KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION

PRE-BOARD-I EXAMINATION 2025-26 **SET-2**

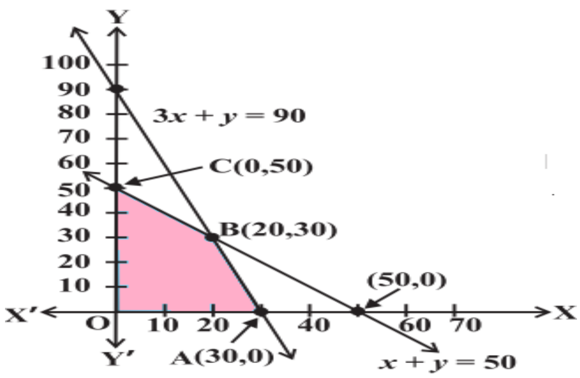
Class-XII **Max Marks: 80**

Subject: MATHEMATICS (041) **Time Allowed: 3 Hours**

General Instructions:

1. This question paper contains-**five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section-A has 18 MCQ's and 2 Assertion-Reason based questions of 1 mark each.
3. Section-B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section-C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section-D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section-E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

	SECTION-A *(Each question carries 1 mark)*	**MARKS**
Q1.	For the set A = {1, 2, 3}, define a relation R in the set A as follows R = {(1, 1), (2, 2), (3, 3), (1, 3)} Then, the ordered pair to be added to R to make it the smallest equivalence relation is (a) (2, 3) (b) (3, 1) (c) (2, 1) (d) (1, 2)	1
Q2.	If A is a non-singular square matrix of order 3 such that $\|A\|$=3, then value of $\|2A^T\|$ is (a) 3 (b) 6 (c) 12 (d) 24	1
Q3.	If $[x-2 \quad 5+y]\begin{bmatrix}0 & 1\\1 & 0\end{bmatrix} = 0$, then $x+y=$ (a) -3 (b) -2 (c) -1 (d) 0	1
Q4.	A matrix $A=\left[a_{ij}\right]_{3\times3}$ is defined by $a_{ij}=\begin{cases}2i+3j, & i<j\\5, & i=j\\3i-2j, & i>j\end{cases}$ The number of elements in A which are more than 5, is (a) 2 (b) 3 (c) 4 (d) 5	1
Q5.	The differential coefficient of $\sec(\tan^{-1} x)$ w.r.t. x is (a) $\frac{x}{\sqrt{1+x^2}}$ (b) $\frac{x}{1+x^2}$ (c) $x\sqrt{1+x^2}$ (d) $\frac{1}{\sqrt{1+x^2}}$	1
Q6.	The number of points at which the function $f(x)=\frac{1}{x-[x]}$ is not continuous is (a) 0 (b) 1 (c) 2 (d) None of these	1
Q7.	The set of all points where the function $f(x)=x+\|x\|$ is differentiable is (a) $(0, \infty)$ (b) $(-\infty,0)$ (c) $(-\infty,0)\cup(0, \infty)$ (d) $(-\infty,\infty)$	1

Q8.	$\int_0^{\frac{\pi}{4}} (\tan^4 x + \tan^2 x)\, dx =$ (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ $(c)\,\frac{4}{3}$ $(d)\,\frac{5}{3}$	
Q9.	$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} x^3 cos^2 x\, dx$ is equal to : (a) 1 (b) 0 (c) -1 (d) Not defined	1
Q10.	Integrating factor of differential equation $(x - y^3)dy + y\, dx = 0$ is: (a) $\frac{1}{y}$ (b) log y (c)y (d) y^2	1
Q11.	The cosine of angle which vector $\sqrt{2}\hat{\imath} + \hat{\jmath} + \hat{k}$ makes with y- axis is (a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) 0	1
Q12.	The sum of order and degree differential equation $\frac{d}{dx}\left[\frac{dy}{dx}\right]$= 5 (a) 2 (b) 3 (c) 4 (d) 5	1
Q13.	The value of $\boldsymbol{\mu}$ such that the vectors $\vec{a} = 2\hat{\imath} + \boldsymbol{\mu}\hat{\jmath} + \hat{k}$ and $\overrightarrow{b}$ = $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ are orthogonal is (a) - $\frac{5}{2}$ (b) $\frac{5}{2}$ (c) $\frac{3}{2}$ (d) 0	1
Q14.	If the point P (a, b, 0) lies on the line $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z+3}{4}$, then a+2b = (a) 0 (b) 1 (c) 2 (d) 3	1
Q15.	If the direction cosines of a line are k,k,k then (a) k>0 (b) 0<k<1 (c) k=1 (d) k=$\frac{1}{\sqrt{3}}$ or k= -$\frac{1}{\sqrt{3}}$	1
Q16.	The corner points of the shaded bounded feasible region of an LPP are (0,0),(30,0),(20,30) and (0,50) as shown in the figure . The maximum value of the objective function Z=4x+y is  (a) 120 (b) 130 (c) 140 (d) 150	1
Q17.	Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let F = 4*x* + 6*y* be the objective function. The Minimum value of F occurs at (a) (0, 2) only (b) (3, 0) only (c) the midpoint of the line segment joining the points (0, 2) and (3, 0) only (d) any point on the line segment joining the points (0, 2) and (3, 0).	1

Q18.	Let A and B be two events . If P(A)=0.2, P(B)=0.4 , P(AUB)=0.6 then $P(A/B)$ is equal to (a) 1 (b) 0 (c) 0.2 (d) 0.4	1
	ASSERTION- REASON BASED QUESTIONS	
	In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct 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 and R is not the correct explanation of A (c) A is true but R is false. (d) A is false but R is true.	
Q19	**Assertion (A)**: The function $f(x) = x^2 - \mathrm{x} + 1$ is strictly increasing in $(0,1)$. **Reason (R):** The function has turning point at $x = \frac{1}{2}$.	**1**
Q20	**Assertion (A):** P is a point on the line joining points (3, 2, -1) and (6, -4, -2). If the x coordinate of the point P is 5, then its y coordinate is -2. **Reason(R):** If a, b, c are direction cosines of a line, then $a^2 + b^2 + c^2 = 1$	**1**
	SECTION -B *(This section comprises of very short answer type-question (VSA) of 2 marks each)*	
Q21	Find the value of $\tan^{-1}(\tan\frac{3\pi}{5})$. **OR** Find the value of $\sin^{-1}[\cos(\frac{33\pi}{5})]$	2
Q22	Find matrix A, If $\begin{bmatrix}4\\1\\3\end{bmatrix}$ A = $\begin{bmatrix}-4 & 8 & 4\\-1 & 2 & 1\\-3 & 6 & 3\end{bmatrix}$	2
Q23	Find the vector of magnitude 6, which is perpendicular to both the vectors $2\hat{\imath} - \hat{\jmath} + 2\hat{k}\ and\ 4\,\hat{\imath} - \hat{\jmath} + 3\hat{k}$.	2
Q24	If $\mathrm{x}\sin(\mathrm{a}+\mathrm{y}) + \mathrm{sina}\cos(\mathrm{a}+\mathrm{y}) = 0,$ then prove that $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\sin^2(\mathrm{a+y})}{\mathrm{sina}}$ **OR** If $\mathrm{x^y} = \mathrm{e^{x-y}}$, prove that $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{logx}}{(1+\mathrm{logx})^2}$	2
Q25	Find the equation of a line in vector and Cartesian form which passes through the point (1,-2,3) and is parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 2\hat{k}$	2

SECTION C

(This section comprises of short type questions (SA) of 3 marks each)

Q26 Find: $\int \frac{dx}{\sqrt{5-4x-2x^2}}$ — 3

Q27 Evaluate : $\int_0^{\pi} \frac{x\,sinx}{1+cos^2x}dx$ — 3

OR

Evaluate: $\int_{-5}^{5}|\,x+2|$ dx

Q28 Evaluate: $\int \frac{x^2}{(x^2+4)(x^2+9)}dx$ — 3

Q29 Solve the differential equation: $(1-y^2)(1+\log x)dx + 2xy\,dy = 0$: y(1)=0. — 3

OR

Solve the differential equation x dy - y dx = $\sqrt{x^2+y^2}$ dx

Q30 Solve the following Linear Programming Problem graphically: — 3

Maximize:Z= $100x + 120y$

Subject to :$5x + 8y \leq 200, 5x + 4y \leq 120, x, y \geq 0$

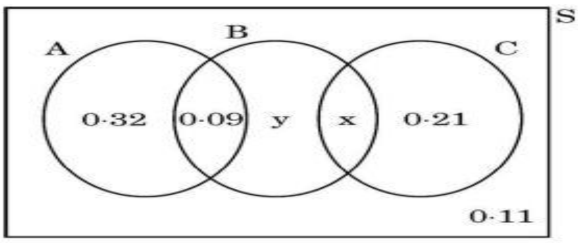
Q31 Probabilities of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that — 3

(i) the problem is solved

(ii) exactly one of them solves the problem.

OR

There are different types of Yoga which involve the usage of different poses of Yoga Asanas, Meditation and Pranayam etc. The Venn diagram below represents the probabilities of three different types of Yoga, A, B and C performed by the people of a society. Further, it is given that probability of a member performing type C Yoga is 0·44.



On the basis of the above information, answer the following questions:

I. Find the value of x. — 1

II. Find the value of y. — 1

III. Find P $\left(\frac{C}{B}\right)$. — 1

	SECTION D *(This section comprises of long answer -type question (LA) of 5 marks each)*	
Q32	Prove that the function $: N \rightarrow N$ defined by $f(x) = x^2 + x + 1$ is one-one but not onto. **OR** Let $A = \{1,2,3, \dots ,9\}$ and R be the relation in $A \times A$ defined by (a, b) R (c, d) if a+ d = b+ c, for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation and also obtain the equivalence class $[(2,5)]$.	5
Q33	Find the inverse of the matrix A = $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$. Using the inverse, A^{-1}, solve the system of linear equations: $x - y + 2z = 1$, $2y - 3z = 1$, $3x - 2y + 4z = 3$.	5
Q34	Make a rough sketch of the region bounded by circle $x^2 + y^2 \leq 4$ and the line $y + x \geq 2$ in first quadrant and hence find the area of the region bounded by these two curves using integration.	5
Q35	An insect is crawling along the line $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$ and another insect is crawling along the line $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$. At what points on the lines should they reach so that the distance between them is the shortest? Find the shortest possible distance between them. **OR** The equations of motion of a rocket are: $x = 2t$, $y = -4t$, $z = 4t$, where the time t is given in seconds, and the coordinates of a moving point in km. What is the path of the rocket? At what distances will the rocket be from the starting point O (0,0,0) and from the line $\vec{r} = 20\hat{\imath} - 10\hat{\jmath} + 40\hat{k} + \mu(10\hat{\imath} - 20\hat{\jmath} + 10\hat{k}$ in 10 seconds?	5
	SECTION-E (*This section comprises of 3 case -study /passage -based questions of 4 marks each*)	
Q36	**Case – Study 1** The temperature of a person during an intestinal illness is given by $f(x) = -0.1x^2 + mx + 98.6$, $0 \leq x \leq 12$, m being a constant, where f(x) is the temperature in °F at x days. (i) Is the function f differentiable in the interval (0, 12)? Justify your answer. (ii) If 6 is the critical point of the function, then find the value of the constant m.	 1 1

	(iii) Find the intervals in which the function is (a) strictly increasing (b) strictly decreasing. **OR** (iii) Find the points of local maximum/local minimum, if any, in the interval (0, 12) as well as the points of absolute maximum/absolute minimum in the interval [0, 12]. Also, find the corresponding local maximum/local minimum and the absolute maximum/absolute minimum values of the function.	2
Q37	**Case – Study 2** A tank, as shown in the figure, formed by using a combination of a cylinder and a cone, offers better drainage as compared to a flat-bottomed tank.  A tap is connected to such a tank whose conical part is full of water. Water is dripping out from a tap at the bottom at the uniform rate of $2\ \text{cm}^3/\text{s}$. The semi-vertical angle of the conical tank is 45^0. (i) Find the volume of water in the tank in terms of its radius "r". (ii) Find rate of change of radius at an instant when r= $2\sqrt{2}$ cm. (iii) Find the rate at which the wet surface of the conical tank is decreasing at an instant when radius, r= $2\sqrt{2}$ cm. OR (iii) Find the rate of change of height 'h' at an instant when slant height is 4 cm.	1 1 2
Q38	**Case – Study 3** In an office three employees Vinay, Sonia and Iqbal process incoming copies of a certain form. Vinay process 50% of the forms, Sonia process 20% and Iqbal the remaining 30% of the forms. Vinay has an error rate of 0.06, Sonia has an error rate of 0.04 and Iqbal has an error rate of 0.03. Based on the above information Answer the following: **(i)** Let A be the event of committing an error in processing the form and E_1, E_2, E_3 be the events that Vinay, Sonia, Iqbal processed the form. What is the Value of $\sum_{i=1}^{3} P(\frac{E_i}{A})$? **(ii)** Find the conditional probability that an error is committed in processing given that Sonia has Processed the forms. **(iii)** The manager of the company wants to do a quality check. During inspection he selects a form at random from the days output of processed forms. If the form selected at random has an error, what is the probability that the form is not processed by Vinay?	1 1 2