

PART 1 - MATHEMATICS

Topic : Integrals

SECTION-A : (Maximum Marks : 4)

This section contains **ONE** question.

Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

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. The value of the definite integral

$$\int_0^2 \frac{1}{3^x + 3} dx$$

is

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{\log_e 3}{3}$

(D) $\frac{\log_e 3}{2}$

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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.

2. If

$$\alpha = \int_1^2 \frac{\tan^{-1} x}{2x^2 - 3x + 2} dx,$$

then the value of $\sqrt{7} \tan \left(\frac{2\alpha\sqrt{7}}{\pi} \right)$ is _____.

(Here, the inverse trigonometric function $\tan^{-1} x$ assumes values in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.)

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3. Let the function $f: [1, \infty) \rightarrow \mathbb{R}$ be defined by

$$f(t) = \begin{cases} (-1)^n + 12, & \text{if } t = 2n-1, n \in \mathbb{N}, \\ \frac{(2n+1-t)2f(2n-1) + (t-(2n-1))2f(2n+1)}{2}, & \text{if } 2n < t < 2n+2, n \in \mathbb{N}. \end{cases}$$

Define $g(x) = \int_1^x f(t) dt$, $x \in (1, \infty)$. Let α denote the number of solutions of the equation

$g(x) = 0$ in the interval $(1, 8]$ and $\beta = \lim_{x \rightarrow 1+} \frac{g(x)}{x-1}$. Then the value of $\alpha + \beta$ is equal to _____.

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Paragraph for Questions 4 and 5

Let $f: \left[0, \frac{\pi}{2}\right] \rightarrow [0, 1]$ be the function defined by $f(x) = \sin^2 x$ and let $g: \left[0, \frac{\pi}{2}\right] \rightarrow [0, \infty)$ be

the function defined by $g(x) = \sqrt{\frac{\pi x}{2} - x^2}$.

4. The value of $2 \int_0^{\frac{\pi}{2}} f(x)g(x) dx - \int_0^{\frac{\pi}{2}} g(x) dx$ is _____.

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5. The value of $\frac{16}{\pi^3} \int_0^{\frac{\pi}{2}} f(x)g(x) dx$ is _____.

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JEE ADVANCED INTEGRALS — PYQS

Test Pattern : JEE (Advanced)

ANSWER KEY

SECTION-A																									
Ques.	1																								
Ans.	B																								

SECTION-B																									
Ques.	2	3	4	5																					
Ans.	21	5	0	0.25																					