KENDRIYA VIDYALAYA SANGATHAN, BHOPAL REGION

1st PRE-BOARD EXAMINATION 2025-26

Class: XII (Mathematics) 041

Set-2

MM: 80 **Time: 3 Hours**

General Instructions: -

(i)	All questions are **compulsory.**
(ii)	This question paper contains 38 questions divided into 5 sections **A, B, C, D** and **E**.
(iii)	Section **A** comprises of **20** questions of **1** mark each. Section **B** comprises of **5**questions (**SA-I**) of **2** marks each. Section **C** comprises of **6** questions (**SA-II**) of **3**marks each. Section **D** comprises of **4**long answer type questions (**LA**) of **5** marks each. Section **E** comprise of **3** Case Study Based Questions of **4** marks each.
(iv)	There is no overall choice. However, an internal choice has been provided in **2**questions of **2** marks each, **3** questions of **3** marks each and **2** questions of **5** marks each. You have to attempt only one of the alternatives in all such questions.
(v)	Use of calculators is not permitted.
	SECTION A (Multiple Choice Questions of 1Mark each)
Q.1	The principal value of [$\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$] is (a) π (b) $-\pi/2$ (c) 0 (d) $2\sqrt{3}$
Q.2	If A and B are two skew symmetric matrices, then (AB + BA) is: (a) a skew symmetric matrix (b) a symmetric matrix (c) a null matrix (d) an identity matrix
Q.3	If $\begin{bmatrix} 2x-1 & 3x \\ 0 & y^2-1 \end{bmatrix} = \begin{bmatrix} x+3 & 12 \\ 0 & 35 \end{bmatrix}$, then value of (x – y) is : (a) 2 or 10 (b) -2 or 10 (c) 2 or -10 (d) -2 or -10
Q.4	If y = log (sin e^x), then dy/dx is: (a) cot e^x (b) cosec e^x (c) e^x cot e^x (d) e^x cosec e^x
Q.5	The function $y = x^2 e^{-x}$ is decreasing in the interval (a) (0, 2) (b) (2, ∞) (c) (-∞, 0) (d) (-∞, 0)∪(2, ∞)
Q.6	The rate of change of surface area of a sphere with respect its surface radius ‘r’, when r = 4 cm, is: (a) 64π cm^2/cm (b) 48π cm^2/cm (c) 32π cm^2/cm (d) 16π cm^2/cm
Q.7	$\int e^{5logx}\, dx$ is equal to: (a) $x^5/5 + C$ (b) $x^6/6 + C$ (c) $5x^4 + C$ (d) $6x^5 + C$
Q.8	If $\int_0^a 3x^2 dx = 8$, then the value of ‘a’ is:

	(a) 2 (b) 4 (c) 8 (d) 10
Q.9	The integrating factor for solving the differential equation, $x\frac{dy}{dx} - y = 2x^2$ is (a) e^{-y} (b) e^{-x} (c) x (d) 1/x
Q.10	The order and degree (if defined) of the differential equation, $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 = xsin\left(\frac{dy}{dx}\right)$ respectively are: (a) 2 ,2 (b) 1 ,3 (c) 2, 3 (d) 2, degree not defined
Q.11	Let $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ .If $\vec{b}$ is a vector such that $\vec{a}.\vec{b} = \lvert\vec{b}\rvert^2$ and $\lvert\vec{a} - \vec{b}\rvert = \sqrt{7}$,then $\lvert\vec{b}\rvert$ equals (a) 7 (b) 14 (c) √7 (d) 21
Q.12	A unit vector along the vector $4\hat{\imath} - 3\hat{k}$ is : (a) $\frac{1}{7}(4\hat{\imath} - 3\hat{k})$ (b) $\frac{1}{5}(4\hat{\imath} - 3\hat{k})$ (c) $\frac{1}{\sqrt{7}}(4\hat{\imath} - 3\hat{k})$ (d) $\frac{1}{\sqrt{5}}(4\hat{\imath} - 3\hat{k})$
Q.13	The two lines x = ay +b, z = cy + d; and x = a'y + b' , z = c' y + d' are perpendicular to each other, if (a) $\frac{a}{a'} + \frac{c}{c'} = 1$ (b) $\frac{a}{a'} + \frac{c}{c'} = -1$ (c) $aa' + cc' = 1$ (d) $aa' + cc' = -1$
Q.14	If a line makes an angle of π/4 with the positive directions of both x-axis and z-axis, then the angle which it makes with the positive direction of y-axis is: (a) 0 (b) π/4 (c) π/2 (d) π
Q.15	In an LPP, if the objective function Z = ax + by has the same maximum value on two corner points on the feasible region, then the number of points at which $Z_{max\ occurs}$ is: (a) 0 (b) 2 (c) finite (d) infinite
Q.16	The restrictions imposed on decision variables involved in an objective function of a LPP are called (a) feasible solutions (b) constraints (c) optimal solutions (d) infeasible solutions
Q.17	Let E and F be two events such that P(E) = 0.1, P(F) = 0.3, P(E∪F) = 0.4, then P(E/F) is: (a) 0.6 (b) 0.4 (c) 0.5 (d) 0
Q.18	If P(A) = 1/7, P(B) = 5/7 and P(A∩B) = 4/7, then $P(\bar{A}/B)$ is: (a) 6/7 (b) 3/4 (c) 4/5 (d) 1/5
	Assertion Reason Based Question: Two statements are given, one labeled assertion (A) and the other labeled Reason (R). Select the correct answer from the codes (a), (b), (c) and (d) as given below (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not correct explanation of the Assertion (A). (c) Assertion (A) is true and Reason (R) is false. (d) Assertion (A) is false and Reason (R) is true.

Q.19	***Assertion (A)**: All* trigonometric functions have their inverse over their respective domains. ***Reason (R): The*** inverse of $\tan^{-1}x$ exists for some $x \in R$.
Q.20	***Assertion (A)**: The* order of the differential equation: $\left(\frac{d^4y}{dx^4}\right)^2 = \left[x + \left(\frac{dy}{dx}\right)^2\right]^3$ is 4. ***Reason (R): The*** order of the differential equation is order of highest order derivative involved in the differential equation.
	SECTION-B (SA-I of 2 Marks each)
Q.21	Let f: A→B be defined by $f(x) = \frac{x-2}{x-3}$, where A = R – {3} and B = R – {1}. Discuss the bijectivity of the function.
Q.22	Find the interval in which the function $f(x) = 2x^3 - 3x$ is strictly increasing.
Q.23	Evaluate: $\int_0^{\pi/2} sin2x \cos 3x dx$ **OR** Given $\frac{d}{dx}F(x) = \frac{1}{\sqrt{2x-x^2}}$ and F (1) = 0, find F(x).
Q.24	If $\vec{a} = 4\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\vec{b} = 2\hat{\imath} - 2\hat{\jmath} + \hat{k}$, then find a unit vector along the vector $\vec{a} \times \vec{b}$.
Q.25	A pair of dice is thrown and the sum of the numbers appearing on the dice is observed to be 7. Find the probability that the number 5 has appeared on atleast one die. **OR** The probability that A hits the target is 1/3 and the probability that B hits it, is 2/5. If both try to hit the target independently, find the probability that the target is hit.
	SECTION-C (SA-II of 3 Marks each)
Q.26	If A = $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ and I is the identity matrix of order 2 then show that $A^2 = 4A - 3I$. Hence find A^{-1}.
Q.27	If y = x sin (a + y), prove that: $\frac{dy}{dx} = \frac{sin^2(a+y)}{sina}$. **OR** If $(sinx)^y = x + y, find \frac{dy}{dx}$.
Q.28	Find: $\int \frac{2+sin2x}{1+cos2x} e^x dx$. **OR** Evaluate: $\int_0^{\pi/4} \frac{1}{sinx+cosx} dx$.
Q.29	Find the particular solution of the differential equation $x\frac{dy}{dx} - y = x^2e^x$, given y (1) = 0. **OR** Find the general solution of the differential equation $x\frac{dy}{dx} = y(logy - logx + 1)$.

Q.30 Find shortest distance between the following lines: $\vec{r} = 3\hat{i} + 5\hat{j} + 7\hat{k} + \lambda(\hat{i} - 2\hat{j} + \hat{k})$ and $\vec{r} = -\hat{i} - \hat{j} - \hat{k} + \mu(7\hat{i} - 6\hat{j} + \hat{k})$.

Q.31 Solve the following LPP graphically: Maximize z = x + y

Subject to constraints $2x + 5y \le 100$, $8x + 5y \le 200$, $x, y \ge 0$.

SECTION-D (LA of 5 Marks each)

Q.32 Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$. Using A^{-1}, solve the system of linear equations: $x - y + 2z = 1$; $2y - 3z = 1$; $3x - 2y + 4z = 3$.

Q.33 Find the intervals on which the function $f(x) = (x-1)^3 (x-2)^2$ is

(a) strictly increasing (b) strictly decreasing.

OR

Find the dimensions of the rectangle of perimeter 36 cm which will sweep out a volume as large as possible, when revolved about one of its side. Also find the maximum volume.

Q.34 Using integration, find the area of the region bounded by the circle $x^2 + y^2 = 16$, line y = x and y-axis, but lying in the 1st quadrant.

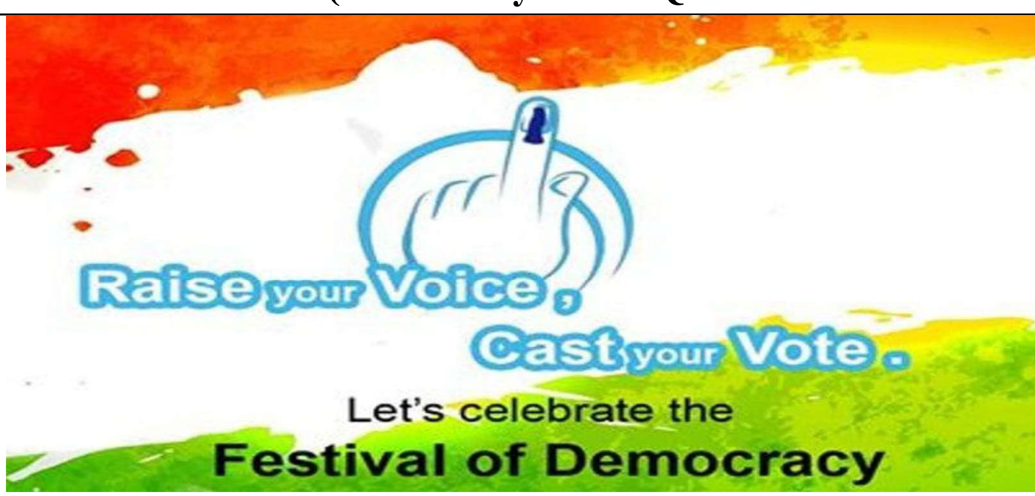
Q.35 Find the image of the point (2, -1, 5) in the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$.

OR

Vertices B and C of ΔABC lie on line $\frac{x+2}{2} = \frac{y-1}{1} = \frac{z}{4}$. Find the area of ΔABC given that point A has coordinates (1, -1, 2) and the line segment BC has length of 5 units.

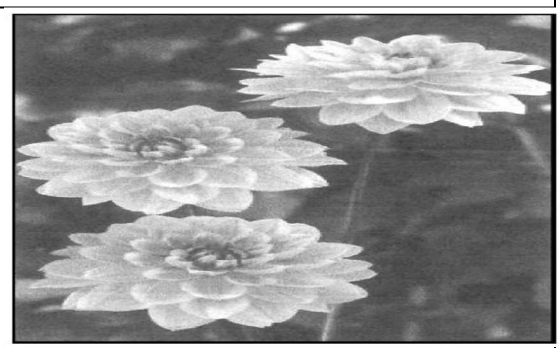
SECTION-E (Case Study Based Questions of 4 Marks each)

Q.36



Let I be the set of all citizens of India who were eligible to exercise their voting right in general election held in 2019. A relation 'R' is defined on I as follows:

$R = \{(V_1, V_2) : V_1, V_2 \in I$ and both use their voting right in general election – 2019$\}$

	(*i*) Two neighbors *X* and *Y* ϵI. *X* exercised his voting right while *Y* did not cast her vote in general election-2019. Check whether *X* is related to *Y* or not. (*ii*) Mr. '*X*' and his wife '*W*' both exercised their voting right in general election-2019. Show that (*X*, *W*) ϵ *R*and (*W*, *X*) ϵ *R*. (*iii*) Three friends F_1, F_2 and F_3 exercised their voting right in general election-2019. Show that (F_1, F_2) ϵ *R*, (F_2, F_3) ϵ *R* and (F_1, F_3) ϵ*R*. **OR** Show that the relation *R* defined on set *I* is an equivalence relation.
Q.37	Let f(x) be a real valued function. Then its Left Hand Derivative (L.H.D.):$Lf'(a) = \lim_{h\to 0}\frac{f(a-h)-f(a)}{-h}$ Right Hand Derivative (R.H.D.):$Rf'(a) = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$. Also, a function f(x) is said to be differentiable at x = a if its L.H.D. and R.H.D. at x = a exist and both are equal. For the function $f(x) = \begin{cases} \lvert x-3\rvert & ; x \geq 1 \\ \frac{x^2}{4} - \frac{3x}{2} + \frac{13}{4} & ; x < 1 \end{cases}$ answer the following questions: (i). What is R.H.D. of f(x) at x = 1 ? (ii). What is L.H.D. of f(x) at x = 1 ? (iii). (a) Check if the function f(x) is differentiable at x = 1. OR (iii). (b) Find $f'(2)$ and $f'(-1)$.
Q.38	A shopkeeper sells three types of flower seeds A1 , A2,A3. They are sold in the form of a mixture , where the proportions of these seeds are 4 : 4 : 2 , respectively. The germination rates of the three types of seeds are 45% , 60% and 35% respectively .  Based on the above information : (a) Calculate the probability that a randomly chosen seed will germinate. (b) Calculate the probability that the seed is of the type A2 , given that a randomly chosen seed germinates.

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