



General Instructions

- (i) **Duration:** The total duration of the examination is 3 hours (180 minutes).
- (ii) **Total Marks:** The complete paper carries a maximum of 200 marks.
- (iii) **Structure:** The paper has 3 Sections:
 - **Section A:** 50 Multiple Choice Questions (Physics).
 - **Section B:** 50 Multiple Choice Questions (Chemistry).
 - **Section B:** 100 Multiple Choice Questions (Biology).
- (iv) **Compulsory Questions:** All 200 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +1 marks.
- (vii) **Incorrect Answer:** (No Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

1. If $\sin x \cos x = \frac{1}{4}$, then the general solution is:

- (A) $\frac{n\pi}{2} + (-1)^n \frac{\pi}{12}$
- (B) $\frac{n\pi}{2} + \frac{\pi}{4}$
- (C) $n\pi \pm \frac{\pi}{6}$
- (D) $\frac{n\pi}{2} + (-1)^n \frac{\pi}{6}$

2. If $n \in \mathbb{Z}$, then the expression $\frac{2^n}{(1-i)^{2n}} + \frac{(1+i)^{2n}}{2^n}$ is equal to:

- (A) $2(-1)^n$
(B) 0
(C) 2
(D) 2^n
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3. The value of $\int \frac{x^2-1}{(x^4+3x^2+1)\tan^{-1}(x+\frac{1}{x})} dx$ is:

- (A) $\log |\tan^{-1}(x + \frac{1}{x})| + C$
(B) $\tan^{-1}(x + \frac{1}{x}) + C$
(C) $-\log |\tan^{-1}(x + \frac{1}{x})| + C$
(D) $\frac{1}{2} \log |x + \frac{1}{x}| + C$
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4. If $f(x) = \int \frac{x^2}{(1-x^2)(1+\sqrt{1-x^2})} dx$ and $f(0) = 2$, then $f(\frac{1}{2})$ is:

- (A) $2 + \frac{1}{2} \log 3 - \frac{\sqrt{3}}{2}$
(B) $2 + \log 3 - \sqrt{3}$
(C) $2 + \sqrt{3} - \log 3$
(D) $2 + \frac{\sqrt{3}}{2} - \frac{1}{2} \log 3$
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5. If $A = \begin{bmatrix} \sin \alpha & -\cos \alpha \\ \cos \alpha & \sin \alpha \end{bmatrix}$ and $\alpha \in (\frac{\pi}{2}, \frac{3\pi}{2})$. If $A + A^T = I$, then $\alpha =$

- (A) $\frac{2\pi}{3}$
(B) $\frac{5\pi}{6}$
(C) $\frac{\pi}{3}$
(D) $\frac{4\pi}{3}$
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6. The range of the function $y = \log(\sin x)$ where $\sin x > 0$ is:

- (A) $[0, \infty)$
(B) $(-\infty, 0]$

(C) $(-\infty, \infty)$

(D) $[-1, 1]$

7. Let $f(x)$ be defined by $f(x) = \begin{cases} \int_x^6 (|t-2| + 3) dt, & x > 4 \\ 2x + 8, & x \leq 4 \end{cases}$. Then at $x = 4$, $f(x)$ is:

(A) Continuous but not differentiable

(B) Differentiable

(C) Discontinuous

(D) None of these

8. If $y = (x-1)(x-2)(x-3)\dots(x-100)$, and the value of $\frac{dy}{dx}$ at $x = 0$ is equal to $\lambda \left(\frac{100!}{100C_5} \right)$, then λ is:

(A) $\frac{1}{120}$

(B) 120

(C) 1

(D) $\frac{1}{24}$

9. If a vector $\vec{c}$ is coplanar with $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ such that $\vec{c} \cdot \vec{a} = 1$ and $\vec{c} \cdot \vec{b} = 2$, then $\vec{c}$ is:

(A) $\frac{1}{3}(-\hat{i} + 5\hat{j} + 3\hat{k})$

(B) $\frac{1}{3}(5\hat{i} - \hat{j} + 3\hat{k})$

(C) $\hat{i} - \hat{j} + \hat{k}$

(D) $\frac{1}{2}(\hat{j} + \hat{k})$

10. If n is an odd natural number and $I_n = \int_0^1 e^x (x-1)^n dx$, then $I_n + nI_{n-1}$ is equal to:

(A) 1

(B) -1

(C) e

(D) 0
