

PART 1 - MATHEMATICS

Topic : Trigonometric functions, Application of integrals

SECTION-A : (Maximum Marks : 12)

This section contains **THREE** questions.

Each question has **TWO** lists: **List-I** and **List-II**.

Four options are given representing matching of elements from List-I and List-II. **ONLY ONE** of these four options corresponds to a correct matching.

For each question, choose the option corresponding to the correct answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

1. Match each entry in **List-I** to the correct entry in **List-II** and choose the correct option.

[JEE Advanced 2026 Paper 1]

List-I		List-II	
P.	The number of elements in the set $\{x \in [-\pi, \pi] : \sin^6 x + \cos^4 x = 1\}$	1.	is 1
Q.	The number of elements in the set $\left\{x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] : \sin^2 x + \cos^6 x = 1\right\}$	2.	is 2
R.	The number of elements in the set $\left\{x \in [-\pi, \pi] : \cos^2\left(\frac{x}{2}\right) - \sin^2 x = \frac{1}{2}\right\}$	3.	is 3
S.	The number of elements in the set $\left\{x \in [-2\pi, 2\pi] : 6\sin^2\left(\frac{x}{2}\right) - \cos 3x = 3\right\}$	4.	is 4
		5.	is 5

- (A) (P) $\rightarrow$ (2), (Q) $\rightarrow$ (5), (R) $\rightarrow$ (3), (S) $\rightarrow$ (4) (B) (P) $\rightarrow$ (5), (Q) $\rightarrow$ (3), (R) $\rightarrow$ (2), (S) $\rightarrow$ (4)
 (C) (P) $\rightarrow$ (5), (Q) $\rightarrow$ (4), (R) $\rightarrow$ (1), (S) $\rightarrow$ (3) (D) (P) $\rightarrow$ (4), (Q) $\rightarrow$ (3), (R) $\rightarrow$ (2), (S) $\rightarrow$ (5)

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2. Let $\frac{\pi}{2} < x < \pi$ be such that $\cot x = \frac{-5}{\sqrt{11}}$. Then

$$\left(\sin \frac{11x}{2}\right)(\sin 6x - \cos 6x) + \left(\cos \frac{11x}{2}\right)(\sin 6x + \cos 6x)$$

is equal to

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(A) $\frac{\sqrt{11}-1}{2\sqrt{3}}$

(B) $\frac{\sqrt{11}+1}{2\sqrt{3}}$

(C) $\frac{\sqrt{11}+1}{3\sqrt{2}}$

(D) $\frac{\sqrt{11}-1}{3\sqrt{2}}$

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3. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by

$$f(x) = \begin{cases} x^2 \sin\left(\frac{\pi}{x^2}\right), & \text{if } x \neq 0, \\ 0, & \text{if } x = 0. \end{cases}$$

Then which of the following statements is TRUE?

[JEE Advanced 2024 Paper 2]

(A) $f(x) = 0$ has infinitely many solutions in the interval $\left[\frac{1}{10^{10}}, \infty\right)$.

(B) $f(x) = 0$ has no solutions in the interval $\left[\frac{1}{\pi}, \infty\right)$.

(C) The set of solutions of $f(x) = 0$ in the interval $\left(0, \frac{1}{10^{10}}\right)$ is finite.

(D) $f(x) = 0$ has more than 25 solutions in the interval $\left(\frac{1}{\pi^2}, \frac{1}{\pi}\right)$.

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SECTION-B : (Maximum Marks : 16)

This section contains **ONE** paragraph.

Based on each paragraph, there are **FOUR** questions.

The answer to each question is a **NUMERICAL VALUE**.

For each question, enter the correct numerical value of the answer (in decimal notation, truncated / rounded-off to the **SECOND DECIMAL PLACE**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) in the place designated to enter the answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct answer is entered;

Zero Marks : 0 In all other cases.

4. Let

$$\alpha = \left(1 - 2\cos\left(\frac{\pi}{11}\right)\right)\left(1 - 2\cos\left(\frac{3\pi}{11}\right)\right)\left(1 - 2\cos\left(\frac{9\pi}{11}\right)\right) \\ \left(1 - 2\cos\left(\frac{27\pi}{11}\right)\right)\left(1 - 2\cos\left(\frac{81\pi}{11}\right)\right).$$

Then the value of $5 - \alpha^2$ is _____.

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Paragraph for Questions 5 and 6

Consider the curve C_1 given by

$$y = e^{-x} \text{ for } x \in [0, 10\pi],$$

and the curve C_2 given by

$$y = e^{-x}(\sin x + \cos x) \text{ for } x \in [0, 10\pi].$$

Let n be the total number of points of intersection of the curves C_1 and C_2 .

Suppose that $\alpha_1, \alpha_2, \dots, \alpha_n \in [0, 10\pi]$ are the x -coordinates of the points of intersection of the curves C_1 and C_2 such that

$$\alpha_1 < \alpha_2 < \dots < \alpha_n.$$

5. The value of n is _____.

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6. Let β be the area of the region enclosed between the curves C_1 , C_2 , and the lines $x = \alpha_1$ and $x = \alpha_4$. Then the value of

$$-\frac{1}{\pi} \log_e \left(\beta - 2e^{-\frac{\pi}{2}} \right)$$

is _____.

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7. Let

$$\alpha = \frac{1}{\sin 60^\circ \sin 61^\circ} + \frac{1}{\sin 62^\circ \sin 63^\circ} + \cdots + \frac{1}{\sin 118^\circ \sin 119^\circ}.$$

Then the value of

$$\left(\frac{\operatorname{cosec} 1^\circ}{\alpha} \right)^2$$

is _____.

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JEE ADVANCED TRIGONOMETRIC FUNCTIONS —
PYQS

Test Pattern : JEE (Advanced)

ANSWER KEY

SECTION-A																													
Ques.	1	2	3																										
Ans.	B	B	D																										

SECTION-B													
Ques.	4		5		6		7						
Ans.	3.9 to 4.1		11		2.4 to 2.6		3						