केन्द्रीय विद्यालय संगठन, बेंगलुरु संभाग

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प्रथम प्री बोर्ड परीक्षा-2025-26

MS-FIRST PRE BOARD EXAMINATION-2025-26

Class: XII **Subject: Applied Mathematics (241)**

1	2	3	4	5	6	7	8	9	10
A	C	B	A	B	B	D	A	A	A
11	12	13	14	15	16	17	18	19	20
B	C	B	B	D	A	B	B	D	A

21(A)	The last two digits of 7^{100} are 01. The last two digits of 13^{50} are 49. The last two digits of $7^{100} + 13^{50}$ are **50**.	1.5 0.5
21(B)	Squaring both the sides Proving	0.5 1.5
22	k + 2k + 3k +2k = 1 so k=1/8 using k, mean =11/4	0.5 1.5
23	Formula $P=P_0(1+r)^t$ $120{,}000=80{,}000(1+r)^5$ ln (1.5) =5 ln (1+r), r = 0.0845, r is 84.5%	0.5 0.5 1
24(A)	$P(X=k)=\frac{e^{-\lambda}\lambda^k}{k!}$ P(X=2) = 0.448083/2 ≈ 0.22404	0.5 1.5
24(B)	$P(T>t)=e^{-t/\theta}$ where mean θ=500 and t = 10000 $P(T>1000)=e^{-1000/500}=e^{-2}=0.1353$	0.5 0.5 1
25	Value after t years: V = 1,000,000 − 80,000 t. After 6 years: V = 1,000,000 − 480,000 = ₹520,000. When becomes half initial (500,000): Solve 1,000,000 − 80,000 t = 500,000 ⇒ 80,000 t = 500,000 ⇒ t = 500,000/80,000 = 6.25 years = 6 years 3 months.	0.5 0.5 1
26	Let speed in still water = u km/hr, speed of current = v. Upstream speed = u − v = distance/time = 12/4 = 3 km/hr. Downstream speed = u + v = 12/3 = 4 km/hr.	1

	Solve: u−v=3, u+v=4 ⇒ 2u=7 ⇒ u=3.5 km/hr. Then v = u+v − u = 4 − 3.5 = 0.5 km/hr.	**1**
27(A)	**Stationary points where dy/dx = 3p x^2 + 2q x = x(3p x + 2q) = 0. x = 0 or x = −2q/(3p).** **Given one stationary point at x = 2 ⇒ either x=0 (no) or 2 = −2q/(3p) ⇒ −2q = 6p ⇒ q = −3p.** **Use point (2,4): y(2) = p(8) + q(4) = 8p + 4q = 4. Substitute q = −3p ⇒ 8p + 4(−3p) = 8p −12p = −4p = 4 ⇒ p = −1. Then q = −3(−1) = 3.** **Other stationary point x = 0. Corresponding y = y(0) = 0. So other stationary point is (0,0). And p=−1, q=3.**	**0.5** **0.5** **1.5** **0.5**
27(B)	$AR = \frac{R}{x} = \frac{24x + \frac{x^2}{2} - \frac{x^3}{6}}{x}$ $AR = 24 + \frac{x}{2} - \frac{x^2}{6}$ $MR = \frac{dR}{dx} = \frac{d}{dx}\left(24x + \frac{x^2}{2} - \frac{x^3}{6}\right)$ $MR = 24 + \frac{2x}{2} - \frac{3x^2}{6}$ **Find the point of maximum AR, x= 1.5** **Verify that AR is a maximum, using second order derivative** **Compare AR and MR at maximum AR (Value of AR at x = 1.5 is 24.375 and Value of MR at x = 1.5 is also 24.375) Therefore, at maximum AR, AR=MR**	**0.5** **0.5** **0.5** **0.5** **1**
28(A)	**Periodic coupon payment: C=(FV×c)/m = (₹60,000×0.08)/4 = ₹1,200** **Periodic yield rate: i =y/m = 0.10/4 = 0.025** **Present value of the annuity:** $P = C \times \left[\frac{1-(1+i)^{-N}}{i}\right] + \frac{RV}{(1+i)^N}$ **P = ₹56,083.83**	**0.5** **0.5** **0.5** **1.5**
28(B)	**Cost of new machine = Original Cost + (0.25 * Original Cost) = ₹1,00,000** **Amount needed = Cost of new machine - Scrap value = ₹90,000** **The formula to find the annual deposit (P) for a sinking fund is:** $P = Ai/[(1+i)^n - 1]$ **P = 6,212.34 (approx.)**	**0.5** **0.5** **0.5** **1.5**
29	**Combined rate of pipes A and B = 1/24+1/36= 5/72 per minute** **Work done in the first 6 minutes = 5/12** **The remaining work = 1 – 5/12 = 7/12 of the tank** **A+B+C = 13/144 per minute**	**0.5** **0.5** **0.5** **0.5**

	Time to fill remaining tank = (7/12) /(13/144) = 84/13 minutes Total time = 6+(84/13) = 162/13 = 12.46 minutes (approx.).	0.5 0.5
30	This is a two-tailed test. $H_0:\mu=1000$ hours, $H_1:\mu\neq1000$ hours $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$ $t = \frac{980 - 1000}{20/\sqrt{10}} = \frac{-20}{20/3.162} = \frac{-20}{6.3245} \approx -3.162$ We compare the absolute value of our calculated test statistic |t| to the critical value ($t_{critical}$) |-3.162| = 3.162. Since 3.162 > 2.262, the calculated t-statistic falls in the rejection region. Since the absolute value of the calculated t-statistic is greater than the critical value, we reject the null hypothesis at the 5% significance level. So we can conclude that the population mean lifetime is not 1000 hours, hence we reject the null hypothesis.	0.5 0.5 1 0.5 0.5
31	Let x = units of X, y = units of Y. Objective: Maximize Z=30x+40y Constraints: Labour: 5x+8y≤400. Capacity: x≤60, y≤40. Nonnegativity: x,y≥0. LPP: Maximize Z=30x+40y subject to 5x+8y≤400, x≤60, y≤40, x,y≥0.	0.5 0.5 0.5 0.5 0.5 0.5
32(A)	Write matrix form AX=B $X = A^{-1} B$ So |A| = 11 ≠ 0. Thus A is invertible x= 28/11, y = 29/11, z = 25/11	1 0.5 1 2.5
32(B)	For good A: $x_d(A)= x_s(A)$ $60-2p_A+p_B= -5+8p_A$ For good B: $x_d(B)=x_s(B)$ $70+p_A-3p_B = -6+10p_B$ Solve the system of equations, $p_A \approx 7.14$ and $p_B \approx 6.40$	0.5 0.5 0.5 0.5 3

33	**MR=MC**	**0.5**
	$x \approx \frac{50 \pm 42.19}{6}$	
	$x_1 \approx \frac{50 + 42.19}{6} \approx 15.365$ $x_2 \approx \frac{50 - 42.19}{6} \approx 1.301$	**1**
	$\frac{d(MC)}{dx} = -10 + 2x$ $\frac{d(MR)}{dx} = 40 - 4x$	**0.5**
	At $x \approx 15.365$: $$\frac{d(MC)}{dx} \approx -10 + 2(15.365) = 20.73$$ $$\frac{d(MR)}{dx} \approx 40 - 4(15.365) = -21.46$$	**0.5**
	Since $20.73 > -21.46$, the profit-maximizing output is approximately **15.365**.	
	$TR = \int MR dx = \int (40x - 2x^2) dx = 20x^2 - \frac{2}{3}x^3$ $TC = \int MC dx = \int (60 - 10x + x^2) dx = 60x - 5x^2 + \frac{1}{3}x^3$	**1**
	$TR \approx 20(15.365)^2 - \frac{2}{3}(15.365)^3 \approx 4716.29 - 2419.68 = 2296.61$ $TC \approx 60(15.365) - 5(15.365)^2 + \frac{1}{3}(15.365)^3 \approx 921.9 - 1179.91 + 1209.84 = 951.8$	**1**
	Finally, calculate the profit: $$\pi = TR - TC \approx 2296.61 - 951.83 = 1344.78$$	**0.5**

<table>
<tr><td>34(A)</td><td>

Year	x (Year index)	y (Output)	x^2	xy
2018	1	12	1	12
2019	2	14	4	28
2020	3	16	9	48
2021	4	17	16	68
2022	5	20	25	100
Sum	15	79	55	256

$$\sum y = na + b\sum x$$

$$\sum xy = a\sum x + b\sum x^2$$

b= 1.9 and a = 10.1

The equation for the least squares trend line is y=10.1+1.9x

The year 2026 corresponds to an x value of 9, since 2026-2017 = 9. We can use the trend line equation to predict the output y: y=10.1+1.9(9) = 10.1+17.1 = 27.2. The predicted production for 2026 is 27.2 tonnes.
</td><td>1
1
2
0.5
0.5</td></tr>
<tr><td>34(B)</td><td>February: ₹11 lakhs
March: ₹13.5 lakhs
April: ₹16.5 lakhs
May: ₹17 lakhs
June: ₹18 lakhs</td><td>1
1
1
1
1</td></tr>
<tr><td>35</td><td>

Down Payment = 12,00,000* 0.25= 3,00,000, Principal Loan Amount = 12,00,000-3,00,000 = 9,00,000

$$EMI = P \times \frac{i \times (1+i)^n}{(1+i)^n - 1}$$

$$EMI = 9,00,000 \times \frac{0.0075 \times (1.56)}{1.56 - 1}$$

$$EMI = 9,00,000 \times \frac{0.0117}{0.56} \approx 18,803.57$$
</td><td>1
0.5
2.5</td></tr>
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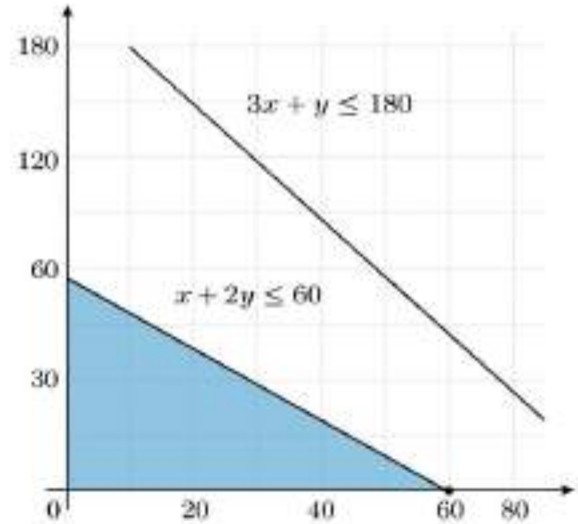
	Total amount paid = $EMI \times 60 = 18,803.57 \times 60 = 11,28,214.2$ Total interest = Total amount paid - Principal = $11,28,214.2 - 9,00,000 = 2,28,214.2$	1
36	**(i) Below mean 70 ⇒ by symmetry 50% of students. So 50%.** **(ii) P(X>80) ⇒ Z = (80−70)/10 = 1. So P(Z>1) = 0.1587 (from standard normal table). Number = 400 × 0.1587 = 63.48 ≈ 63 students (or 63.5 → 63). (Round to nearest whole student: 63.)** **(iii) (A) (2 marks) Between 60 and 80: Z for 60 = (60−70)/10 = −1; for 80 = +1. P(−1 < Z < 1) = 0.6826. Number = 400 × 0.6826 = 273.04 ≈ 273 students.** **OR** **(B) If top 5% with Z=1.645: cutoff score = μ + Zσ = 70 + 1.645×10 = 70 + 16.45 = 86.45 marks. So minimum qualifying ≈ 86.45 (≈ 86.5).**	**1** **1** **2**
37	**(i) Demand: p_d=50−1/30x.** **(ii) Price p = p_s at x=600: p = −10 + 600/15 = −10 + 40 = ₹30/kg.** **(iii) (A) CS = ₹6,000 OR (B) 12000**	**1** **1** **2**
38	**(i) Maximize $Z=x+y$** **subject to the constraints** **$3x+y \le 180$,** **$x+2y \le 60$,** **$x \ge 0$, $y \ge 0$** **(ii) Maximum value for the distance is at point (60, 0), the maximum distance that can be travelled is 60 km.** 	**2** **2**