NCERT Solutions Class 12 Maths
Chapter 8: Application of Integrals
Exercise 8.1

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 8 Exercise 8.1, students learn to find areas under simple curves using definite integration. This exercise covers fundamental area calculation techniques for regions bounded by curves like ellipses, circles, and parabolas, which are essential for scoring well in CBSE board exams and competitive tests.

Key Takeaways:

- Area under a curve y = f(x) from x = a to x = b is calculated using A = \int_a^b f(x) \, dx
- For curves symmetric about axes, calculate area in one quadrant and multiply by appropriate factor to save time
- Standard curves like ellipse (x^2)/(a^2) + (y^2)/(b^2) = 1 have area = π ab
- Always sketch the curve first to identify correct limits of integration and avoid sign errors

Complete Solutions

Question 1

QUESTION

Find the area of the region bounded by the ellipse (x^2)/(16) + (y^2)/(9) = 1.

SOLUTION

We are asked to find the area of the region enclosed by the ellipse . This problem tests our understanding of how to use integration to find the area under a curve, specifically in the context of an ellipse.

Step 1: Express in terms of

First, we need to express in terms of from the equation of the ellipse:

We will consider the positive root, , which represents the upper half of the ellipse.

Step 2: Determine the limits of integration

The ellipse has its major axis along the x-axis, with vertices at and . Therefore, we will integrate from to to find the area of the upper half of the ellipse.

Step 3: Set up the integral for the area of the upper half

The area of the upper half of the ellipse is given by:

Step 4: Calculate the total area

Since the ellipse is symmetric about the x-axis, the total area is twice the area of the upper half:

The integral represents the area of a semicircle with radius 4, which is .

Therefore, the total area is:

Final Answer: The area of the region bounded by the ellipse is .

ANSWER

12π

Question 2

QUESTION

Find the area of the region bounded by the ellipse (x^2)/(4) + (y^2)/(9) = 1.

SOLUTION

We need to find the area of the region enclosed by the ellipse . This involves using integration to calculate the area.

Step 1: Express in terms of

From the equation of the ellipse, we have:

We will consider the positive root to find the area of the region above the x-axis and then multiply by 2 to get the total area.

Step 2: Determine the limits of integration

The ellipse intersects the x-axis when . Thus,

So, the limits of integration are from -2 to 2.

Step 3: Set up the integral for the area

The area of the region above the x-axis is given by:

The total area of the ellipse is twice this area:

Step 4: Evaluate the integral

The integral . In our case, .

So,

Step 5: Calculate the total area

Therefore, the area of the region bounded by the ellipse is .

ANSWER

6π

Question 3

QUESTION

Area lying in the first quadrant and bounded by the circle x^2 + y^2 = 4 and the lines x = 0 and x = 2 is

SOLUTION

We are asked to find the area in the first quadrant bounded by the circle , and the lines and .

Step 1: Visualize the region

The equation represents a circle centered at the origin (0,0) with a radius of 2. The lines and are vertical lines representing the y-axis and a line parallel to the y-axis at x=2, respectively. We are looking for the area enclosed within the circle and between these two lines in the first quadrant.

Step 2: Set up the integral

First, we need to express in terms of from the equation of the circle. Since we are in the first quadrant, is positive.

The area can be found by integrating with respect to from to :

Step 3: Evaluate the integral

The integral . In our case, .

So,

Since and , we have:

Final Answer: The area is .

The correct option is .

ANSWER

0

Question 4

QUESTION

Area of the region bounded by the curve y^2 = 4x, y-axis and the line y = 3 is

SOLUTION

We need to find the area of the region bounded by the curve , the y-axis, and the line . This involves using integration to calculate the area under a curve.

Step 1: Express x in terms of y

The equation of the curve is given as . We need to express as a function of to integrate with respect to . Dividing both sides by 4, we get:

Step 2: Set up the integral

We are integrating with respect to , and the limits of integration are from (the y-axis) to (the given line). The area is given by the integral:

Step 3: Evaluate the integral

We integrate the function with respect to :

Now, we evaluate the definite integral by plugging in the limits:

Step 4: State the final answer

The area of the region is square units.

Therefore, the correct answer is .

Option 1 (2) is incorrect because it does not match the calculated area.

Option 3 () is incorrect because it simplifies to 3, which is not the calculated area.

Option 4 () is incorrect because it does not match the calculated area.

ANSWER

1

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Key Formulas

Important Formulas for Exercise 8.1

Formula / Concept	Description
Area under a Curve (with respect to x-axis)	The area of the region bounded by the curve $y = f(x)$, the x-axis, and the vertical lines $x = a$ and $x = b$ is given by the definite integral: Area = $\int_a^b y \,dx = \int_a^b f(x) \,dx$
Area under a Curve (with respect to y-axis)	The area of the region bounded by the curve $x = g(y)$, the y-axis, and the horizontal lines $y = c$ and $y = d$ is given by: Area = $\int_c^d x \,dy = \int_c^d g(y) \,dy$
Area between Two Curves	The area of the region enclosed between two curves $y = f(x)$ and $y = g(x)$, and the lines $x = a$ and $x = b$, is given by: Area = $\int_a^b [f(x) - g(x)] \,dx$ where $f(x) \geq g(x)$ in the interval [a, b]. This represents the area of the upper curve minus the area of the lower curve.
Area below the x-axis	If the curve $y = f(x)$ lies below the x-axis for the interval [a, b], the integral $\int_a^b f(x) \,dx$ will be negative. Since area is a non-negative quantity, the required area is given by: Area = $\left\| \int_a^b f(x) \,dx \right\|$
Standard Equation of a Circle	The equation of a circle with its center at the origin (0, 0) and radius 'a' is: $x^2 + y^2 = a^2$
Standard Equation of an Ellipse	The equation of a standard ellipse centered at the origin with semi-major and semi-minor axes 'a' and 'b' is: $(x^2)/(a^2) + (y^2)/(b^2) = 1$
Standard Equations of a Parabola	• Right-handed parabola: $y^2 = 4ax$ • Left-handed parabola: $y^2 = -4ax$ • Upward parabola: $x^2 = 4ay$ • Downward parabola: $x^2 = -4ay$

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Exercise 8.1 ✓ →

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