

Business Mathematics

(For regular and partial students whose first two digits of registration number starts from 78, 79, 80 and 81)

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 question in your answer sheet.

1. If A is a non-singular matrix, then
- A^{-1}
- equal to

A) A. (adj A) B) (adj.A). A C) $\frac{1}{|A|}$ (adj. A) D) $\frac{1}{|A|}$ (A)^T

2. What is the value of
- $\begin{vmatrix} 4 & 3 & 5 \\ 0 & 0 & 7 \\ 8 & 6 & -1 \end{vmatrix}$
- ?

A) 0 B) -2 C) 2 D) 4

3. Which of the following matrix is satisfied Hawkin's-Simon condition ?

A) $\begin{pmatrix} -0.5 & 0.3 \\ 0.7 & -0.2 \end{pmatrix}$

B) $\begin{pmatrix} -0.5 & -0.2 \\ 0.7 & 0.3 \end{pmatrix}$

C) $\begin{pmatrix} 0.3 & 0.7 \\ -0.2 & -0.5 \end{pmatrix}$

D) $\begin{pmatrix} 0.3 & -0.5 \\ -0.2 & 0.7 \end{pmatrix}$

4. If
- $f(x) = x^2 - 4x$
- , the function
- $f(x)$
- is increasing at

A) $x = 0$ B) $x = 1$ C) $x = 2$ D) $x = 4$

5. Which one of the following is the degree of differential equation
- $\frac{d^4 y}{dx^4} = \sqrt{\frac{d^3 y}{dx^3}}$
- ?

A) 1 B) 2 C) 3 D) 4

6. Three numbers are in the ratio of 1:4:12. If one is added to the first number, the resulting number together with other two numbers form a G.P. The three original numbers are :

A) 4, 12, 36 B) 5, 10, 20
C) 6, 12, 24 D) 3, 12, 36

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(2)

7. Which one of the following represents net present value ?
 A) Total future returns of the investment
 B) Total investments
 C) Difference of total present value of future returns and the total investment
 D) Total present value of future returns
8. The initial cost of a bicycle is Rs. 50,000 and the rate of compound depreciation is 10% p.a. diminishing balance, then scrap value at the end of third year is
 A) Rs. 36,200 B) Rs. 36,360 C) Rs. 36,400 D) Rs. 36,450
9. In a simplex method a constraint $x+2y \leq 6$ is written as $x+2y+v=0$. What is the 'v' known as ?
 A) Surplus variable B) Slack variable
 C) Pivot element D) Negative number
10. For a distribution, the distance of the median from first quartile is equal to the distance of the third quartile from the median. The coefficient of skewness is
 A) -0.5 B) 0 C) 0.75 D) 1
11. X and Y are two dependent events. Which one of the following is $P(X \cap Y)$?
 A) $P(X) \cdot P(Y)$ B) $P(X) \cdot P(Y/X)$
 C) $P(X) \cdot P(X/X)$ D) $P(X/Y) \cdot P(Y/X)$

Group 'B'

8×5=40

12. a) Write the associative property of matrix addition. [1]
 b) Define symmetric matrix. [1]
 c) If A is a square matrix then what is the value of $A \times (\text{adj. } A)$? [1]
 d) Write the condition in Cramer's rule that the system of linear equations cannot be solved. [1]
 e) What is the Leontief's technology matrix if X = output vector, A = input coefficient matrix and I the unit matrix. [1]
13. (a) Given the input-output table for the two sector economy

Producer	Consumer		Final demand	Total output
	Agriculture	Industry		
Agriculture	1500	2500	1000	5000
Industry	2000	2500	3000	7500

- (a) Calculate the input-output coefficient matrix. [1]
- (b) Calculate the Leontief matrix $(I - A)$, where I being unit matrix of order 2 [2]
- (c) Test Hawkins-Simon condition for the viability of the system. [2]

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14. a) Write the average revenue (AR) in terms of total revenue (R) and output (Q). [1]
 b) Write the formula of elasticity of supply (ϵ_s) [1]
 c) Write the condition of maximization of a function. [1]
 d) If C be the total cost and R be the total revenue, write the break-even condition in terms of cost and revenue. [1]
 e) What is the condition for finding stationary point for the function $g(x)$? [1]
15. a) If the revenue function is $R = Q - 3Q^2$ and the cost function is $C = Q^2 - 2Q$, find the value of the maximum profit. [3]
 b) It is given that the demand function $P = 3Q + 6$. Find the elasticity of demand at $Q = 3$. [2]
16. a) It is given that $R(x) = 2x^2 + 6x + 5$; where $R(x)$ is the revenue function. Find the marginal revenue at $x = 10$. [2]
 b) Find the area under the curve $y^2 = 4x$ between $x = 2$ to $x = 5$ using fundamental theorem of calculus. [3]
17. Using Simplex method, maximize $W = 5x + 2y$ subject to the constraints, $3x + 5y \leq 15$, $5x + 2y \leq 10$, $x \geq 0$, $y \geq 0$ [5]
18. Calculate the Karl Pearson's coefficient of correlation between the height (X) and weight (Y) for the following data. [5]

Height in inches (X)	48	50	52	54	58
Weight in Kg.(Y)	36	42	43	45	60

Also interpret the result.

19. In a cap factory, machine A, B and C manufacture respectively 30%, 35% and 45% out of their output 2%, 3% and 4% defectives respectively are found. A cap is drawn at random to be defective, what is the probability that it is manufactured by the machine A? [5]

Group 'C'

[3×8=24]

20. a) Give an example of first order linear differential equation with constant coefficient and constant term. Solve it. [3]
 b) A function $f(x) = \frac{1}{x}$ defined in $(-8, 0)$. $f'(x)$ is decreasing in the interval $(-8, 0)$. Justify it. [3]
 c) Derivative and anti derivative are inverse of each other. Justify with example. [2]
21. a) Find two geometric mean between 9 and 243. [2]
 b) A sum doubles itself in 5 years by compound interest. How long does it take to be four times the sum? [3]

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(4)

c) A loan of Rs. 2,00,000 is to be paid in 10 yearly instalment. Find the amount of each installment if the rate of interest is 15% p.a. [3]

22. a) Using the line of regression, estimate the weight of a baby at the age of 4 months and age of the baby when weight is 6 kg, from the following table. [3+3]

Age (in month)	1	2	3	5	6
Weight (in Kg)	5	7	8	10	12

b) A fair coin is tossed 4 times. What is the probability of getting at least 2 heads. [2]

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