INDIAN SCHOOL AL WADI AL KABIR

Unit test (2023-2024)

Class: XII | Sub: APPLIED MATHEMATICS (241) | Max Marks: 30

Date: 01.06.2023 | Time: 1 hr.

General Instructions:

1. This question paper is divided in to 4 sections- A, B, C and D.
2. Section A comprises of 7 questions of 1 mark each.
3. Section B comprises of 3 questions of 2 marks each.
4. Section C comprises of 3 questions of 3 marks each.
5. Section D comprises of 2 case study-based question.
6. Internal choice has been provided.

SECTION A

Q.1.	$If\ A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 3 \end{pmatrix}\ then\ \lvert A\rvert + \lvert adjA\rvert =$ _____								1
	A	3	**B**	9	C	12	**D**	27	C
Q2.	For the binomial distribution $B(9, \frac{1}{3})$, $standard\ deviation\ =$ __								1
	A	3	**B**	1	C	2	**D**	1.41	D
Q3.	$The\ derivative\ of\ x^x with\ respect\ to\ x\ is$ _____								1
	A	$x^x(1+logx)$	**B**	$1+logx$	C	x^x	**D**	$x^x logx$	A
Q4.	$The\ slope\ of\ the\ tangent\ to\ the\ curve\ = x^3 - 3x\ \ is\ equal\ to\ zero\ at$								1
	A	(1, 2) and (2, 2)	B	(1, -2) and (-1, 2)	C	(3, 18)	**D**	(-3, -18)	B
Q5.	If X is a Poisson variable such that $P(X=1) = 2\,P(X=2)$, $then\ P(X=0)\ is$ _____								1
	A	e	**B**	$\frac{1}{e}$	C	1	**D**	e^2	B
Q6.	$If\ A(3,4), B(0,-4) and\ C(-1,0)\ then\ area\ of\ \Delta ABC\ is$___ sq. units.								1
	A	10	B	20	C	4	D	12	A

Q7	In the following questions a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. A) Both A and R are true and R is the correct explanation of A. B) Both A and R are true but R is not the correct explanation of A. C) A is true but R is false. D) A is false but R is true.	1
	Assertion (A): If A and B are symmetric matrices then AB – BA is a skew symmetric matrix. Reason (R): For a skew symmetric matrix A= $[a_{ij}], a_{ij} = 0\ if\ i = j.$	B
	SECTION B	
Q8.	Solve for x and y using Cramer's rule: $3x - 4y = 0 \quad 2x - 3y = -1$. $\begin{pmatrix} 3 & -4 \\ 2 & -3 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ -1 \end{pmatrix} \quad x = \frac{-4}{-1} = 4 \quad y = \frac{-3}{-1} = 3$ **OR** $If\ A = \begin{pmatrix} 1 & 0 & -2 \\ 2 & 1 & -1 \\ 1 & 1 & 3 \end{pmatrix}\ adjA = \begin{pmatrix} 4 & -2 & 2 \\ -7 & 5 & -3 \\ 1 & -1 & 1 \end{pmatrix}.$	4x0.5 2
Q9.	A stationery company manufactures 'x' units of pen in a given time, if the cost of raw material is square of the pens produced, cost of transportation is twice the number of pens produced and the property tax costs ₹ 5000. Then, (i) $C(x)=x^2+2x+5000$ (ii) MC= ₹ 102.	 1 1
Q10.	$A = \begin{pmatrix} 4 & -2 & 0 \\ 8 & 0 & -3 \\ 2 & 2 & 1 \end{pmatrix} = \begin{pmatrix} 4 & 3 & 1 \\ 3 & 0 & -\frac{1}{2} \\ 1 & -\frac{1}{2} & 1 \end{pmatrix} + \begin{pmatrix} 0 & -5 & -1 \\ 5 & 0 & -\frac{5}{2} \\ 1 & \frac{5}{2} & 0 \end{pmatrix}$	1 1
	SECTION C	
Q11.	Two numbers are selected at random without replacement from the set of natural numbers 1, 2, 3, 4 and 5. If X denotes the greater number obtained, X: 2 | 3 | 4 | 5 P(X): $\frac{2}{20}$ | $\frac{4}{20}$ | $\frac{6}{20}$ | $\frac{8}{20}$ E(x) = 4	2 1

Q12. *If* $x\sqrt{1+y}+y\sqrt{1=x}=0$, *then prove that* $\frac{dy}{dx}=-\frac{1}{(1+x)^2}$

$$x\sqrt{1+y}=-y\sqrt{1+x}$$

Squaring both sides

$$\left(x\sqrt{1+y}\right)^2=\left(-y\sqrt{1+x}\right)^2$$

$$x^2\left(\sqrt{1+y}\right)^2=(-y)^2\left(\sqrt{1+x}\right)^2$$

$$x^2(1+y)=y^2(1+x)$$

$$x^2+x^2y=y^2+y^2x$$

$$-(y-x)(x+y)=xy(y-x)$$

$$-(x+y)=xy$$

$$-x-y=xy$$

$$-x=xy+y$$

$$-x=(x+1)y$$

$$y=\frac{-x}{x+1}$$

2

$$\frac{dy}{dx}=\frac{\frac{d(-x)}{dx}(x+1)-\frac{d(x+1)}{dx}.(-x)}{(x+1)^2}$$

$$\frac{dy}{dx}=\frac{-1(x+1)+(1+0)x}{(x+1)^2}$$

$$\frac{dy}{dx}=\frac{-x-1+x}{(x+1)^2}$$

$$\frac{dy}{dx}=\frac{-1}{(x+1)^2}$$

OR

$2\log x+3\log y=5\log(x+y)$

Now differentiating both sides with respect to x we get,

$$\frac{2}{x}+\frac{3}{y}\frac{dy}{dx}=\frac{5}{x+y}\left(1+\frac{dy}{dx}\right)$$

$$\text{or, }\left(\frac{2}{x}-\frac{5}{x+y}\right)=\left(\frac{5}{x+y}-\frac{3}{y}\right)\frac{dy}{dx}$$

$$\text{or, }\left(\frac{2y-3x}{x(x+y)}\right)=\left(\frac{2y-3x}{y(x+y)}\right)\frac{dy}{dx}$$

$$\text{or, }\frac{dy}{dx}=\frac{y}{x}.$$

Proving Second derivative = 0 (Using product rule)

2

1

Q13. If the probability that an individual suffers a bad reaction from a injection of a given serum is 0.001.

Mean = 2 Formula Poisson distribution function

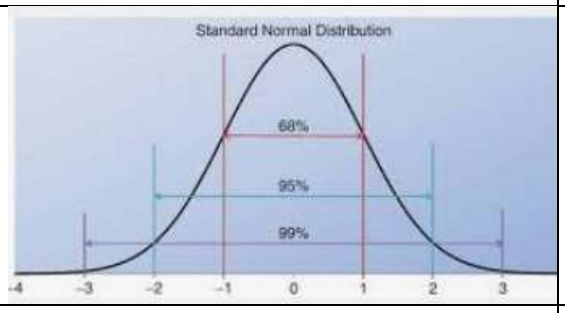
i) P(exactly 3 individuals will suffer from a bad reaction)= $\frac{e^{-2}2^3}{3!}$=0.18

ii) P(more than 2 individuals will suffer from a bad reaction)= 1-[P(0) +P(1) +P(2)]=0.323

1

1

1

	SECTION D Case study-based study questions	
Q14	In an election, a political group hired a public relation firm to promote their candidate in three ways: telephone, house calls and letters. The cost per contact is given as follows: Telephone ₹ 0.10, House call ₹ 1.00 and letter ₹ 2.00. If the number of contacts made in two cities X and Y are given below:  City | Telephone | House call | Letter X | 1000 | 500 | 5000 Y | 3000 | 1000 | 10,000	
	a) *If A is a* 2×3 *matrix and B is a* 3×1, what is the order of matrix AB? 2×1 b) What is the total amount spent on telephone calls by the political group in both the cities together? =₹ 400 c) Using matrices find the total amount spent in each cities X and Y. $\begin{pmatrix} 1000 & 500 & 5000 \\ 3000 & 1000 & 10000 \end{pmatrix} \begin{pmatrix} 0.1 \\ 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 10600 \\ 21300 \end{pmatrix}$ **OR** $A \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 5 & 1 \\ 6 & 3 \end{bmatrix}$. $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$	1 1 2
Q15	The test scores of a university entrance test appeared by 3000 students are normally distributed with mean 200 marks and standard deviation 20 marks. Based on the above information answer the following: 	4
	a) Find the Z score of the mark 190. Z= -0.5 b) If Hari scored 180 marks what can you conclude about his performance compared to his batchmates? 15.87% better c) Find out the number of students expected to score above 220. 476 OR c) If 5% of the total students are qualified for the admission, find the minimum marks required to get the admission. 233 [Given: $P(Z < -1) = 0.1587$ & $P(Z \leq 1.65 = 0.95]$	1 1 2

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