

PART 1 - MATHEMATICS

Topic : Application of integrals, Trigonometric functions, Conic sections

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. Let R denote the set of all real numbers. Then the area of the region

$$\left\{ (x, y) \in \mathbb{R} \times \mathbb{R} : x > 0, y > \frac{1}{x}, 5x - 4y - 1 > 0, 4x + 4y - 17 < 0 \right\}$$

is

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(A) $\frac{17}{16} - \log_e 4$

(B) $\frac{33}{8} - \log_e 4$

(C) $\frac{57}{8} - \log_e 4$

(D) $\frac{17}{2} - \log_e 4$

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Space for Rough Work

SECTION-B : (Maximum Marks : 16)

This section contains **TWO** paragraphs.

Based on each paragraph, there are **TWO** 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.

Paragraph for Questions 2 and 3

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

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

2. The value of n is _____.

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3. 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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Paragraph for Questions 4 and 5

Consider the ellipses given by

$$x^2 + 4y^2 = 1 \text{ and } 4x^2 + y^2 = 1.$$

4. Let P be the point in the first quadrant where the given ellipses intersect. If θ is the acute angle between the tangents to the given ellipses at the point P , then the value of $4\tan \theta$ is _____.

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5. If α is the area of the common region that lies inside both the given ellipses, then the value of $\cot \alpha$ is _____.

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JEE ADVANCED APPLICATION OF INTEGRALS — AREA BETWEEN TWO CURVES — PYQS

Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION-A

[illegible]

SECTION-B

Ques.	2	3	4	5					
Ans.	11	2.4 to 2.6	7.4 to 7.6	0.74 to 0.76					