

PART 1 - MATHEMATICS

Topic : Application of integrals, Trigonometric functions, Conic sections

SECTION-A : (Maximum Marks : 12)

- This section contains **THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	: +4	ONLY if (all) the correct option(s) is(are) chosen;
Partial Marks	: +3	If all the four options are correct but ONLY three options are chosen;
Partial Marks	: +2	If three or more options are correct but ONLY two options are chosen, both of which are correct;
Partial Marks	: +1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	: -1	In all other cases.
- For example, in a question, if **(A), (B) and (D)** are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get -1 marks.

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

Scan or tap for the full solution



2. Let S denote the locus of the mid-points of those chords of the parabola $y^2 = x$, such that the area of the region enclosed between the parabola and the chord is $\frac{4}{3}$. Let R denote the region lying in the first quadrant, enclosed by the parabola $y^2 = x$, the curve S , and the lines $x = 1$ and $x = 4$.

Then which of the following statements is (are) TRUE?

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(A) $(4, \sqrt{3}) \in S$

(B) $(5, \sqrt{2}) \in S$

(C) Area of R is $\frac{14}{3} - 2\sqrt{3}$

(D) Area of R is $\frac{14}{3} - \sqrt{3}$

Scan or tap for the full solution



3. Let $S = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x \geq 0, y \geq 0, y^2 \leq 4x, y^2 \leq 12 - 2x \text{ and } 3y + \sqrt{8}x \leq 5\sqrt{8}\}$. If the area of the region S is $\alpha\sqrt{2}$, then α is equal to

[JEE Advanced 2024 Paper 2]

Space for Rough Work

PYQSide

(A) $\frac{17}{2}$

(B) $\frac{17}{3}$

(C) $\frac{17}{4}$

(D) $\frac{17}{5}$

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full solution



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, -0.30, 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 4 and 5

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

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

4. The value of n is _____.

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

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

is _____.

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Paragraph for Questions 6 and 7

Consider the ellipses given by

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

6. 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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Space for Rough Work

7. 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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Space for Rough Work

JEE ADVANCED APPLICATION OF INTEGRALS — PYQS

Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION-A

[illegible]

SECTION-B

Ques.	4	5	6	7								
Ans.	11	2.4 to 2.6	7.4 to 7.6	0.74 to 0.76								