he promises to pay in 6 annual instalments, each instalment being treble of the proceeding one. Find amount of the First instalment. [2]

c) The compound interest on a certain sum at a certain rate is Rs. 204 in 2 years and the simple interest at the same rate is Rs 300 in 3 years. Find the sum and rate of interest. [3]

21. The following table shows the relation between the price (x) and demand (y) of certain items.

Price (x)	100	120	190	200	240	260
Demand (y)	20	15	16	12	14	13

a) Calculate the correlation coefficient by **Karl Pearson's** method. [4]

b) The mean and variance of a binomial distribution are 7.5 and 1.875 respectively. Find P(2) and P(0). [4]

22. a) In perfect competition, demand and supply function of commodity are given by $P_d = 40 - x^2$ *and* $P_s = 3x^2 + 8x + 8$. Discuss the nature of consumer surplus and producer surplus at the market equilibrium price.[4]

b) Write a homogeneous differential equation of first order and first degree. Also solve it. [2]

c) Price of elasticity is related to demand and total revenue. Justify it.[2]

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