Secondary Education Examination
Model Question - 2078
Grade: 12

Time: 3 hrs **Business Mathematics (Bmt. 406)** **F.M.:** 75

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

Attempt **All** Questions.

Group 'A' $[11 \times 1 = 11]$

Rewrite the correct option in your answer sheet.

1. Two matrices A and B can be multiplied if
   A. Both matrices are rectangular
   B. Both matrices are square
   C. No. of columns of A = No. of rows of B
   D. No. of rows of A = No. of columns of B.

2. If the $x00213014 = 3$, then the value of x is
   A. 1 B. 3 C. 0 D. 2

3. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, Adj.$(A)$ is
   A. $ad + bc$ B. $ad - bc$ C. $bc - ad$ D. $ac - bd$

4. The function $f(x) = 2x^2$–$3x$ is increasing at
   A. $(-1/4, \infty)$ B. $(-3/4, \infty)$ C. $(1/4, \infty)$ D. $(3/4, \infty)$

5. The value of $\int dx$ is
   A. 1 B. x C. 0 D. e

6. If $k - 1, k + 8$ and $k + 26$ are in G.P., then the value of k is
   A. 12 B. 9 C. 10 D. 8

7. A project would normally be undertaken if its net present value is
   A. Negative
   B. Zero
   C. Exactly the same as the NPV of existing projects
   D. Positive

8. A machine whose scrap value after 10 years is Rs. 1500, depreciated at the rate of 12% per annum on the reducing balance, then the original cost is
   A. Rs. 5386 B. Rs. 1500 C. Rs. 2500 D. Rs. 15009

9. In simplex method, the feasible basic solution must satisfy the
   A. non negative constraint B. negative constraint C. basic constraint D. common constraint

10. In a distribution, the difference of the two quartiles is 20 and their sum is 70 and the median is 36, then the coefficient of skewness is
    A. 0.1 B. -0.1 C. 25 D. 45

11. Two events are mutually exclusive if
    A. the sum of their probabilities must be greater than one
    B. if the occurrence of one event excludes the occurrence of other
    C. the sum of their probabilities must be equal to zero
    D. the difference of their probabilities must be equal to one

Group 'B' $[8 \times 5 = 40]$

12. State the Hawkins-Simon conditions for the viability of the system. The output levels of machinery, electricity and oil of a small country are 3000, 5000 and 2000 respectively. Each unit of machinery requires inputs of 0.3 units of electricity and 0.3 units of oil. Electricity requires inputs of 0.1 units of machinery and 0.2 units of oil. Oil requires inputs of 0.2 units of machinery and 0.1 units of electricity. Determine the machinery, electricity and oil available for export. [1 + 4]

13. Solve the following system by using Gauss elimination method:
    $$x\text{–}2y + 3z = 2, 2x\text{–}3y + z = 1, 3x\text{–}y + 2z = 9.$$
    [5]

14. Suppose that the demand equation for a certain commodity is . Is demand elastic or inelastic at P = 200? Prove that the relation $MR = AR1\text{–}1d$, where is the elasticity of demand, AR and MR are average and marginal revenue respectively. Use this relation to find AR if MR is 25 and is 2. [1 + 3 + 1]

15. The demand equation for a certain commodity is $p = 20\text{–}Q$ and the total cost function $C = Q^2 + 8Q + 2$, determine the total profit, revenue and cost under profit maximization. [5]

16. (a) The population growth rate of Nepal is 1.8% in a year. Model the situation using a differential equation. What will be the population after t years? If the current population of Nepal is 30 million, what will the population after 10 years? [2]

(b) A perfectly competitive market has the demand and supply functions$Qd = 170 - 8P$ and $Qs = -10 + 4P$. When the market is out of equilibrium the rate of adjustment of price is a function of excess demand such that $dPdt = 0.5(Qd - Qs)$? In the initial time period price Po is 10, which is not its equilibrium value. Derive a function for P in terms of t, and comment on the stability of this market. [3]

17. Solve the following linear programming problem by simplex method to maximize $z = 7x + 5y$ subject to

$$x + 2y \leq 6, 4x + 3y \leq 12, x, y \geq 0$$

. [5]

18. State Bayes' theorem. A company has rated 75% of its employees as satisfactory and 25% as un-satisfactory. Personnel records indicate that 80% of the satisfactory workers had previous work experience, while only 40% of the unsatisfactory workers had any previous work experience. If a person with previous work experience is hired, what is the probability that this person will be a satisfactory employee? If a person with no previous work experience is hired, what is the probability that this person will be a satisfactory employee? [1 + 4]

19. The mean and variance of binomial distribution are 4 and 4/3 respectively. Find [5]

. **Group 'C'** $[3 \times 8 = 24]$

20. (a) Find the area bounded by the x-axis and the curve $f(x) = x^3 – x^2 – 2x$. [2]

(b) If the marginal revenue function $(MR) = 6x^2 + 4x + 3$, find the total revenue function. Also, deduce the demand function. [2]

(c) The demand and supply curves of an item are given by the equations $Pd = 20 – 3Q – Q^2$ and $Ps = Q – 1$ respectively. Find the difference between consumer and producer surplus at equilibrium price. [4]

21. (a) Divide Rs. 2708 between Ram and Shyam so that Ram's share at the end of 5 years be equal to Shyam's share at the end of 7 years, C.I. beingcalculated at 8% p.a. [4]

(b) A man retires at the age of 60 and gets a pension of Rs. 1,200 per year in half-yearly installments for the rest of his life. Taking his expectation of life to be 13 years further, that the interest is at 4% p.a. payable half yearly, what single sum is equivalent to this pension? [4]

22. The following table shows the relation between price and demand of certain item:

Price (X)	10	12	20	?	24	26
Demand (Y)	16	15	14	12	11	10

(a) Calculate the correlation coefficient by Karl Pearson's method if arithmetic mean of X is 19. [4]

(b) How can you find the correlation coefficient by using regression coefficient? [1]

(c) Find the equation of the line of regression of X on Y. Estimate the value of X when Y = 30. [3]

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