O. P. JINDAL SCHOOL, SAVITRI NAGAR

Half Yearly Examination - (2026 – 2027)

Class: XII **MM: 50**

Subject: Mathematics **Time: 2 Hrs.**

(Fifteen Minutes Extra will be given for reading the Question Paper.)

General Instructions:

i. This question paper has 5 sections A-E.

ii. Section A has 10 MCQs carrying 1 mark each.

iii. Section B has 5 questions carrying 2 mark each.

iv. *Section C has 4 questions carrying 3 mark each.*

v. Section D has 2 questions carrying 5 mark each.

vi. Section E has 2 case based questions of 04 (1 + 1 + 2) marks each .

vii. All the questions are compulsory.

viii. Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.

Section A

1. The function f : R $\rightarrow$ R defined by f(x) = [x], where [.] is greatest integer function is

a) one - one b) many one c) onto d) none of these

2. Consider the set A containing n elements. Then the total number of injective function from A to itself is

a) 2^n b) n c) n^n d) n!

3. Domain of the function $f(x) = \sin^{-1}\sqrt{x-1}$ is

a) [1, 2] b) [-1, 1] c) [0, 1] d) [0, 2]

4. Principal value of $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$ is

a) $\frac{3\pi}{5}$ b) $\frac{2\pi}{5}$ c) $\frac{\pi}{2}$ d) $-\frac{3\pi}{5}$

5. If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to

a) A b) I - A c) I d) 3A

6. If $\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}x\\ y\\ z\end{bmatrix} = \begin{bmatrix}6\\ 3\\ 2\end{bmatrix}$, then 2x + y – z =

a) 1 b) 3 c) 5 d) 7

7. Let A be a non singular square matrix of order 3 x 3, such that | A | = 5, | adj. A | is equal to

a) 5 b) 25 c) 125 d) 15

8. The value of k for which $f(x) = \begin{cases}3x+5, & x \geq 2\\ kx^2, & x < 2\end{cases}$ is continuous is

a) $-\frac{11}{4}$ b) $\frac{4}{11}$ c) 11 d) $\frac{11}{4}$

9. Absolute maximum value of $f(x) = x^3 - 3x + 2$ in $0 \le x \le 2$ is

a) 4 b) 6 c) 2 d) 0

DIRECTIONS: In the question number 19 and 20, a statement of **Assertion(A)** is followed by a statement of **Reason(R).** Choose the correct option

(A) Both assertion and reason are true and reason is the correct explanation of assertion

(B) Both assertion and reason are true and reason is not the correct explanation of assertion

(C) Assertion is true but reason is false

(D) Assertion is false but reason is true.

10. Assertion(A):- $A = \int e^x(\sin x - \cos x)dx = e^x \sin x + c$.

Reason(R) :- If $\int e^x\{f(x) + f'(x)\}dx = e^x f(x) + c$.

Section B

11. Show that the function $f : R - \{0\} \to R - \{0\}$, defined by $f(x) = \frac{1}{x}$ is one-one and onto.

12. Find the value of $\tan^{-1}\left[2\cos\left(2\sin^{-1}\frac{1}{2}\right)\right]$.

OR

Find the value of x if $\cot^{-1}x = \cos^{-1}(-1) - \operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$.

13. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find k so that $A^2 = kA - 2I$.

14. Find the equation of line joining (3, 1) and (9, 3) using determinants.

OR

Using determinants show that points (a, b +c), (b, c + a), (c, a + b) are collinear.

15. Prove that the function f given by $f(x) = |x - 1|$, $x \in R$ is not differentiable at $x = 1$.

Section C

16. Prove that $\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$.

17. If $y = 3\cos(\log x) + 4\sin(\log x)$, show that $x^2y_2 + xy_1 + y = 0$.

18. Evaluate :- $\int x^2 \tan^{-1} x \, dx$.

OR

Evaluate:- $\int_1^3 \frac{1}{x^2(x+1)} \, dx$

19. The volume of a sphere is increasing at the rate of 3 cubic centimeter per second. Find the rate of increase of its surface area, when the radius is 2 cm .

Section D

20. Given $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$. Verify that BA = 6I, use the result to solve the system of linear equations:- $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$.

21. Find $\int \frac{2\cos x}{(1-\sin x)(1+\sin^2 x)}\,dx$

OR

Evaluate $\int_0^{\frac{\pi}{2}} \sin 2x \tan^{-1}(\sin x)\,dx$.

Section E

22. If y = f(u) is a differentiable function of u and u = g(x) is a differentiable function of x, then y = f [g(x)] is a differentiable function of x and $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$. This rule is known as CHAIN RULE.

Based on the above information, answer the following questions.

i) Differentiate $\cos \sqrt{x}$ with respect to x. **(1)**

ii) Find $\frac{dy}{dx}$ if $y = 7^{x+\frac{1}{x}}$ **(1)**

iii) Differentiate $\sqrt{\frac{1-\cos x}{1+\cos x}}$ with respect to x. **(2)**

OR

Differentiate $\log (\cos e^{\sin 2x})$ with respect to x . .

22. A rectangular sheet of tin 45 cm by 24 cm is to be made into the box without top, by cutting a square from each corner and folding up the flaps. Let x be the length of the side of the square to be cut from each corner. Based on the given information, answer the following questions:

i) Express the volume(V) of the box as function of x only. **(1)**

ii) Find the critical points for which volume can be maximum, **(1)**

iii) For what value of x , the volume of box is maximum? **(2)**

OR

At what value of x, V has a point of inflection?

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