NCERT Solutions Class 12 Maths
Chapter 7: Integrals
Exercise 7.1

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 7 Exercise 7.1, students learn integration as the inverse process of differentiation through the method of inspection. This exercise covers fundamental antiderivative techniques for trigonometric, exponential, and polynomial functions which are essential for CBSE board exams and competitive entrance tests.

Key Takeaways:

- Integration by inspection: If (d)/(dx)[F(x)] = f(x), then \int f(x)dx = F(x) + C
- Antiderivatives of basic functions: \int \sin(ax)dx = -(1)/(a)\cos(ax) + C and \int e^axdx = (1)/(a)e^ax + C
- Method of inspection helps identify integrals by recognizing the derivative pattern of known functions
- These foundational integration techniques are crucial for solving complex calculus problems in higher exercises

Complete Solutions

Question 1

QUESTION

Find an anti derivative (or integral) of \sin 2x by the method of inspection.

SOLUTION

We need to find an antiderivative of using the method of inspection. This means we need to think about what function, when differentiated, gives us .

Step 1: Recall basic derivatives

We know that the derivative of is . Also, the derivative of is , where is a constant. This is due to the chain rule.

Step 2: Consider

Let's consider . Its derivative is:

Step 3: Adjust for the constant factor

We want to find a function whose derivative is , but the derivative of is . To get , we need to divide by :

Step 4: State the antiderivative

Therefore, an antiderivative of is .

Final Answer:

Conclusion: The method of inspection involves recognizing the derivative of a known function and adjusting it to match the given function. In this case, we recognized that the derivative of is related to and adjusted the constant factor to obtain the desired antiderivative.

ANSWER

-(1)/(2)\cos 2x

Question 2

QUESTION

Find an anti derivative (or integral) of \cos 3x by the method of inspection.

SOLUTION

We need to find an antiderivative (or integral) of using the method of inspection. This means we need to think about what function, when differentiated, gives us .

Step 1: Recall basic differentiation rules

We know that the derivative of is . Therefore, we can expect that the antiderivative of will involve . However, we need to account for the chain rule.

Step 2: Consider the derivative of

Let's find the derivative of with respect to :

Notice that we obtained instead of just . This is due to the chain rule.

Step 3: Adjust for the constant factor

We want to find a function whose derivative is , but we have . To correct for this, we can divide by 3:

Consider the function . Let's differentiate it:

This is exactly what we wanted!

Step 4: State the antiderivative

Therefore, an antiderivative (or integral) of is .

Final Answer:

ANSWER

(1)/(3)\sin 3x

Question 3

QUESTION

Find an anti derivative (or integral) of e^2x by the method of inspection.

SOLUTION

We are asked to find an antiderivative (or integral) of the function using the method of inspection. This means we need to find a function whose derivative is .

Step 1: Recall basic differentiation rules

We know that the derivative of is . However, we have , so we need to consider the chain rule.

Step 2: Consider a candidate antiderivative

Let's consider as a potential antiderivative. If we differentiate it, we get:

This is close to what we want, but we have an extra factor of 2.

Step 3: Adjust the candidate

To get rid of the factor of 2, we can divide our candidate by 2. Let's try as our antiderivative. Differentiating this, we get:

This is exactly what we wanted!

Step 4: State the antiderivative

Therefore, an antiderivative of is .

Final Answer:

Conclusion: The method of inspection involves educated guessing and checking by differentiation. We started with a function similar to the integrand and adjusted it until its derivative matched the integrand.

ANSWER

(1)/(2)e^2x

Question 4

QUESTION

Find an anti derivative (or integral) of (ax + b)^2 by the method of inspection.

SOLUTION

We need to find an antiderivative (or integral) of the function using the method of inspection.

Step 1: Expand the expression

First, let's expand the given expression:

Step 2: Consider a potential antiderivative

We want to find a function whose derivative is . We know that the power rule for differentiation states that . Therefore, to reverse this process, we need to increase the power by 1 and divide by the new power.

Let's consider a function of the form . If we differentiate this, we get:

Step 3: Adjust the constant factor

We see that the derivative of is , which is times what we want. Therefore, we should divide by to get the correct antiderivative.

Let's consider the function . Differentiating this, we get:

Step 4: State the antiderivative

Thus, an antiderivative of is .

Final Answer:

ANSWER

(1)/(3a)(ax + b)^3

Question 5

QUESTION

Find an anti derivative (or integral) of \sin 2x - 4e^3x by the method of inspection.

SOLUTION

We need to find the antiderivative (or integral) of the function using the method of inspection. This means we need to guess a function whose derivative is equal to the given function.

Step 1: Find the antiderivative of

We know that the derivative of is . Therefore, the derivative of will involve . Let's find the derivative of using the chain rule:

We want to find a function whose derivative is , not . So, we divide both sides by -2:

Thus, the antiderivative of is .

Step 2: Find the antiderivative of

We know that the derivative of is . Therefore, the derivative of will involve . Let's find the derivative of using the chain rule:

We want to find a function whose derivative is . So, we multiply both sides by :

Thus, the antiderivative of is .

Step 3: Combine the antiderivatives

The antiderivative of is the sum of the antiderivatives we found in steps 1 and 2:

Final Answer:

ANSWER

-(1)/(2)\cos 2x - (4)/(3)e^3x

Question 6

QUESTION

Evaluate the integral \int (4e^3x + 1)\,dx.

SOLUTION

We are asked to evaluate the indefinite integral of the function with respect to .

Step 1: Apply the Sum Rule for Integrals

The integral of a sum is the sum of the integrals. Therefore, we can split the integral as follows:

Step 2: Apply the Constant Multiple Rule

We can pull the constant 4 out of the first integral:

Step 3: Evaluate the first integral

To evaluate , we use a simple substitution. Let , then , so . Therefore:

Step 4: Evaluate the second integral

The integral of 1 with respect to is simply :

Step 5: Combine the results

Now, substitute the results back into the original expression:

Where is the constant of integration.

Step 6: Simplify

Final Answer:

ANSWER

(4)/(3)e^3x + x + C

Question 7

QUESTION

Evaluate the integral \int x^2\left(1 - (1)/(x^2)\right)dx.

SOLUTION

We are asked to evaluate the integral . This problem tests our understanding of basic integration rules and algebraic simplification.

Step 1: Simplify the integrand

First, we simplify the expression inside the integral by distributing :

Step 2: Rewrite the integral

Now we can rewrite the integral as:

Step 3: Apply the power rule and constant rule for integration

We can split the integral into two separate integrals:

Now, we apply the power rule for integration, which states that for . We also use the rule that .

So, we have:

and

Step 4: Combine the results

Combining these results, we get:

where is the constant of integration.

Final Answer:

ANSWER

(x^3)/(3) - x + C

Question 8

QUESTION

Evaluate the integral $\int (ax^2 + bx + c)\,dx$.

SOLUTION

We are asked to evaluate the indefinite integral of the quadratic expression with respect to .

Step 1: Apply the Sum/Difference Rule

The integral of a sum (or difference) is the sum (or difference) of the integrals. Therefore, we can split the integral into three separate integrals:

Step 2: Apply the Constant Multiple Rule

We can pull out the constants , , and from their respective integrals:

Step 3: Apply the Power Rule for Integration

The power rule states that , where . Applying this rule to each integral:

Step 4: Combine the Results and Add the Constant of Integration

Combining the results from Step 3, we get:

Since this is an indefinite integral, we must add the constant of integration, :

Final Answer:

ANSWER

$(ax^3)/(3) + (bx^2)/(2) + cx + C$

Question 9

QUESTION

Evaluate the integral $\int (2x^2 + e^x)\,dx$.

SOLUTION

We are asked to evaluate the indefinite integral of the function . This involves applying the power rule for integration and knowing the integral of the exponential function.

Step 1: Separate the integral

We can split the integral into two separate integrals using the linearity property of integrals:

Step 2: Integrate the first term

For the first term, , we use the power rule for integration, which states that , where is the constant of integration. We also pull out the constant 2:

Step 3: Integrate the second term

For the second term, , we know that the integral of is simply itself:

Step 4: Combine the results

Now, we combine the results from Step 2 and Step 3:

Since and are both arbitrary constants, we can combine them into a single constant .

Final Answer:

ANSWER

$(2)/(3)x^3 + e^x + C$

Question 10

QUESTION

Evaluate the integral \int \left(√x - (1)/(√x)\right)^2 dx.

SOLUTION

We need to evaluate the integral . This requires us to first expand the square and then integrate term by term.

Step 1: Expand the square

We use the formula . Here, and . Therefore:

Simplifying this, we get:

Step 2: Rewrite the integral

Now we can rewrite the integral as:

Step 3: Integrate term by term

We can split the integral into three separate integrals:

Now, we integrate each term:

Step 4: Combine the results

Combining the results and the constants of integration, we get:

where .

Final Answer:

Therefore, the integral evaluates to:

ANSWER

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

Question 11

QUESTION

Evaluate the integral \int (x^3 + 5x^2 - 4)/(x^2) dx.

SOLUTION

We need to evaluate the integral . This involves simplifying the integrand and then applying basic integration rules.

Step 1: Simplify the integrand

We can split the fraction into separate terms:

Simplifying each term:

So, the integrand becomes:

Step 2: Rewrite the integral

Now we can rewrite the integral as:

Step 3: Apply the power rule of integration

We integrate each term separately:

Step 4: Combine the results and add the constant of integration

Adding the results of each integration:

Final Answer:

ANSWER

(x^2)/(2) + 5x + (4)/(x) + C

Question 12

QUESTION

Evaluate the integral \int (x^3 + 3x + 4)/(√x) dx.

SOLUTION

We need to evaluate the integral . This involves simplifying the integrand and then applying the power rule for integration.

Step 1: Rewrite the integrand

We can rewrite the integrand by dividing each term in the numerator by which is :

Step 2: Simplify the exponents

Using the rule , we simplify each term:

So, the integrand becomes:

Step 3: Integrate each term

Using the power rule for integration, , we integrate each term:

Step 4: Combine the results and add the constant of integration

Adding the results of the integration and the constant of integration , we get:

Final Answer:

ANSWER

(2)/(7)x^7/2 + 2x^3/2 + 8√x + C

Question 13

QUESTION

Evaluate the integral \int (x^3 - x^2 + x - 1)/(x - 1) dx.

SOLUTION

We are asked to evaluate the integral of a rational function. The key here is to simplify the integrand before integrating.

Step 1: Simplify the integrand using polynomial division or factorization

Notice that the numerator can be factored by grouping:

Therefore, the integrand becomes:

Since , we can cancel the terms:

Step 2: Integrate the simplified expression

Now we need to evaluate the integral:

We can split this into two separate integrals:

Step 3: Apply the power rule for integration

The power rule states that , where is the constant of integration.

Applying the power rule to the first term:

And for the second term:

Step 4: Combine the results and add the constant of integration

Combining the two results, we get:

Final Answer:

ANSWER

(x^3)/(3) + x + C

Question 14

QUESTION

Evaluate the integral \int (1 - x)√x\,dx.

SOLUTION

We need to evaluate the integral . This involves simplifying the integrand and then applying the power rule for integration.

Step 1: Simplify the integrand

First, distribute the term across the parentheses:

Rewrite the terms using fractional exponents:

and

So, the integrand becomes:

Step 2: Rewrite the integral

Now, we can rewrite the integral as:

Step 3: Apply the power rule for integration

The power rule states that , where .

Applying this rule to each term in the integral:

Step 4: Combine the results

Therefore, the integral becomes:

, where .

Final Answer:

ANSWER

(2)/(3)x^3/2 - (2)/(5)x^5/2 + C

Question 15

QUESTION

Evaluate the integral \int √x(3x^2 + 2x + 3)\,dx.

SOLUTION

We need to evaluate the integral . This involves simplifying the expression inside the integral and then applying the power rule for integration.

Step 1: Simplify the expression inside the integral

First, rewrite as . Then, distribute across the terms inside the parentheses:

Using the rule , we get:

Step 2: Apply the power rule for integration

The power rule for integration states that , where is the constant of integration.

Applying this rule to each term:

Step 3: Simplify the result

Final Answer:

ANSWER

(6)/(7)x^7/2 + (4)/(5)x^5/2 + 2x^3/2 + C

Question 16

QUESTION

Evaluate the integral \int (2x - 3\cos x + e^x)\,dx.

SOLUTION

We need to evaluate the indefinite integral . This involves applying the basic rules of integration to each term in the integrand.

Step 1: Apply the Sum/Difference Rule

The integral of a sum or difference is the sum or difference of the integrals. Therefore, we can split the integral as follows:

Step 2: Integrate each term separately

Let's integrate each term individually:

(i) : Using the power rule for integration, , we have:

(ii) : The integral of is . Thus:

(iii) : The integral of is . Thus:

Step 3: Combine the results

Now, we combine the results from each integral:

Here, is the constant of integration.

Final Answer:

ANSWER

x^2 - 3\sin x + e^x + C

Question 17

QUESTION

Evaluate the integral \int (2x^2 - 3\sin x + 5√x)\,dx.

SOLUTION

We need to evaluate the integral . This involves applying the power rule and standard integrals of trigonometric functions.

Step 1: Split the integral into separate terms

We can rewrite the integral as the sum of individual integrals:

Step 2: Apply the power rule and constant multiple rule

We can take the constants out of the integrals:

Now, we apply the power rule and the integral of , which is :

Step 3: Simplify the expression

Simplify the exponents and fractions:

Step 4: Final simplification

Multiply the constants:

Final Answer:

ANSWER

(2)/(3)x^3 + 3\cos x + (10)/(3)x^3/2 + C

Question 18

QUESTION

Evaluate the integral \int \sec x(\sec x + \tan x)\,dx.

SOLUTION

We need to evaluate the integral . This involves trigonometric identities and standard integrals.

Step 1: Expand the integrand

First, distribute the term across the parentheses:

Step 2: Split the integral

Now, split the integral into two separate integrals:

Step 3: Evaluate the first integral

We know that the derivative of is . Therefore, the integral of is :

Step 4: Evaluate the second integral

We also know that the derivative of is . Therefore, the integral of is :

Step 5: Combine the results

Now, combine the results from the two integrals:

Let , where is the constant of integration.

Final Answer:

Therefore, the integral is:

ANSWER

\tan x + \sec x + C

Question 19

QUESTION

Evaluate the integral \int (\sec^2 x)/(\cosec^2 x)\,dx.

SOLUTION

We need to evaluate the integral . This question tests our knowledge of trigonometric identities and integration techniques.

Step 1: Rewrite the integrand using basic trigonometric identities

Recall that and . Therefore,

and .

Substituting these into the integral, we get:

Step 2: Simplify the integrand

Dividing by a fraction is the same as multiplying by its reciprocal. Thus,

We know that , so .

Therefore, the integral becomes:

Step 3: Use another trigonometric identity to rewrite the integrand

Recall the identity: , which implies .

Substituting this into the integral, we have:

Step 4: Integrate

We can split the integral into two separate integrals:

The integral of is , and the integral of 1 is . Therefore,

where is the constant of integration.

Final Answer:

ANSWER

\tan x - x + C

Question 20

QUESTION

Evaluate the integral \int (2 - 3\sin x)/(\cos^2 x)\,dx.

SOLUTION

We need to evaluate the integral . This problem involves splitting the integral and using trigonometric identities to simplify.

Step 1: Split the integral

We can rewrite the integral as the difference of two integrals:

Step 2: Simplify using trigonometric identities

Recall that and . Thus, and .

So, we have:

Step 3: Evaluate the integrals

We know that the integral of is and the integral of is . Therefore:

where is the constant of integration.

Final Answer:

ANSWER

2\tan x - 3\sec x + C

Question 21

QUESTION

The anti derivative of \left(√x + (1)/(√x)\right) equals

SOLUTION

We are asked to find the antiderivative (indefinite integral) of the function .

Step 1: Rewrite the expression using exponents

First, rewrite the given expression using fractional exponents:

and

So, the expression becomes .

Step 2: Apply the power rule for integration

The power rule for integration states that , where and is the constant of integration.

Applying this rule to each term:

Step 3: Combine the results

Adding the two integrals together, we get:

, where .

Final Answer: The antiderivative is .

Explanation of Incorrect Options:

Option 1 is incorrect because the exponents and coefficients do not match the result of the integration.

Option 2 is incorrect because the exponents are wrong; it has instead of .

Option 4 is incorrect because the coefficients are wrong; it has and instead of and .

ANSWER

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Question 22

QUESTION

If (d)/(dx)f(x) = 4x^3 - (3)/(x^4) such that f(2) = 0, then f(x) is

SOLUTION

We are given the derivative of a function and a specific value . We need to find the function by integrating the given derivative and using the given condition to find the constant of integration.

Step 1: Integrate the given derivative

We have . To find , we need to integrate this expression with respect to :

Using the power rule for integration, , we get:

Step 2: Use the given condition to find the constant of integration

We are given that . Substitute into the expression for :

Step 3: Write the final expression for

Substitute the value of back into the expression for :

Final Answer:

The correct option is .

ANSWER

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Key Formulas

Important Formulas for Exercise 7.1

Formula / Concept	Description
$\int f(x) \,dx = F(x) + C \Leftrightarrow (d)/(dx)[F(x)] = f(x)$	This defines the indefinite integral. Integration is the inverse process of differentiation. The function F(x) is called an anti-derivative or primitive of f(x). C is the constant of integration.
Power Rule $\int x^n \,dx = x^n+1n+1 + C, \quad (n \neq -1)$	The general formula for the integral of a power of x.
$\int \,dx = x + C$	A special case of the power rule where n=0.
$\int (1)/(x) \,dx = \ln\lvert x\rvert + C$	The integral of (1)/(x) is the natural logarithm of the absolute value of x.
Exponential Functions $\int e^x \,dx = e^x + C$ $\int a^x \,dx = (a^x)/(\ln a) + C$	Formulas for integrating natural and general exponential functions.
Trigonometric Functions $\int \sin x \,dx = -\cos x + C$ $\int \cos x \,dx = \sin x + C$	Basic integrals for sine and cosine functions.
$\int \sec^2 x \,dx = \tan x + C$ $\int \csc^2 x \,dx = -\cot x + C$	Integrals derived from the derivatives of tan(x) and cot(x).
$\int \sec x \tan x \,dx = \sec x + C$ $\int \csc x \cot x \,dx = -\csc x + C$	Integrals derived from the derivatives of sec(x) and csc(x).
Properties of Integrals $\int k \cdot f(x) \,dx = k \int f(x) \,dx$	The integral of a function multiplied by a constant is the constant multiplied by the integral of the function.
$\int [f(x) \pm g(x)] \,dx = \int f(x) \,dx \pm \int g(x) \,dx$	The integral of a sum or difference of two functions is the sum or difference of their individual integrals.

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