केन्द्रीय विद्यालय संगठन, बेंगलुरु संभाग

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प्रथम प्री बोर्ड परीक्षा-2025-26

FIRST PRE BOARD EXAMINATION-2025-26

Class: XII **Maximum Marks: 80**

Subject: Applied Mathematics (241) **Time: 3 hrs.**

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are case study-based questions carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and one sub-part each in 2 questions of Section E.
9. Use of calculators is not allowed.

SECTION- A

1 **A dealer mixes two types of rice costing ₹45/kg and ₹60/kg in such a way that the selling price of the mixture at ₹54/kg gives a gain of 20%. The ratio in which the two varieties are mixed is:** **1**

(A) 1: 1 (B) 3 : 2 (C) 2 : 3 (D) 5 : 3

2 **A can finish a piece of work in 20 days, while B can do it in 25 days. They start together, but A leaves after 5 days. In how many more days will B complete the work?** **1**

(A) 10 (B) 12 (C) 13.75 (D) 20

3 **If $x = a t^2$ and $y = 3 a t$, then at $t = 1$, the value of $\frac{d^2y}{dx^2}$ is** **1**

(A) –1/(9a) (B) 1/(3a) (C) –3/(4a) (D) 1/(9a)

4 **Match the following columns and choose the correct option:** **1**

Trend Type	Nature	Time Period
I. Secular trend	a. Regular periodic	i. Over long term
II. Seasonal trend	b. Oscillatory	ii. Within a year
III. Cyclical trend	c. Smooth, persistent	iii. Several years

(A) I–c–i ; II–a–ii; III–b–iii **(B) I–a–ii; II–b–iii; III–c–i**

(C) I–b–ii; II–c–i; III–a–iii **(D) I–c–ii; II–a–iii; III–b–i**

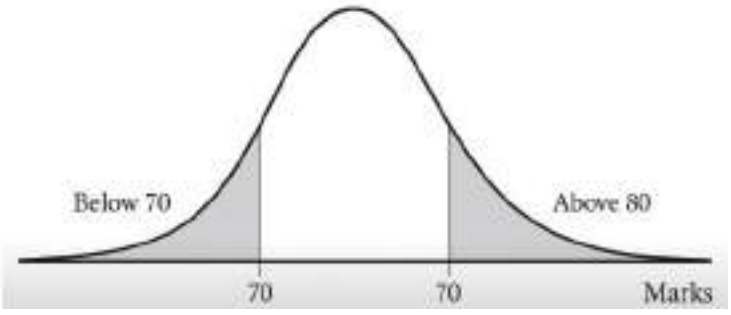
5 **If the annual payment R is constant, when the interest rate increases from 4% to 6%, the present value of a perpetuity will:** **1**

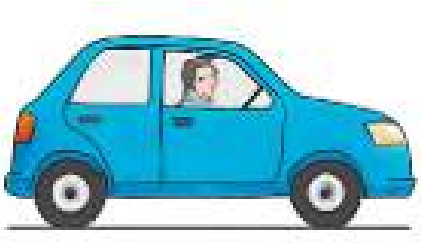
(A) Increase (B) Decrease (C) Remain same (D) Double

6	If $11 \le k \le 20$, $5 \le p \le 15$, and $1 < m < 5$, all integers, then $\frac{k-p}{m}$ is always less than: (A) 3.5 (B) 7.5 (C) 5.5 (D) 6.5	1
7	Let $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ Then (A) $\|A\| = 1$ (B) $\|A\| = 0$ (C) A is skew-symmetric matrix (D) $\|A\| = -1$	1
8	If $\int \frac{x+3}{x^2+6x+10} dx = P \int \frac{2x+6}{x^2+6x+10} dx + Q \int \frac{dx}{x^2+6x+10}$, then P = (A) ½ (B) ¼ (C) 1 (D) ⅓	1
9	The Central Limit Theorem states that as sample size increases, the sampling distribution of the sample mean tends to: (A) Normal (B) Uniform (C) Poisson (D) Exponential	1
10	For two independent samples of sizes 8 and 10, degrees of freedom for a two-sample t-test are: (A) 16 (B) 17 (C) 18 (D) 15	1
11	If $P = \begin{bmatrix} 2 & \propto & 1 \\ 1 & 2 & 0 \\ 3 & 1 & 2 \end{bmatrix}$ is adjoint of A and $\|A\| = 3$, find $\propto$. (A) 6 (B) 9 (C) 12 (D) 18	1
12	The order of differential equation $\frac{d^3y}{dx^3} + x\frac{dy}{dx} = 0$ is: (A) 1 (B) 2 (C) 3 (D) 4	1
13	Find the annual rate of interest if the present value of a perpetuity of ₹800 per year is ₹16,000. (A) 4% (B) 5% (C) 6% (D) 8%	1
14	If A and B are square matrices such that $B = A^{-1}BA$, then $(A - B)^2$ = (A) O (B) $A^2 - 2AB + B^2$ (C) $A^2 + B^2$ (D) 2AB	1
15	For the LPP: Minimize $Z = 8x + 6y$ subject to $x + y \ge 5$, $2x + y \ge 8$, $x \ge 0$, $y \ge 0$, the redundant constraint is: (A) $x + y \ge 5$ (B) $2x + y \ge 8$ (C) $x \ge 0$ (D) None	1
16	A fair die is thrown 4 times. Let X be the number of sixes obtained. If $P(X = k) = P(X = k+1)$, find k. (A) 0 (B) 1 (C) 2 (D) 3	1
17	If $\det(A) = 2$ and $\det(B) = 3$ for square matrices of order 3, then $\det(2A^2B)$ = (A) 48 (B) 96 (C) 192 (D) 384	1
18	The EMI to repay a loan of ₹50,000 in 3 years at 6% p.a. flat rate is: (A) ₹1,583 (B) ₹1,666 (C) ₹1,700 (D) ₹1,800	1

Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below:
(A) Both Assertion (A) and Reason (R) are true and (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) but (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19	**Assertion (A): For any invertible matrix A , adj(adj(A)) = |A|A .** **Reason (R): |adj(A)| = $\|A^{n-1}$.**	**1**
20	**Assertion (A): For a binomial random variable X, variance = np(1−p).** **Reason (R): Mean of X equals np.**	**1**
	SECTION- B	
21	**(A) Find the last two digits of $7^{100} + 13^{50}$.** **OR** **(B) Prove that $\sqrt{11} + \sqrt{7} > \sqrt{13} + \sqrt{5}$**	**2**
22	**A discrete random variable X has P(X=x) = kx, for x = 1, 2, 3, and P(X=4) = 2k .** **Find k and mean of X.**	**2**
23	**A town's population grows from 80,000 to 1,20,000 in 5 years. Find the annual growth rate.** **(use logarithms, log (1.5) = 0.405465, $e^{(0.405465/5)} = e^{0.081093}$ = 1.0845 (approx))**	**2**
24	**(A) A company averages 3 defects per batch. Assuming Poisson distribution, find the probability of exactly 2 defects in a batch. (e^{-3} = 0.049787)** **OR** **(B) A light bulb fails at an average rate of 1 per 500 hours. Find probability that it lasts more than 1000 hours (e^{-2} = 0.1353)**	**2**
25	**A car worth ₹10,00,000 depreciates linearly by ₹80,000 per year. Find its value after 6 years and when it becomes half its initial value.**	**2**
	SECTION- C	
26	**A boat goes 12 km upstream in 4 hours and the same distance downstream in 3 hours. Find speed of boat and current.**	**3**
27	**(A) If $y = px^3 + qx^2$ has a stationary point at (2, 4), find p and q and other stationary point.** **OR** **(B) If $R = 24x + x^2/2 - x^3/6$, show that at maximum AR, AR = MR. (where AR is Average Revenue, MR is Marginal Revenue)**	**3**
28	**(A) A bond of face value ₹60,000, redeemable in 4 years at par, pays 8% interest p.a. quarterly. Find its price if yield = 10% p.a. compounded quarterly (Use $(1.025)^{-16}$ = 0.6736246)** **OR** **(B) A machine worth ₹80,000 has scrap ₹10,000 after 10 years. A sinking fund is set up to replace it with one costing 25% more. Interest 8% p.a. Find annual deposit. (Use $(1.08)^{10}$ = 2.158925)**	**3**

29	**Pipes A, B, and C can fill a tank in 24, 36, and 48 minutes. A and B start together; C joins after 6 minutes. How long to fill tank?**	**3**
30	**A sample of 10 bulbs has mean lifetime 980 hours and standard deviation 20 hours. Test at 5% level if population mean = 1000 hours. ($t_{0.059}$=2.262)**	**3**
31	**A firm produces goods X and Y requiring 5 and 8 labour hours per unit. Total labour = 400 hrs. Profit per unit ₹30, ₹40. Maximize profit with $x \leq 60$, $y \leq 40$. Formulate LPP.**	**3**
	SECTION- D	
32	**(A) Solve by matrix method:** **$2x + y + z = 10$** **$x + 3y + 2z = 15$** **$3x + 2y + 4z = 22$** **OR** **(B) Find equilibrium prices p_A, p_B :** **$x_d(A) = 60 – 2p_A + p_B$, $x_s(A) = –5 + 8\,p_A$** **$x_d(B) = 70 + p_A – 3\,p_B$, $x_s(B) = –6 + 10\,p_B$**	**5**
33	**A firm's MC = $60 – 10x + x^2$, MR = $40x – 2x^2$. Find profit-maximizing output and profit (fixed cost zero).**	**5**
34	**(A) The production (in tonnes) of steel in a factory is:** **Year | 2018 | 2019 | 2020 | 2021 | 2022** **Output | 12 | 14 | 16 | 17 | 20** **Find least squares trend line and predict production in 2026.** **OR** **(B) Compute 2-month moving averages for sales data (in ₹ lakhs):** **Jan–Jun: 10, 12, 15, 18, 16, 20**	**5**
35	**Mr. Mehta buys a car worth ₹12,00,000, paying 25% down. Loan for 5 years, 9% p.a. compounded monthly. Calculate EMI and total interest. [Use $(1.0075)^{60} = 1.56$]**	**5**
	SECTION- E	
36	**Student Scores (Normal Distribution): A teacher analysed the Mathematics scores of 400 students. The marks were found to be Normally distributed with** • **Mean (μ) = 70,** • **Standard Deviation (σ) = 10.** **Use the normal distribution curve to answer the following:** **(i) What percentage of students scored below 70 marks?**  	**1** **1**

	(ii) Find the number of students who scored more than 80 marks. **(iii)(A) Calculate the number of students scoring between 60 and 80 marks.** **OR** **(iii)(B) The top 5 % of students are to receive a certificate of excellence. If the Z-score = 1.645, find the minimum qualifying score for this group.**	**2**
37	**Market for Sugar: A survey of a city's wholesale sugar market provided the following data:**  **The supply relationship is given by $p_s = -10 + (x/15)$, where x is quantity (in tons).** **Answer the following:** **(i) Derive the demand function $p_d = a + bx$, using the data above.** **(ii) Determine the equilibrium price and quantity by equating p_d and p_s.** **(iii) (A) Using integration, compute the consumer surplus at the equilibrium price.** **OR** **(iii) (B) Compute the producer surplus at the equilibrium price.**	**1** **1** **2**
38	**Travel Optimization: A traveller has ₹180 to spend on fuel and can choose between two modes of travel:**  **He has a maximum time of 1 hour to travel and wants to maximize the total distance covered.** **Let x and y represent the distance (in km) travelled by Mode A and Mode B respectively.** **(i) Formulate the Linear Programming Problem to maximize distance.** **(ii) Using graphical method, find the maximum distance that can be travelled within the given conditions.**	**2** **2**

Price ₹/kg	Quantity Demanded (tons)
30 ₹/kg	600 tons
40 ₹/kg	300 tons

Mode	Speed (km/h)	Cost per km (₹)
A	60 km/h	3 ₹/km
B	30 km/h	1 ₹/km