NAVODAYA VIDYALAYA SAMITI: HYDERABAD REGION

Term I Examination (2025-26)

CLASS :XII **SUBJECT : MATHEMATICS**

Max Time: 3 hrs. **Max Marks: 80**

SET- I

General Instructions:

i. ***This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.***
ii. ***Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.***
iii. ***Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.***
iv. ***Section C has 6 Short Answer (SA)-type questions of 3 marks each.***
v. ***Section D has 4 Long Answer (LA)-type questions of 5 marks each.***
vi. ***Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.***
vii. ***Use of calculators is not permitted.You may ask for logarithmic tables if required.***

SECTION A

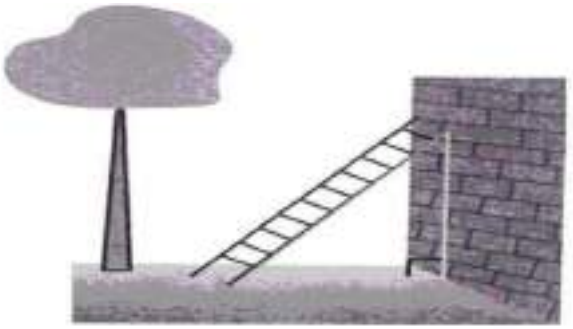
Select the most appropriate option out of the four choices given for each of the question

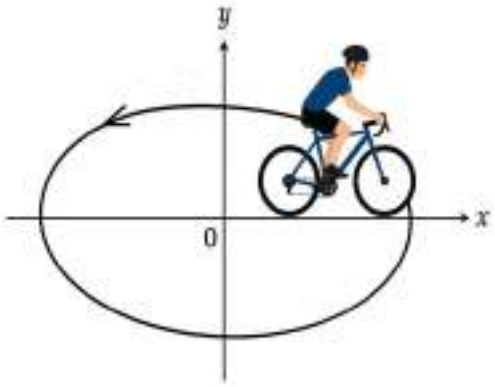
Q No	Question	Marks
1	If A={1,2,3} and R is a relation on A given by R={(1,1),(2,2),(3,3),(2,3)}, then which of the following statement is true about the relation R ? (A) R is reflexive ,symmetric but not transitive (B) R is reflexive ,not symmetric but transitive (C) R is reflexive,not symmetric and not transitive (D) R is an equivalence relation	**1**
2	Let f : $\mathbb{Z} \to \mathbb{Z}$ defined by f(x)= 2x+4 .Then f is : (A) one-one but not onto (B) onto but not one-one (C) neither one-one nor onto (D) both one –one and onto	**1**
3	If A is a non zero square matrix ,then A-A^T is always a : (A)symmetric matrix (B) skew symmetric matrix (C) zero matrix (D) diagonal matrix	**1**
4	If A is a square matrix of order 3 such that $\|A\| = 2$,then $\|3adjA\|$ is equal to: (A) 6 (B) 36 (C) 54 (D) 108	**1**
5	The value of $sin^2\left(cos^{-1}\frac{4}{5}\right)$ is equal to : (A) $\frac{3}{5}$ (B) $\frac{16}{25}$ (C) $\frac{9}{25}$ (D) $\frac{1}{5}$	**1**

6	The matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ is a/an : (A) scalar matrix (B) identity matrix (C) null matrix (D) symmetric matrix	**1**
7	The total number of possible matrices of order 3×2 in which each entry is either 1 or 2 is equal to: (A) 8 (B) 32 (C) 12 (D) 64	**1**
8	If A and B are invertible matrices of the same order ,then which of the following is not correct ? (A) $(AB)^{-1} = B^{-1}A^{-1}$ (B) $(AB)^T = B^T A^T$ (C) $(A+B)^{-1} = B^{-1}+A^{-1}$ (D) $adjA = \|A\|A^{-1}$	**1**
9	If the matrix A= $\begin{bmatrix} 4+x & x-1 \\ -2 & 3 \end{bmatrix}$ is singular (A) 0 (B) 1 (C) -2 (D) -4	**1**
10	Which of the following statement is true about the function f(x)= $\|x-2\|$? (A) f(x) is differentiable but not continuous at x=2 (B) f(x) is differentiable and continuous at x=2 (C) f(x) is continuous but not differentiable at x= 2 (D) f(x) is neither differentiable nor continuous at x=2	**1**
11	If $y = a(1-cos\theta)$ and $x = a(\theta - \sin\theta)$, $then$ $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$ is : (A) 1 (B) $\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) $-\frac{1}{\sqrt{3}}$	**1**
12	The maximum value of the function sinx + cosx is equal to : (A) 2 (B) $\sqrt{2}$ (C) $\frac{1}{\sqrt{2}}$ (D) 1	**1**
13	The function $f(x) = x^2 - 4x + 6$ is increasing in the interval (A) (0,2) (B) $(-\infty, 2]$ (C) [1,2] (D) [2,∞)	**1**
14	$\int_0^{\frac{\pi}{2}} cosx.e^{sinx}dx$ = (A) 0 (B) e (C) $e-1$ (D) $1-e$	**1**
15	The integrating factor of the differential equation (x log x) $\frac{dy}{dx}$ + y = 2logx is (A) e^x (B) x (C) log(logx) (D) $logx$	**1**
16	The value of $\int_0^{\frac{\pi}{2}} \frac{sin^5x}{sin^5x+cos^5x}dx$ = (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) π (D) 0	**1**

17	The value of the integral $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (x^5 cosx - sinx)dx$ *is* equal to : (A) π (B) $\frac{\pi}{2}$ (C) 1 (D) 0	**1**
18	The degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^3 + \left(\frac{d^2y}{dx^2}\right)^4 + \left(\frac{dy}{dx}\right)^5 + sin^{-1}x = 0$ is (A) 3 (B) 4 (C) 5 (D) not defined	**1**
	Question numbers 19 and 20 are Assertion-reason Questions: there are two statements- Assertion (A) and reason (R) in each question. Answer these questions by selecting the most suitable options given below: 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	
19	**Assertion (A)** : If A is a square matrix of order 3 such that $\|A\| = -2, then\ \|2A\| = -4$ **Reason (R)** : If A is a square matrix of order 'n' then $\|kA\| = k^n\|A\|$ where k is any real number.	**1**
20	**Assertion (A)**: Set values of $cosec^{-1}\left(\frac{1}{2}\right)$ is an empty set **Reason (R)** : $cosec^{-1}x$ is defined for x ∈ $\mathbb{R} - (-1,1)$	**1**
	SECTION-B	
21	Evaluate : $tan^{-1}\left[2sin\left(2cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$	**2**
22	Express in the simplest form : $tan^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right)$	**2**
23	Evaluate: $\int e^x sin\left(x + \frac{\pi}{4}\right) dx$ OR Evaluate: $\int \frac{e^{2x}-1}{e^{2x}+1} dx$	**2**
24	(a) If the area of a circle increases at a constant rate,then prove that that the perimeter varies inversely as the radius. OR (b) The volume of the cube increases at a constant rate. Prove that the rate of increase of its surface area varies inversely as the length of the side.	**2**
25	Evaluate : $\int tan^{-1}x\ dx$	**2**

	SECTION-C	
26	(a) Evaluate: $\int \frac{2x}{(x^2+2)(x^2-3)}\, dx$ OR (b) Evaluate: $\int \frac{e^x}{\sqrt{5-4e^x-e^{2x}}}\, dx$	**3**
27	Check the continuity of the function $f(x) = \begin{cases} \frac{x^2-4}{x-2}, if\ x < 2 \\ 4, if\ x = 2 \\ \frac{e^{4x}-1}{x}, if\ x > 2 \end{cases}$ at the point x = 2	**3**
28	Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\tan x}}{1+\sqrt{\tan x}}\, dx$	**3**
29	(a) Solve the differential equation : $cosx\frac{dy}{dx} + y = sinx\ \ given\ that\ y = 3$ $when\ x = 0$ OR (b) Solve the differential equation :$(1 + cos2x)dy - (1 - cos2x)dx = 0$, given that $y = 2$ when $x = 0$	**3**
30	A function f is defined from set A to set B defined by $f(x) = \frac{x-3}{x-2}$, where $A = R - \{2\}$ and $B = R - \{1\}$ .Show that f is a bijective function. OR Show that the function $f: [0, \infty) \to [1, \infty)$ given by $f(x) = x^2 + 2x + 1$ is both one and onto.	**3**
31	Find $\frac{dy}{dx}\ if\ y = x^{sinx} + (sinx)^x$	**3**
	SECTION-D	
32	Find the area bounded by the parabola $y^2 = 2x, the\ line\ 2x + 3y = 10$ and the x-axis ,in the first quadrant.	**5**
33	On the set Z of all integers, consider the relation defined by R ={(a,b) : a-b is divisible by 3}.Show that R is an equivalence relation on Z. Also find the partitioning of Z into mutually disjoint equivalence classes. OR Let N be the set of all natural numbers and let R be a relation on N X N defined by (a,b)R (c,d) if and only if ad=bc . Show that R is an equivalence relation.	**5**

34	Given A= $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and B= $\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ Find AB.Use this product to solve the following system of linear equations: $x - y + z = 4$ $x - 2y - 2z = 9$ $2x + y + 3z = 1$	**5**
35	(a) Find the intervals in which the function $f(x) = 2x^3 - 21x^2 + 72x + 6$ is (b) (a) strictly increasing (b) strictly decreasing OR (c) Find the points of local maxima and local minima of the function $f(x) = sin2x - x, -\frac{\pi}{2} < x < \frac{\pi}{2}$.	**5**
	SECTION-E	
36	A ladder of length 5 metres is placed along a vertical wall in such a way that it is free to slide up or down the wall.Let **y** be the distance of the foot of the ladder from the wall, and **x** be the height of the top of the ladder from the floor at a certain instant.  Based on the above information, answer the following questions: (i) Express 'y' in terms of 'x' (ii) Find $\frac{dy}{dx}$ in terms of x (iii) (a) If the foot of the ladder is being pulled towards the wall such that the rate of decrease of the distance **y** is **2 m/s**, then at what rate is the height **x** on the wall increasing when the foot of the ladder is **3 m** away from the wall? OR (b) If the ladder is being pushed downwards such that the rate of decrease of its height **x** on the wall is **3 m/s**, then at what rate is the foot of the ladder moving away from the wall when the height on the wall is **3 m**?	**1** **1** **2** **2**

37	A company sells three products: P, Q, and R in two different cities. The sales (in lakhs of rupees) for the first quarter and second quarter are given by: First Quarter: $A = \begin{bmatrix} 12 & 10 & 8 \\ 15 & 9 & 11 \end{bmatrix}$ Second Quarter: $B = \begin{bmatrix} 14 & 11 & 9 \\ 16 & 10 & 12 \end{bmatrix}$ Rows represent City1 and City 2 ,columns represent products P,Q and R. Based on the above information,answer the following questions: (i) Find the total half-yearly sales for each product in both cities (ii) Find the increase in sales from the first to the second quarter. (iii) (a) If the price of each product is 2000,1500 and 1000 respectively, find the revenue in each city for both quarters using matrix multiplication. OR (b) Find the matrix $B^T A$	**1** **1** **2** **2**
38	A cyclist pedals around a closed elliptical track. The position of the cyclist at time t seconds is given by the parametric equations $x = 5\,cost, y = 4sint, 0 \leq t \leq 2\pi$ where x and y are measured in metres from a fixed origin and t=0 corresponds to the point (5,0).  Based on the above information, answer the following questions : (i) Calculate the slope of the tangent to this path at $t = \frac{\pi}{4}$ (ii) Calculate $\frac{d^2y}{dx^2}$	**2** **2**