NEB-XII
2079(2023)
Model Question
Business Mathematics

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

Group A   **[11 × 1=11]**

1. If $A = \begin{bmatrix} 0 & 3 \\ -3 & 0 \end{bmatrix}$ be a square matrix, which of the following relations is true?

2. What is the value of $\begin{vmatrix} 1 & -1 & -1 \\ -1 & 0 & 1 \\ 0 & 1 & 0 \end{vmatrix}$?

   a) 0   b) 1   c) -1   d) 3

3. Which of the following entries will make the matrix $\begin{pmatrix} \ldots & -0.1 \\ -0.2 & 0.3 \end{pmatrix}$ satisfy Hawkin's –Simon conditions?

   a)   -0.2   c) 0.5

   b)   0   d) 0.01

4. On calculation of Elasticity of demand if E_d = -2.25 then

   a)   Demand is unit elastic

   b)   Demand is elastic

   c)   Demand is inelastic

   d)   Demand is viable

5. What is the integrating factor of the differential equation $\frac{dy}{dx} - \frac{y}{x} = e^x$?

   a) $-\frac{1}{x}$ b) x   c) log x   d) $\frac{1}{x}$

6. If 'P' be the present value 'P_T' the present value of future return, 'T' the time of cash flow, 'i' the discount rate per annum then which of the following is applied to find the present value of future return.

   a) $P = \frac{P_T}{(1+i)^T}$ b) $P = \frac{P_T}{(1-i)^T}$

   c) $P_T = \frac{P}{(1+i)^T}$ c) $P_T = \frac{P}{(1-i)^T}$

7. What is the geometric mean between 1 and 64?

   a)   5   b) 7   c) 8   d) 9

8. There are 'm' simultaneous linear equations and 'n' unknown variables (n>m) then which of the following is the numbers of basic solution.

   a) m + n   b) n – m   c) m – n   d) n

9. The original cost of machine is Rs. 50000. It depreciates at the rate of 20% per annum then what is the value of machine after 2 years.
   a) Rs. 10000   b) Rs. 20000   c) Rs. 25000   d) Rs. 32000

10. In a frequency distribution the difference between mean ($\bar{X}$) and mode (Mo) is 1.4 and coefficient of skewness $S_K(P)$ is 0.625. What is the value of standard deviation?
    a) 1.24   b) 2.24   c) 1.34   d) 2.34

11. If P(A) and P(B) are probability of events A and B respectively. Which of the following condition is true?
    a) $P(A/B) = \dfrac{P(A \cap B)}{P(A)}$ b) $P(A/B) = \dfrac{P(A \cap B)}{P(B)}$

    c) $P(A/B) = \dfrac{P(A)}{P(A \cap B)}$ d) $P(A/B) = \dfrac{P(B)}{P(A \cap B)}$

Group B   **[8 × 5=40]**

12. $3x + 3y = 6$ and $x + y = 2$ are two simultaneous equations.
    i. Write the above system of equations in the matrix form AX = B where A, X and B have their usual meanings. [1]
    ii. Find the determinant of A. [1]
    iii. Does the inverse of A exit? [1]
    iv. Does the system have unique solution? [1]
    v. On the basis of Gauss elimination method, what types of the solutions exist. [1]

13. If A $= \begin{pmatrix} 1 & 2 & -3 \\ 2 & -1 & 4 \\ 3 & 1 & 3 \end{pmatrix}$, find A^{-1} and verify that $A.A^{-1} = I_3$ [5]

14. a) Write average cost (AC) in terms of total cost (C) and output (Q) [1]
    b) What does $\int_a^b f(x)dx$ represent geometrically? [1]
    c) Write the degree of differential equation $\dfrac{dy}{dx} + 2y = 5$. [1]
    d) If P is demand function and Q is output, Write the corresponding revenue function. [1]
    e) Write the formula of elasticity of demand (E_d). [1]

15. The demand function is $P_d = 196 - x^2$ and the supply function is $P_s = x^2 + 4x + 126$. Find the consumer and producer surplus at market equilibrium. [5]

16. The birth rate population in a certain country is given by
    $\dfrac{dp}{dt} = 0.15(6000 - P)$ where t is the time in years. (P = 0 when t = 0).
    a. Solve the above differential equation. [3]
    b. Calculate the population after 10 years. [2]

17. Using simplex method, maximize(z) = 6x – 9y, subject to the constraints x + y ≤ 20, 2x – 3y ≤ 6, x, y ≥ 0. [5]

18. The height(ft) and weight(Kgs) of five students of a class are given below:

Height	4	4.5	5	5.5	6
Weight	30	38	42	58	70

Find the correlation coefficient between the height and weight. Also interpret the result. [4 + 1]

19. A binomial distribution has 5 independent trials. If the probabilities of 1 and 3 success are $\frac{1}{4}$ and $\frac{144}{625}$ respectively, find p and q. Also find the probability of 2 success. [5]

Group C [8 × 3=24]

20. a) A rectangular garden requires 144m of fencing wire for its complete fencing. What will be its shape if its area is maximize? Justify its reason. [4 + 1]

    b) Find the area between curves y = x³ and x-axis, when x = -2 and y = 8. [3]

21. a) The ages in years of three students are in G.P such that the sum and the product of their ages are 21 and 64 respectively. Find their ages in years. [4]

    b) A donor decides to grant scholarship to the student of medicine Rs. 50000 yearly for 5 years. What sum of money should be deposited in the bank with the compound rate of interest 8% per year so that the sum is sufficient to grant the scholarship at the end of each year. [4]

22. a) Regression equations in two variables X and Y are

    3X + 2Y – 26 = 0 and 6X + Y – 31 = 0.

    i.   Find the mean values of X and Y. [2]

    ii. Find two regression coefficients. [2]

    b) In a season, 70% visitors went to travel Janakpur and 30% visitors to Lumbini. It is estimated that 35%Janakpur visitors and 65% Lumbini visitors are Nepali. A visitor is selected at random and found to be Nepali.

    i.   What is the probability that the visitor is Janakpur visitor? [2]

    ii. What is the probability that the visitor is Lumbini visitor? [2]