NCERT Solutions Class 12 Maths
Chapter 7: Integrals
Exercise 7. Miscellaneous

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 7 Exercise misc, students learn advanced integration techniques for complex rational and irrational functions. This exercise covers sophisticated methods including partial fractions, trigonometric substitutions, and algebraic manipulations which are essential for scoring high marks in CBSE board exams and competitive entrance tests.

Key Takeaways:

- Master integration of rational functions like (1)/(x - x^3) using partial fraction decomposition
- Learn techniques for integrating functions with square roots such as (1)/(√x+a) + √x+b through rationalization
- Apply the Fundamental Theorem of Calculus to evaluate definite integrals and solve area problems
- Develop problem-solving strategies for complex integrals that frequently appear in CBSE Class 12 board examinations

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Complete Solutions

Question 1

QUESTION

Integrate (1)/(x - x^3).

SOLUTION

We need to integrate the function . This requires partial fraction decomposition.

Step 1: Factor the denominator

First, factor the denominator as follows:

Step 2: Partial fraction decomposition

Now, express the given function as a sum of partial fractions:

Multiplying both sides by gives:

Step 3: Solve for A, B, and C

Let :

Let :

Let :

Step 4: Rewrite the integral

Now we can rewrite the integral as:

Step 5: Integrate each term

Step 6: Simplify the expression

Final Answer:

ANSWER

(1)/(2) \log \left| (x^2)/(1 - x^2) \right| + C

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Question 2

QUESTION

Integrate (1)/(√x+a) + √x+b.

SOLUTION

We are asked to integrate the function with respect to .

Step 1: Rationalize the denominator

To simplify the integral, we first rationalize the denominator by multiplying the numerator and denominator by the conjugate of the denominator, which is .

Simplifying the denominator gives:

Step 2: Rewrite the integral

Now we can rewrite the integral as:

Since and are constants, we can take out of the integral:

Step 3: Integrate each term separately

We can split the integral into two separate integrals:

Recall that . Using this, we have:

Step 4: Combine the results

Substituting these results back into the expression, we get:

Final Answer:

ANSWER

(2)/(3(a-b)) \left[(x+a)^3/2 - (x+b)^3/2 \right] + C

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Question 3

QUESTION

Integrate (1)/(x√ax - x^2).

SOLUTION

We need to evaluate the integral . This integral requires a clever substitution to simplify the expression.

Step 1: Simplify the expression inside the square root

We can rewrite the expression inside the square root as:

So the integral becomes:

Step 2: Perform the substitution

Let's use the substitution . Then, .

Also,

And

Step 3: Substitute into the integral

The integral becomes:

Step 4: Evaluate the integral

We know that . So,

Step 5: Convert back to

Since , we have , so .

Then .

Therefore, .

Step 6: Final Answer

Substituting back, we get:

ANSWER

-(2)/(a) √(a-x)/(x) + C

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Question 4

QUESTION

Integrate (1)/(x^2 (x^4 + 1)^3/4).

SOLUTION

We are asked to integrate the given function .

Step 1: Rewrite the integral

First, we rewrite the integral to make it easier to work with. Divide inside the bracket and multiply outside the bracket.

Step 2: Perform u-substitution

Let . Then, , so . Therefore, .

This implies .

Step 3: Substitute and integrate

Substituting and into the integral, we get:

Now, integrate with respect to :

Step 4: Substitute back for x

Substitute back into the expression:

Final Answer:

ANSWER

-\left(1 + (1)/(x^4)\right)^1/4 + C

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Question 5

QUESTION

Integrate (1)/(x^1/2) + x^1/3.

SOLUTION

We need to evaluate the integral . This integral can be solved using substitution to simplify the expression.

Step 1: Find a common denominator for the fractional powers.

The least common multiple of 2 and 3 is 6. Let's substitute , so .

Step 2: Perform the substitution.

Substituting into the integral, we get:

So the integral becomes:

Step 3: Perform polynomial long division.

Dividing by , we get .

So, .

Step 4: Integrate the simplified expression.

Now we have:

Step 5: Substitute back .

Substituting back into the expression, we get:

Final Answer:

ANSWER

2√x - 3x^1/3 + 6x^1/6 - 6\log(1 + x^1/6) + C

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Question 6

QUESTION

Integrate (5x)/((x+1)(x^2+9)).

SOLUTION

We need to integrate the given function . This requires using partial fraction decomposition.

Step 1: Partial Fraction Decomposition

We express the given fraction as a sum of simpler fractions:

Multiplying both sides by gives:

Step 2: Solve for A, B, and C

Comparing coefficients, we get the following system of equations:

From the first equation, . Substituting into the second equation, , so . Substituting into the third equation, , so , and .

Then and .

Step 3: Rewrite the integral

Now we can rewrite the integral as:

Step 4: Evaluate each integral

Step 5: Combine the results

Final Answer:

ANSWER

-(1)/(2)\log|x+1| + (1)/(4)\log(x^2+9) + (3)/(2)\tan^(-1)/(x)3 + C

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Question 7

QUESTION

Integrate (\sin x)/(\sin(x-a)).

SOLUTION

We need to evaluate the integral .

Step 1: Rewrite the numerator

We can rewrite as . This allows us to use the sine addition formula.

Step 2: Apply the sine addition formula

Recall that . Therefore:

Step 3: Substitute back into the integral

Now we have:

Step 4: Split the integral

We can split the integral into two parts:

Step 5: Simplify each integral

The first integral simplifies to:

The second integral simplifies to:

Step 6: Evaluate the second integral

We know that . Therefore:

Step 7: Combine the results

Combining both integrals, we get:

Final Answer:

ANSWER

\sin a \log|\sin(x-a)| + x\cos a + C

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Question 8

QUESTION

Integrate e^5\log x - e^4\log xe^3\log x - e^2\log x.

SOLUTION

We need to integrate the given expression: .

Step 1: Simplify using logarithm properties

Recall the property and . We can rewrite the expression using these properties.

Therefore, the expression becomes:

Step 2: Factor the numerator and denominator

Factor out the common terms from the numerator and the denominator.

Numerator:

Denominator:

So the expression is now:

Step 3: Cancel out common factors

We can cancel out the common factors and from the numerator and denominator, provided and .

Step 4: Integrate the simplified expression

Now we need to integrate with respect to .

Final Answer:

ANSWER

(x^3)/(3) + C

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Question 9

QUESTION

Integrate (\cos x)/(√4 - \sin^2 x).

SOLUTION

We are asked to integrate the function . This integral can be solved using a simple substitution method.

Step 1: Identify a suitable substitution

Notice that the derivative of is , which appears in the numerator. Let's substitute:

Then, the derivative of with respect to is:

Which implies:

Step 2: Rewrite the integral in terms of

Substituting and into the integral, we get:

Step 3: Recognize the standard integral form

The integral now resembles the standard form:

In our case, , so . Therefore, we have:

Step 4: Substitute back to the original variable

Substitute back into the result:

Final Answer:

The integral of is .

ANSWER

\sin^-1\left((\sin x)/(2) \right) + C

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Question 10

QUESTION

Integrate $(\sin^8 x - \cos^8 x)/(1 - 2\sin^2 x\cos^2 x)$.

SOLUTION

We are asked to integrate the given expression . This problem involves trigonometric identities and simplification before integration.

Step 1: Factor the numerator using the difference of squares.

We can rewrite the numerator as a difference of squares:

Step 2: Further factor the second term in the numerator.

The term can be further factored as:

Since , we have:

Therefore, the numerator becomes:

Step 3: Simplify the denominator.

We can rewrite the denominator as follows:

Step 4: Simplify the entire expression.

Now we can rewrite the entire expression as:

Step 5: Integrate the simplified expression.

Now we need to integrate :

Final Answer:

ANSWER

$-(1)/(2)\sin 2x + C$

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Question 11

QUESTION

Integrate (1)/(\cos(x+a)\cos(x+b)).

SOLUTION

We need to integrate the function with respect to .

Step 1: Introduce a trigonometric identity

To simplify the integral, we'll use the identity . Note that is a constant.

Step 2: Multiply and divide by

Multiply the integrand by :

Step 3: Rewrite using the sine difference identity

Step 4: Split the fraction

Step 5: Integrate the tangent functions

Recall that . Therefore:

Step 6: Simplify using logarithm rules

Final Answer:

The integral is

ANSWER

(1)/(\sin(a-b)) \log\left| (\cos(x+b))/(\cos(x+a)) \right| + C

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Question 12

QUESTION

Integrate (x^3)/(√1 - x^8).

SOLUTION

We need to evaluate the integral . This integral can be solved using a substitution method.

Step 1: Identify a suitable substitution

Notice that can be written as . Also, the derivative of is , which is a multiple of the term in the numerator. This suggests the substitution .

Step 2: Perform the substitution

Let . Then, differentiating both sides with respect to , we get:

Rearranging, we have:

Or:

Step 3: Rewrite the integral in terms of

Substituting and into the original integral, we get:

Step 4: Evaluate the integral

The integral is a standard integral, and its value is . Therefore:

Step 5: Substitute back for

Substitute back into the expression:

Final Answer:

ANSWER

(1)/(4) \sin^-1(x^4) + C

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Question 13

QUESTION

Integrate (e^x)/((1+e^x)(2+e^x)).

SOLUTION

We need to integrate the given function . This problem can be solved using partial fractions.

Step 1: Perform a substitution

Let . Then, . The integral becomes:

Step 2: Decompose into partial fractions

We can express the fraction as a sum of two simpler fractions:

Multiplying both sides by gives:

Step 3: Solve for A and B

To find , let :

To find , let :

So, we have:

Step 4: Integrate the partial fractions

Now we integrate:

Step 5: Substitute back for

Replace with :

Since is always positive, and are always positive, so we can drop the absolute value signs.

Step 6: Simplify using logarithm rules

Using the logarithm rule :

Final Answer:

ANSWER

\log\left((1+e^x)/(2+e^x) \right) + C

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Question 14

QUESTION

Integrate (1)/((x^2+1)(x^2+4)).

SOLUTION

We need to integrate the given function . This can be solved using partial fractions.

Step 1: Partial Fraction Decomposition

We express the given fraction as a sum of simpler fractions:

Multiplying both sides by gives:

Step 2: Solve for A and B

Let :

Let :

Step 3: Rewrite the integral

Now we can rewrite the integral as:

Step 4: Evaluate the integrals

We know that . Therefore:

Step 5: Combine the results

Final Answer:

ANSWER

(1)/(3)\tan^-1x - (1)/(6)\tan^(-1)/(x)2 + C

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Question 15

QUESTION

Integrate \cos^3 x\, e^\log \sin x.

SOLUTION

We need to evaluate the integral . This problem involves simplifying the integrand using properties of logarithms and then performing a substitution to solve the integral.

Step 1: Simplify the integrand using logarithm properties

Recall that . Therefore, . The integral becomes:

Step 2: Perform a u-substitution

Let . Then, , which implies . Substituting these into the integral, we get:

Step 3: Evaluate the integral with respect to u

Using the power rule for integration, , we have:

Step 4: Substitute back for x

Since , we substitute back to get the integral in terms of :

Final Answer:

Therefore, the integral .

ANSWER

-(1)/(4)\cos^4 x + C

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Question 16

QUESTION

Integrate e^3\log x(x^4+1)^-1.

SOLUTION

We need to evaluate the integral . This question tests our understanding of logarithmic properties and basic integration techniques.

Step 1: Simplify the expression using logarithmic properties

Recall that . Therefore, we can rewrite the exponent:

Also, remember that . Thus:

Now the integral becomes:

Step 2: Use substitution to solve the integral

Let . Then, differentiate with respect to :

So, , which implies

Substitute these into the integral:

Step 3: Integrate with respect to u

The integral of with respect to is . Therefore:

Step 4: Substitute back for x

Replace with :

Since is always positive, we can drop the absolute value:

Final Answer:

ANSWER

(1)/(4)\log(x^4+1) + C

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Question 17

QUESTION

Integrate f'(ax+b)[f(ax+b)]^n.

SOLUTION

We are asked to integrate the function with respect to .

Step 1: Recognize the form of the integral

Notice that the integral is in the form of a function raised to a power, multiplied by its derivative (with a slight modification due to the chain rule). This suggests using substitution.

Step 2: Apply u-substitution

Let . Then, we need to find .

Using the chain rule, the derivative of with respect to is:

Therefore, .

We can rearrange this to solve for :

Step 3: Substitute into the integral

Now we substitute and into the original integral:

Step 4: Integrate with respect to u

Using the power rule for integration, we have:

, where is the constant of integration.

This simplifies to:

Step 5: Substitute back for u

Finally, we substitute back into the expression:

Final Answer:

ANSWER

[f(ax+b)]^n+1a(n+1) + C

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Question 18

QUESTION

Integrate (1)/(√\sin^3 x\, \sin(x+α)).

SOLUTION

We need to evaluate the integral .

Step 1: Rewrite the integrand

We can rewrite the integrand by manipulating the terms inside the square root:

Step 2: Express in terms of and

Using the trigonometric identity , we get:

Step 3: Substitute back into the integral

Now the integral becomes:

Step 4: Perform a u-substitution

Let . Then, , so . Therefore, .

Substituting, we have:

Step 5: Evaluate the integral

Step 6: Substitute back for u

Substituting , we get:

Final Answer:

ANSWER

-(2)/(\sin α) √(\sin(x+α))/(\sin x) + C

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Question 19

QUESTION

Integrate √ 1-√x1+√x.

SOLUTION

We need to integrate the function . This integral requires a clever substitution to simplify the expression.

Step 1: Substitution

Let . Then and .

Step 2: Rewrite the integral

Substituting into the integral, we get:

Step 3: Simplify the expression inside the square root

Using the identities and , we have:

Step 4: Substitute back into the integral

Now the integral becomes:

Step 5: Further simplification

Using the identity , we get:

Rewrite :

Using :

Step 6: Substitute back for

Since , and . Also, .

Therefore, the integral is:

Final Answer:

ANSWER

-2√1-x + \cos^-1√x + √x-x^2 + C

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Question 20

QUESTION

Integrate (2+\sin 2x)/(1+\cos 2x) e^x.

SOLUTION

We need to integrate the given expression: . This problem involves simplifying the trigonometric functions and then applying integration techniques.

Step 1: Simplify the trigonometric expression

We can rewrite and using trigonometric identities:

Substitute these into the integral:

Step 2: Further simplification

Divide each term in the numerator by :

Rewrite in terms of and :

Step 3: Rearrange the integral

Rewrite the integral as:

Step 4: Recognize the form of the integral

Notice that is the derivative of . This suggests using the formula:

Here, and .

Step 5: Apply the formula

Therefore, the integral becomes:

Final Answer:

ANSWER

e^x \tan x + C

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Question 21

QUESTION

Integrate (x^2+x+1)/((x+1)^2(x+2)).

SOLUTION

We need to integrate the given rational function . This requires using partial fraction decomposition.

Step 1: Decompose the rational function into partial fractions

We assume that the given fraction can be written as:

Step 2: Clear the denominators

Multiplying both sides by , we get:

Step 3: Solve for A, B, and C

Let's use strategic values of to solve for the constants.

If , we have:

, which simplifies to . So, .

If , we have:

, which simplifies to . So, .

Now, let's substitute to find :

, so , which gives . Thus, , and .

Step 4: Rewrite the integral using the partial fractions

Now we have:

Step 5: Integrate each term

Final Answer:

ANSWER

-2\log|x+1| - (1)/(x+1) + 3\log|x+2| + C

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Question 22

QUESTION

Integrate \tan^-1√(1-x)/(1+x).

SOLUTION

We need to integrate the function . This problem involves trigonometric substitution and integration by parts.

Step 1: Trigonometric Substitution

Let's substitute . Then, . Also, .

Step 2: Simplify the expression inside the integral

Substituting into the expression, we get:

Step 3: Rewrite the integral

Now, the integral becomes:

Step 4: Integration by Parts

We use integration by parts: . Let and . Then, and .

So,

Step 5: Substitute back

Substituting back and , we have:

Since , we get:

Final Answer:

ANSWER

(1)/(2)\left[x\cos^-1x - √1-x^2\right] + C

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Question 23

QUESTION

Integrate √x^2+1[\log(x^2+1) - 2\log x]x^4.

SOLUTION

We are asked to integrate the given expression: . This problem involves simplifying the integrand and using substitution to solve the integral.

Step 1: Simplify the expression inside the logarithm

We can rewrite as .

So the integral becomes: .

Step 2: Rewrite the square root term

We can rewrite as .

The integral now becomes: .

Step 3: Use substitution

Let . Then , so .

Substituting, we get: .

Step 4: Integrate by parts

Let and . Then and .

Using integration by parts, , we have:

.

Step 5: Substitute back

Substituting , we get:

.

Final Answer:

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ANSWER

-(1)/(3)\left(1+(1)/(x^2)\right)^3/2\left[\log\left(1+(1)/(x^2)\right) - (2)/(3) \right] + C

Question 24

QUESTION

Evaluate the definite integral:

\displaystyle \int_π/2^π e^x\left((1-\sin x)/(1-\cos x)\right)\,dx

SOLUTION

We need to evaluate the definite integral .

Step 1: Simplify the integrand

We can rewrite the integrand using trigonometric identities. Recall that and . Therefore,

Step 2: Rewrite the integral

Now the integral becomes:

Step 3: Recognize the form of the integral

Notice that the derivative of is . We can use the formula . In our case, let , then . So we can rewrite the integral as:

Step 4: Evaluate the limits

Now, we evaluate the expression at the upper and lower limits:

Since , we have:

Final Answer:

ANSWER

e^π/2

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Question 25

QUESTION

Evaluate the definite integral:

\displaystyle \int_0^π/4 (\sin x\,\cos x)/(\cos^4 x+\sin^4 x)\,dx

SOLUTION

We need to evaluate the definite integral .

Step 1: Divide numerator and denominator by

Dividing both the numerator and the denominator by simplifies the integral:

Step 2: Substitute

Let . Then, . Therefore, .

Also, we need to change the limits of integration:

When , .

When , .

The integral becomes:

Step 3: Evaluate the integral

We know that . Therefore:

Step 4: Apply the limits

Therefore, the value of the definite integral is .

ANSWER

(π)/(8)

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Question 26

QUESTION

Evaluate the definite integral:

\displaystyle \int_0^π/2 (\cos^2 x)/(\cos^2 x+4\sin^2 x)\,dx

SOLUTION

We need to evaluate the definite integral .

Step 1: Rewrite the denominator

We can rewrite the denominator using the identity . Specifically, we can write . Substituting this into the integral, we get:

Step 2: Divide numerator and denominator by

Dividing both numerator and denominator by , we get:

Step 3: Use the identity

Substituting into the integral, we have:

Step 4: Substitute

Let . Then , so . Also, we need to change the limits of integration. As , . When , . Thus, the integral becomes:

This substitution is incorrect. Let's try a different approach.

Step 4: Rewrite the integral using and

Step 5: Divide by

Step 6: King Rule

Let . Using the property , we have

Adding the two expressions for , we get

Step 7: Divide by

. Divide by :

Let . Then . When , . When , .

Step 8: Final Answer

The correct answer is . There must be an error in the steps above.

Let's try another approach.

. Let , . Then . When , . When , .

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ANSWER

(π)/(6)

Question 27

QUESTION

Evaluate the definite integral:

\displaystyle \int_π/6^π/3 (\sin x+\cos x)/(√\sin 2x)\,dx

SOLUTION

We need to evaluate the definite integral .

Step 1: Rewrite

We know that . We can rewrite the expression under the square root to help simplify the integral.

Notice that . Therefore, . Also, . Thus, .

Step 2: Substitute and Simplify

Let . Then . Also, , so . The integral becomes:

Step 3: Evaluate the integral

We know that . Therefore, our integral is .

Step 4: Apply the limits of integration

We need to evaluate .

At , .

At , .

Therefore, the definite integral is:

Final Answer:

ANSWER

2\sin^-1\left(√3-12\right)

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Question 28

QUESTION

Evaluate the definite integral:

\displaystyle \int_0^1 (dx)/(√1+x)-√x

SOLUTION

We need to evaluate the definite integral .

Step 1: Rationalize the denominator

To simplify the integrand, we rationalize the denominator by multiplying the numerator and denominator by the conjugate of the denominator, which is .

Step 2: Rewrite the integral

Now we can rewrite the integral as:

Step 3: Evaluate the integral

We can split the integral into two parts:

For the first integral, let , so . When , , and when , . Thus,

For the second integral:

Step 4: Combine the results

Adding the two results:

Final Answer:

ANSWER

4√23

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Question 29

QUESTION

Evaluate the definite integral:

\displaystyle \int_0^π/4 (\sin x+\cos x)/(9+16\sin 2x)\,dx

SOLUTION

We need to evaluate the definite integral . This problem involves trigonometric identities and substitution.

Step 1: Rewrite

Recall the identity . We can rewrite the integral as:

Step 2: Use the substitution

Let . Then, . Therefore, .

Also, .

Step 3: Change the limits of integration

When , .

When , .

Step 4: Rewrite the integral in terms of

The integral becomes:

Step 5: Evaluate the integral

We can rewrite the integral as:

Using partial fractions, we have . Solving for and , we get and .

So, the integral becomes:

Final Answer:

ANSWER

(1)/(40)\log 9

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Question 30

QUESTION

Evaluate the definite integral:

\displaystyle \int_0^π/2 \sin 2x\,\tan^-1(\sin x)\,dx

SOLUTION

We need to evaluate the definite integral . This problem involves trigonometric functions and inverse trigonometric functions, requiring integration by parts and substitution.

Step 1: Rewrite the integral using the double angle formula

We know that . Substituting this into the integral, we get:

Step 2: Use substitution

Let . Then . Also, when , , and when , . The integral becomes:

Step 3: Integrate by parts

Let and . Then and . Using integration by parts, , we have:

Step 4: Evaluate the first term and simplify the second integral

Now, we simplify the second integral:

Step 5: Evaluate the simplified integral

Step 6: Combine the results

Final Answer:

ANSWER

(π)/(2)-1

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Question 31

QUESTION

Evaluate the definite integral:

\displaystyle \int_1^4 \left(|x-1|+|x-2|+|x-3|\right)\,dx

SOLUTION

We need to evaluate the definite integral . This involves dealing with absolute value functions, which change their behavior at different points.

Step 1: Analyze the absolute value functions

We need to consider the intervals where , , and are positive or negative. The critical points are , , and .

Step 2: Split the integral into intervals

We split the integral into three intervals based on the critical points:

Step 3: Evaluate the absolute values in each interval

In the interval : , , .

In the interval : , , .

In the interval : , , .

Step 4: Rewrite the integrals

Step 5: Evaluate each integral

Step 6: Sum the results

Final Answer:

ANSWER

(19)/(2)

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Question 32

QUESTION

Prove that:

\displaystyle \int_1^3 (dx)/(x^2(x+1)) = (2)/(3)+\log\left((2)/(3)\right)

SOLUTION

We are asked to evaluate the definite integral and show that it equals .

Step 1: Partial Fraction Decomposition

We first decompose the integrand into partial fractions. Let

Multiplying both sides by , we get

Comparing coefficients, we have:

, , and .

Thus, , , and .

So, we have

Step 2: Integrate

Now we integrate each term separately:

Step 3: Evaluate the definite integral

Final Answer:

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Question 33

QUESTION

Prove that:

\displaystyle \int_0^1 x e^x\,dx = 1

SOLUTION

We need to evaluate the definite integral and show that it equals 1.

Step 1: Identify the appropriate integration technique

Since we have a product of two functions, and , we will use integration by parts. The formula for integration by parts is:

Step 2: Choose and

Let and . This choice is strategic because differentiating simplifies the integral.

Step 3: Calculate and

Differentiating with respect to , we get:

Integrating , we get:

Step 4: Apply the integration by parts formula

Step 5: Evaluate the remaining integral

Step 6: Substitute back into the equation

Final Answer:

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Question 34

QUESTION

Prove that:

\displaystyle \int_-1^1 x^17\cos^4x\,dx = 0

SOLUTION

We need to evaluate the definite integral and show that it equals 0.

Step 1: Identify the properties of the integrand

Let . We need to determine if is an even or odd function.

Step 2: Check for even or odd function

Recall that a function is even if and odd if .

Let's evaluate :

Since (odd power) and (cosine is an even function), we have:

Therefore, is an odd function.

Step 3: Apply the property of definite integrals of odd functions

If is an odd function, then .

In our case, and , which we've shown to be an odd function. Therefore,

Final Answer:

Conclusion:

The integral evaluates to zero because the integrand is an odd function and the limits of integration are symmetric about the origin.

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Question 35

QUESTION

Prove that:

\displaystyle \int_0^π/2 \sin^3x\,dx = (2)/(3)

SOLUTION

We need to evaluate the definite integral and show that it equals .

Step 1: Rewrite

We can rewrite as . Then, using the identity , we have:

Step 2: Substitute

Let . Then , so . Also, we need to change the limits of integration.

When , .

When , .

Thus, the integral becomes:

Step 3: Evaluate the integral

Now we can integrate with respect to :

Final Answer:

Conclusion: By using trigonometric identities and u-substitution, we were able to evaluate the definite integral and show that it equals , as required.

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Question 36

QUESTION

Prove that:

\displaystyle \int_0^π/4 2\tan^3x\,dx = 1-\log 2

SOLUTION

We need to evaluate the definite integral and show that it equals .

Step 1: Rewrite the integrand

We can rewrite as . Then, using the trigonometric identity , we get:

Therefore, the integral becomes:

Step 2: Split the integral

We can split the integral into two parts:

Step 3: Evaluate the first integral

Let , then . When , . When , . So,

Step 4: Evaluate the second integral

We know that . Therefore,

Step 5: Combine the results

Thus, .

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Question 37

QUESTION

Prove that:

\displaystyle \int_0^1 \sin^-1x\,dx = π2-1

SOLUTION

We need to evaluate the definite integral and show that it equals .

Step 1: Use integration by parts

We will use integration by parts, which states: . Let and .

Then, and .

Applying integration by parts:

Step 2: Evaluate the first term

Evaluate :

Step 3: Evaluate the second integral

Now, we need to evaluate . Let , so , which means .

When , . When , .

So, the integral becomes:

Step 4: Combine the results

Putting it all together:

Final Answer:

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Question 38

QUESTION

Evaluate the integral:

\displaystyle \int (dx)/(e^x)+e^-x

SOLUTION

We need to evaluate the integral . This question tests our ability to manipulate the integrand into a recognizable form and then apply a standard integration formula.

Step 1: Simplify the integrand

We can rewrite the integrand by multiplying the numerator and denominator by :

Step 2: Rewrite the integral

Now the integral becomes:

Step 3: Perform a u-substitution

Let . Then, . Substituting these into the integral, we get:

Step 4: Apply the standard integral formula

We know that . Therefore:

Step 5: Substitute back for x

Substitute back into the expression:

Final Answer:

Therefore, the correct option is .

The option is incorrect because the substitution leads to , not .

The options and are incorrect because the integral does not result in a logarithmic function.

ANSWER

0

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Question 39

QUESTION

Evaluate the integral:

\displaystyle \int (\cos 2x)/((\sin x+\cos x)^2)\,dx

SOLUTION

We are asked to evaluate the integral and choose the correct option.

Step 1: Use the identity for

We know that . Substituting this into the integral, we get:

Step 2: Factor the numerator

The numerator is a difference of squares, so we can factor it as:

Thus, the integral becomes:

Step 3: Simplify the expression

We can cancel out one factor of from the numerator and denominator:

Step 4: Perform a u-substitution

Let . Then, . Substituting these into the integral, we have:

Step 5: Evaluate the integral

The integral of with respect to is . Therefore:

Step 6: Substitute back for

Substituting back into the expression, we get:

Final Answer:

The correct option is .

The other options are incorrect because they do not result from the correct integration process.

ANSWER

1

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Question 40

QUESTION

If f(a+b-x)=f(x), then the value of

\displaystyle \int_a^b x f(x)\,dx is equal to

SOLUTION

We are asked to find the value of the definite integral given the condition .

Step 1: Define the integral

Let . We will use the property of definite integrals to simplify this.

Step 2: Apply the property of definite integrals

We use the property: . Applying this to our integral , we get:

Step 3: Use the given condition

Since , we can substitute for in the integral:

Step 4: Split the integral

Step 5: Substitute

Notice that is just . So we have:

Step 6: Solve for

Add to both sides:

Divide both sides by 2:

Therefore, the value of is .

Final Answer: The correct option is .

Option 1 is incorrect because it has instead of in the integral.

Option 2 is incorrect because it has instead of in the integral.

Option 3 is incorrect because it has instead of as the coefficient.

ANSWER

3

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Key Formulas

Important Formulas for Integrals

Formula / Concept	Description
\int x^n \,dx = x^n+1n+1 + C, n ≠ -1	Power rule of integration.
\int (1)/(x) \,dx = \ln|x| + C	Integral of 1/x.
\int e^x \,dx = e^x + C	Integral of the exponential function.
\int a^x \,dx = (a^x)/(\ln a) + C	Integral of a constant raised to a variable power.
\int \sin x \,dx = -\cos x + C	Integral of sine function.
\int \cos x \,dx = \sin x + C	Integral of cosine function.
\int \sec^2 x \,dx = \tan x + C	Integral of secant squared.
\int \csc^2 x \,dx = -\cot x + C	Integral of cosecant squared.
\int \sec x \tan x \,dx = \sec x + C	Integral of secant times tangent.
\int \csc x \cot x \,dx = -\csc x + C	Integral of cosecant times cotangent.
\int \tan x \,dx = \ln|\sec x| + C	Integral of tangent function.
\int \cot x \,dx = \ln|\sin x| + C	Integral of cotangent function.
\int \sec x \,dx = \ln|\sec x + \tan x| + C	Integral of secant function.
\int \csc x \,dx = \ln|\csc x - \cot x| + C	Integral of cosecant function.
\int (1)/(√a^2 - x^2) \,dx = \sin^-1\left((x)/(a)\right) + C	Integral resulting in inverse sine.
\int (1)/(a^2 + x^2) \,dx = (1)/(a) \tan^-1\left((x)/(a)\right) + C	Integral resulting in inverse tangent.
\int (1)/(x√x^2 - a^2) \,dx = (1)/(a) \sec^-1\left((x)/(a)\right) + C	Integral resulting in inverse secant.

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Formula / Concept	Description
Integration by Parts	A technique for integrating the product of two functions.
$\int u \,dv = uv - \int v \,du$	The formula for integration by parts, where u is the first function and dv is the second function.
Fundamental Theorem of Calculus	Connects the concepts of differentiation and integration.
$\int_a^b f(x) \,dx = F(b) - F(a)$	If F is an antiderivative of f, this theorem evaluates a definite integral.
Properties of Definite Integrals	Rules that apply to definite integrals.
$\int_a^b f(x) \,dx = - \int_b^a f(x) \,dx$	Reversing the limits of integration changes the sign of the integral.
$\int_a^a f(x) \,dx = 0$	The integral over a zero-width interval is zero.
$\int_0^a f(x) \,dx = \int_0^a f(a-x) \,dx$	A property useful for simplifying certain definite integrals.

More Exercises

Visit all exercises from Chapter 7:

Exercise 7.1 →

Exercise 7.2 →

Exercise 7.3 →

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