NCERT Solutions Class 12 Maths
Chapter 7: Integrals
Exercise 7.8

Document Information:
Class: 12 | **Subject:** Mathematics | **Chapter:** 7 | **Exercise:** 7.8
Total Questions: 22 | **Academic Year:** 2025-26
Source: www.ncertbooks.net | **Generated:** February 21, 2026

Quick Summary: In NCERT Solutions Class 12 Maths Chapter 7 Exercise 7.8, students learn to evaluate definite integrals using the Fundamental Theorem of Calculus and integration techniques. This exercise covers definite integration problems with various functions including algebraic, trigonometric, and rational expressions which are essential for CBSE board exams and competitive entrance tests.

Key Takeaways:

- Master the Fundamental Theorem of Calculus: \int_a^b f(x)dx = F(b) - F(a) where F'(x) = f(x)
- Apply integration by parts formula \int u \, dv = uv - \int v \, du for products of functions
- Evaluate definite integrals of trigonometric functions using standard formulas and substitution methods
- Solve rational function integrals using partial fractions and direct integration techniques for exam success

Complete Solutions

Question 1

QUESTION

Evaluate \int_-1^1 (x+1)\,dx.

SOLUTION

We are asked to evaluate the definite integral . This involves finding the antiderivative of the integrand and then evaluating it at the limits of integration.

Step 1: Find the antiderivative of

We need to find a function whose derivative is . We can use the power rule for integration, which states that , where is the constant of integration.

So, .

Therefore, the antiderivative of is . We can ignore the constant when evaluating definite integrals.

Step 2: Evaluate the antiderivative at the upper and lower limits of integration

We need to evaluate . This means we plug in the upper limit (1) and subtract the result of plugging in the lower limit (-1).

At :

At :

Step 3: Subtract the value at the lower limit from the value at the upper limit

Final Answer: The value of the definite integral is 2.

ANSWER

2

Question 2

QUESTION

Evaluate \int_2^3 (1)/(x)\,dx.

SOLUTION

We are asked to evaluate the definite integral of from 2 to 3. This tests our knowledge of basic integration and the application of the fundamental theorem of calculus.

Step 1: Find the indefinite integral

We know that the integral of is , where is the constant of integration. Since we are dealing with a definite integral, we can ignore the constant because it will cancel out during the evaluation.

Step 2: Apply the Fundamental Theorem of Calculus

The Fundamental Theorem of Calculus states that if is an antiderivative of , then . In our case, , , , and .

Therefore, we need to evaluate .

Step 3: Evaluate the definite integral

Since both 2 and 3 are positive, we can drop the absolute value signs:

Step 4: Simplify using logarithm properties

Using the logarithm property , we can simplify the expression:

Final Answer:

ANSWER

\log(3)/(2)

Question 3

QUESTION

Evaluate \int_1^2 (4x^3-5x^2+6x+9)\,dx.

SOLUTION

We need to evaluate the definite integral . This involves finding the antiderivative of the polynomial and then evaluating it at the limits of integration.

Step 1: Find the antiderivative

We find the antiderivative of each term in the polynomial:

Therefore, the antiderivative of is . We can ignore the constant when evaluating definite integrals.

Step 2: Evaluate the antiderivative at the upper limit

We substitute into the antiderivative:

Step 3: Evaluate the antiderivative at the lower limit

We substitute into the antiderivative:

Step 4: Subtract the value at the lower limit from the value at the upper limit

Final Answer:

ANSWER

(64)/(3)

Question 4

QUESTION

Evaluate \int_0^π/4 \sin 2x\,dx.

SOLUTION

We need to evaluate the definite integral . This involves finding the antiderivative of and then evaluating it at the limits of integration.

Step 1: Find the antiderivative of

We know that the derivative of is . Since we have , we need to use the chain rule in reverse. The antiderivative of will be of the form . We can verify this by differentiating:

So, the antiderivative of is .

Step 2: Evaluate the antiderivative at the upper and lower limits

We need to evaluate at and . This gives us:

At :

At :

Step 3: Calculate the definite integral

The definite integral is the difference between the antiderivative evaluated at the upper limit and the antiderivative evaluated at the lower limit:

Therefore, the value of the definite integral is .

ANSWER

(1)/(2)

Question 5

QUESTION

Evaluate \int_0^π/2 \cos 2x\,dx.

SOLUTION

We need to evaluate the definite integral .

Step 1: Find the indefinite integral of

We know that the integral of is , where is the constant of integration. In our case, .

Therefore, .

Step 2: Evaluate the definite integral using the limits of integration

We need to evaluate . This means we need to find the value of the antiderivative at the upper limit () and subtract the value of the antiderivative at the lower limit (0).

So, we have:

Step 3: Simplify using known trigonometric values

We know that and .

Therefore, .

Final Answer:

Conclusion: The definite integral of from 0 to is 0. This is because the areas above and below the x-axis cancel each other out over this interval.

ANSWER

0

Question 6

QUESTION

Evaluate \int_4^5 e^x\,dx.

SOLUTION

We are asked to evaluate the definite integral of the exponential function from 4 to 5.

Step 1: Find the antiderivative

The antiderivative of is simply . This is because the derivative of is .

Step 2: Apply the Fundamental Theorem of Calculus

The Fundamental Theorem of Calculus states that to evaluate a definite integral, we need to find the antiderivative of the function and evaluate it at the upper and lower limits of integration. Then, we subtract the value of the antiderivative at the lower limit from the value at the upper limit.

In this case, we have:

Step 3: Evaluate the antiderivative at the limits

We evaluate at and :

and

Step 4: Subtract the values

Now, we subtract the value at the lower limit from the value at the upper limit:

Step 5: Simplify the expression

We can factor out from the expression:

Final Answer:

The value of the definite integral is .

Therefore,

ANSWER

e^4(e-1)

Question 7

QUESTION

Evaluate \int_0^π/4 \tan x\,dx.

SOLUTION

We need to evaluate the definite integral of from 0 to . This involves knowing the integral of and applying the limits of integration.

Step 1: Find the indefinite integral of

Recall that . We can use substitution to find the integral:

Let . Then, , so .

Thus, .

The integral of is , so we have .

Alternatively, we can write this as , since .

Step 2: Evaluate the definite integral

Now we need to evaluate the definite integral . We will use the antiderivative .

We know that and .

So, we have:

Since , we get:

Final Answer:

ANSWER

(1)/(2)\log 2

Question 8

QUESTION

Evaluate \int_π/6^π/4 \cosec x\,dx.

SOLUTION

We need to evaluate the definite integral of from to . This requires knowing the integral of .

Step 1: Recall the integral of

The integral of is given by:

Alternatively, it can also be written as:

We will use the first form for this problem.

Step 2: Apply the limits of integration

We need to evaluate:

Step 3: Evaluate at the upper limit

At :

So,

Since , we can drop the absolute value.

Step 4: Evaluate at the lower limit

At :

So,

Since , we can drop the absolute value.

Step 5: Calculate the definite integral

Using the property :

Final Answer:

ANSWER

\log\left(√2-12-√3\right)

Question 9

QUESTION

Evaluate \int_0^1 (dx)/(√1-x^2).

SOLUTION

We need to evaluate the definite integral . This integral involves a standard inverse trigonometric function.

Step 1: Recognize the standard integral form

The integrand is the derivative of . Therefore, we know that:

Step 2: Apply the limits of integration

Now we need to evaluate the definite integral from 0 to 1:

Step 3: Evaluate the antiderivative at the upper and lower limits

We substitute the upper limit (1) and the lower limit (0) into the antiderivative:

Step 4: Determine the values of the inverse sine function

We know that because . Also, because .

Therefore:

Final Answer:

The value of the definite integral is .

ANSWER

(π)/(2)

Question 10

QUESTION

Evaluate \int_0^1 (dx)/(1+x^2).

SOLUTION

We are asked to evaluate the definite integral . This involves finding the antiderivative of and then evaluating it at the limits of integration.

Step 1: Recall the antiderivative

We know that the derivative of (also written as) is . Therefore, the antiderivative of is . So, we have:

Step 2: Evaluate the definite integral

Now we need to evaluate the definite integral from 0 to 1:

Step 3: Apply the limits of integration

We substitute the upper limit (1) and the lower limit (0) into the antiderivative and subtract:

Step 4: Evaluate the arctangent function

We know that is the angle whose tangent is 1. This angle is (or 45 degrees).

We also know that is the angle whose tangent is 0. This angle is .

Therefore:

Final Answer:

The value of the definite integral is .

ANSWER

(π)/(4)

Question 11

QUESTION

Evaluate \int_2^3 (dx)/(x^2-1).

SOLUTION

We need to evaluate the definite integral . This involves using partial fractions to simplify the integrand before integrating.

Step 1: Decompose the integrand using partial fractions

We can write as . Using partial fractions, we want to find constants and such that:

Multiplying both sides by gives:

Step 2: Solve for A and B

Let :

Let :

Thus,

Step 3: Integrate

Step 4: Evaluate the definite integral

Final Answer:

ANSWER

(1)/(2)\log(3)/(2)

Question 12

QUESTION

Evaluate \int_0^π/2 \cos^2 x\,dx.

SOLUTION

We need to evaluate the definite integral . This requires using trigonometric identities to simplify the integrand before integrating.

Step 1: Use the trigonometric identity to rewrite

We know that . Therefore, we can express as:

Step 2: Substitute the rewritten expression into the integral

Now we substitute this into our integral:

Step 3: Split the integral into two parts

We can split the integral into two simpler integrals:

Step 4: Evaluate the first integral

Step 5: Evaluate the second integral

Step 6: Combine the results

Now we add the results from the two integrals:

Final Answer:

Therefore,

ANSWER

(π)/(4)

Question 13

QUESTION

Evaluate \int_2^3 (x\,dx)/(x^2+1).

SOLUTION

We need to evaluate the definite integral . This involves using substitution to simplify the integral.

Step 1: Substitution

Let . Then, differentiating with respect to , we get , which implies . Therefore, .

Step 2: Change the limits of integration

When , .

When , .

So, the new limits of integration are from 5 to 10.

Step 3: Rewrite the integral in terms of

The integral becomes:

Step 4: Evaluate the integral

The integral of is . Therefore,

Step 5: Simplify using logarithm properties

Using the property , we have:

Final Answer:

The value of the integral is .

ANSWER

(1)/(2)\log 2

Question 14

QUESTION

Evaluate \int_0^1 (2x+3)/(5x^2+1)\,dx.

SOLUTION

We need to evaluate the definite integral .

Step 1: Split the integral

We can split the integral into two parts:

Step 2: Evaluate the first integral

Let . We can use substitution. Let , then , so . When , , and when , . Therefore,

Step 3: Evaluate the second integral

Let . We can rewrite this as:

Now, we use the formula . Here, and we have instead of , so we need to divide by after integration.

Step 4: Combine the results

The original integral is the sum of and :

Final Answer:

ANSWER

(1)/(5)\log 6+(3)/(√5)\tan^-1√5

Question 15

QUESTION

Evaluate \int_0^1 x e^x^2\,dx.

SOLUTION

We need to evaluate the definite integral . This problem involves using substitution to simplify the integral.

Step 1: Identify a suitable substitution

Let . Then, we need to find in terms of . Differentiating with respect to , we get:

So, . We can rewrite this as .

Step 2: Change the limits of integration

Since we are changing the variable of integration from to , we must also change the limits of integration.

When , .

When , .

So, the new limits of integration are from to .

Step 3: Rewrite the integral in terms of

Substituting and , the integral becomes:

Step 4: Evaluate the integral

The integral of with respect to is simply . Therefore:

Step 5: Apply the limits of integration

Final Answer:

The value of the integral is .

ANSWER

(1)/(2)(e-1)

Question 16

QUESTION

Evaluate \int_1^2 (5x^2)/(x^2+4x+3)\,dx.

SOLUTION

We need to evaluate the definite integral .

Step 1: Simplify the integrand using polynomial long division

Since the degree of the numerator and denominator are the same, we first perform polynomial long division to simplify the integrand. Dividing by gives us:

So,

Step 2: Factor the denominator and perform partial fraction decomposition

The denominator can be factored as . Now we perform partial fraction decomposition on the remaining fraction:

Multiplying both sides by gives:

Let :

Let :

Thus,

Step 3: Rewrite the integral

Now we can rewrite the original integral as:

Step 4: Evaluate the integral

Final Answer:

ANSWER

5-(5)/(2)\left(9\log(5)/(4)-\log(3)/(2)\right)

Question 17

QUESTION

Evaluate \int_0^π/4 (2\sec^2 x+x^3+2)\,dx.

SOLUTION

We need to evaluate the definite integral . This involves finding the antiderivative of the integrand and then applying the limits of integration.

Step 1: Find the antiderivative of each term

We know the following antiderivatives:

- The antiderivative of is .
- The antiderivative of is .
- The antiderivative of is .

Therefore, the antiderivative of is .

Step 2: Evaluate the definite integral

We need to evaluate the antiderivative at the upper and lower limits of integration and subtract the values:

Step 3: Simplify the expression

We know that and . So,

Since , we have

Rearranging the terms, we get

Final Answer:

ANSWER

(π^4)/(1024)+(π)/(2)+2

Question 18

QUESTION

Evaluate \int_0^π \left(\sin^2(x)/(2)-\cos^2(x)/(2)\right)\,dx.

SOLUTION

We need to evaluate the definite integral .

Step 1: Simplify the integrand using trigonometric identities

Recall the trigonometric identity: . Therefore, . In our case, , so .

Thus, we can rewrite the integral as:

Step 2: Evaluate the integral

We know that the integral of is . So, we have:

Now we evaluate the definite integral:

Step 3: Apply the limits of integration

We substitute the upper and lower limits into the antiderivative:

Since and , we have:

Final Answer:

Conclusion: By using the trigonometric identity to simplify the integrand and then evaluating the definite integral, we found that the value of the integral is 0.

ANSWER

0

Question 19

QUESTION

Evaluate \int_0^2 (6x+3)/(x^2+4)\,dx.

SOLUTION

We need to evaluate the definite integral .

Step 1: Split the integral

We can split the integral into two parts:

Step 2: Evaluate the first integral

Let . We can use substitution. Let , then .

So, . When , , and when , .

Therefore, .

Step 3: Evaluate the second integral

Let .

We know that .

So, .

Step 4: Combine the results

Final Answer:

ANSWER

3\log 2+(3π)/(8)

Question 20

QUESTION

Evaluate \int_0^1 \left(x e^x+\sin(π x)/(4)\right)\,dx.

SOLUTION

We need to evaluate the definite integral . This involves integrating two separate terms and then applying the limits of integration.

Step 1: Separate the integral

We can split the integral into two parts:

Step 2: Integrate the first term,

We use integration by parts. Let and . Then and . Using the formula , we have:

Step 3: Integrate the second term,

Let , so , and . When , , and when , . Thus:

Step 4: Combine the results

Adding the two results together:

Final Answer:

ANSWER

1+(4)/(π)-2√2π

Question 21

QUESTION

\int_1^√3 (dx)/(1+x^2) equals

SOLUTION

We need to evaluate the definite integral .

Step 1: Recognize the integral form

The integral is a standard integral whose antiderivative is the arctangent function, denoted as or . Therefore, we have:

, where is the constant of integration.

Step 2: Apply the limits of integration

To evaluate the definite integral , we need to find the difference between the antiderivative evaluated at the upper limit and the antiderivative evaluated at the lower limit.

Step 3: Evaluate the arctangent values

We know that , so .

We also know that , so .

Step 4: Substitute the values and simplify

Substituting these values into the expression, we get:

To subtract these fractions, we need a common denominator, which is 12.

Final Answer: The value of the definite integral is .

The correct option is .

ANSWER

3

Question 22

QUESTION

\int_0^2/3 (dx)/(4+9x^2) equals

SOLUTION

We need to evaluate the definite integral .

Step 1: Rewrite the integral

We can rewrite the integral to match a standard form:

Step 2: Apply substitution

Let . Then, , so .

Also, we need to change the limits of integration.

When , .

When , .

The integral becomes:

Step 3: Use the standard integral formula

We know that .

In our case, , so:

Step 4: Evaluate the definite integral

Since and , we have:

Final Answer: The integral evaluates to .

Option 1 is incorrect because it gives .

Option 2 is incorrect because it gives .

Option 4 is incorrect because it gives .

ANSWER

2

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Key Formulas

Important Formulas for Exercise 7.8

Formula / Concept	Description
First Fundamental Theorem of Integral Calculus	Let f be a continuous function on the closed interval [a, b] and let A(x) be the area function, $A(x) = \int_a^x f(t) dt$. Then $A'(x) = f(x)$, for all $x \in [a, b]$.
Second Fundamental Theorem of Integral Calculus	Let f be a continuous function defined on the closed interval [a, b] and F be an antiderivative of f. Then, $\int_a^b f(x) dx = [F(x)]_a^b = F(b) - F(a)$ This theorem provides a method of calculating the definite integral without using the limit of a sum.
Integration by Parts	If u and v are two differentiable functions, then the integral of their product is given by: $\int u \, dv = uv - \int v \, du$ This method is used to integrate the product of two functions.
Integration by Parts (Alternative Form)	If f(x) is the first function and g(x) is the second function, the formula is: $\int f(x)g(x)dx = f(x) \int g(x)dx - \int \left(f'(x) \int g(x)dx\right)dx$
ILATE Rule for Integration by Parts	A rule of thumb for choosing the first function (u) in integration by parts. The preference order is: • **I**: Inverse trigonometric functions • **L**: Logarithmic functions • **A**: Algebraic functions • **T**: Trigonometric functions • **E**: Exponential functions
A Special Integral Form	A useful formula derived from integration by parts: $\int e^x [f(x) + f'(x)] dx = e^x f(x) + C$

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Exercise 7.2 →

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