NCERT Solutions Class 11 Maths Chapter 12: Limits and Derivatives EXERCISE 12.2

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 12 Exercise 12.2, students learn to find derivatives using the first principle of differentiation and limit methods. This exercise covers fundamental derivative calculations for polynomial functions, building essential skills for calculus that are crucial for CBSE Class 11 board exams and competitive entrance tests.

Key Takeaways:

- Master the first principle of derivatives using \lim_h \to 0 (f(x+h) - f(x))/(h)
- Apply algebra of limits to simplify complex derivative expressions
- Learn standard limit formulas like \lim_x \to 0 (\sin x)/(x) = 1 for solving derivative problems
- Develop techniques for evaluating derivatives of polynomial functions at specific points

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Complete Solutions

Question 1

QUESTION

Find the derivative of x^2-2 at x=10.

SOLUTION

We are asked to find the derivative of the function at the specific point . This involves applying the power rule of differentiation.

Step 1: Find the derivative of the function

We have . To find its derivative, , we differentiate each term separately.

The power rule states that if , then .

Applying the power rule to , we get .

The derivative of a constant is zero. Therefore, the derivative of is .

So, .

Step 2: Evaluate the derivative at

Now we need to find the value of the derivative at the point . We substitute into the expression for .

Final Answer: The derivative of at is 20.

Conclusion: We found the derivative of the given function using the power rule and then evaluated it at the specified point to obtain the final answer. A common mistake is forgetting to apply the power rule correctly or incorrectly differentiating the constant term.

ANSWER

20

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Question 2

QUESTION

Find the derivative of x at x=1.

SOLUTION

The question asks us to find the derivative of the function at the point . This tests our understanding of basic differentiation.

Step 1: Define the function

Our function is .

Step 2: Find the derivative of the function

We need to find , which represents the derivative of with respect to . Using the power rule, which states that if , then , we can differentiate .

Here, , so:

Therefore, the derivative of is .

Step 3: Evaluate the derivative at

We need to find the value of the derivative at the specific point . Since is a constant function, its value is the same for all values of .

Therefore, .

Final Answer: The derivative of at is 1.

Conclusion: The derivative of is always 1, regardless of the value of . This is because the function represents a straight line with a slope of 1. The derivative represents the slope of the tangent line to the function at a given point, and for a straight line, the tangent line is the line itself, so the slope is constant and equal to 1.

ANSWER

1

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Question 3

QUESTION

Find the derivative of 99x at x=100.

SOLUTION

We are asked to find the derivative of the function at the specific point .

Step 1: Find the derivative of the function

We need to find , which represents the derivative of with respect to .

Recall the power rule for differentiation: if , then .

In our case, . Here, and .

Applying the power rule:

So, the derivative of is .

Step 2: Evaluate the derivative at

We need to find the value of when .

Since , the derivative is a constant function. This means that the value of the derivative is the same for all values of .

Therefore, .

Final Answer: The derivative of at is 99.

Conclusion: The derivative of a linear function is simply the constant . In this case, the derivative of is always 99, regardless of the value of . A common mistake is to try to substitute into the original function instead of the derivative.

ANSWER

99

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Question 4

QUESTION

Find the derivative of the following functions from first principle:

(i) x^3 - 27

(ii) (x-1)(x-2)

(iii) (1)/(x^2)

(iv) (x+1)/(x-1)

SOLUTION

This question requires us to find the derivatives of the given functions using the first principle of differentiation, which involves limits.

(i)

Step 1: Write the definition of the derivative from the first principle.

Step 2: Find .

Step 3: Substitute and into the limit definition.

Step 4: Simplify the expression.

Step 5: Evaluate the limit by substituting .

Final Answer:

(ii)

Step 1: Write the definition of the derivative from the first principle.

Step 2: Find .

Step 3: Substitute and into the limit definition.

Step 4: Simplify the expression.

Step 5: Evaluate the limit by substituting .

Final Answer:

(iii)

Step 1: Write the definition of the derivative from the first principle.

Step 2: Find .

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Step 3: Substitute and into the limit definition.

Step 4: Simplify the expression.

Step 5: Evaluate the limit by substituting .

Final Answer:

(iv)

Step 1: Write the definition of the derivative from the first principle.

Step 2: Find .

Step 3: Substitute and into the limit definition.

Step 4: Simplify the expression.

Step 5: Evaluate the limit by substituting .

Final Answer:

ANSWER

(i) 3x^2

(ii) 2x - 3

(iii) -(2)/(x^3)

(iv) -(2)/((x-1)^2)

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Question 5

QUESTION

For the function

f(x)=x^100100+x^9999+·s+x^22+x+1,

prove that f'(1)=100f'(0).

SOLUTION

This question tests our understanding of derivatives of polynomial functions and how to evaluate them at specific points.

Step 1: Find the derivative of f(x)

Given the function:

We need to find its derivative, . We will apply the power rule of differentiation, which states that if , then .

Applying the power rule to each term:

Simplifying:

Step 2: Evaluate f'(1)

Substitute into :

Since each term is 1, and there are 100 terms:

Step 3: Evaluate f'(0)

Substitute into :

All terms except the last one are zero:

Step 4: Verify the given relation

We need to prove that .

We found that and .

So,

Therefore,

Final Answer: The result is proven.

ANSWER

Result: f'(1)=100f'(0)

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Question 6

QUESTION

Find the derivative of the expression:

x^n+ax^n-1+a^2x^n-2+·s +a^n-1x+a^n

SOLUTION

We are asked to find the derivative of the given polynomial expression with respect to .

Step 1: Write down the expression

Let

Step 2: Differentiate each term with respect to

We will use the power rule of differentiation, which states that if , then , where is a constant.

Also, the derivative of a constant is 0.

Differentiating each term:

...

(since is a constant)

Step 3: Combine the derivatives

Step 4: Simplify the expression

Final Answer:

ANSWER

nx^n-1+a(n-1)x^n-2+a^2(n-2)x^n-3+·s +a^n-1

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Question 7

QUESTION

For some constants a and b, find the derivative of the following:

(i) (x-a)(x-b)

(ii) (ax^2+b)^2

(iii) (x-a)/(x-b)

SOLUTION

This question requires us to find the derivatives of given functions using basic differentiation rules such as the power rule, product rule, quotient rule, and chain rule.

(i) Find the derivative of .

Step 1: Expand the expression

First, expand the expression :

Step 2: Differentiate with respect to x

Now, differentiate the expanded expression with respect to :

Step 3: Apply the power rule and constant rule

Using the power rule and the constant rule , we get:

Final Answer:

(ii) Find the derivative of .

Step 1: Expand the expression

Expand the expression :

Step 2: Differentiate with respect to x

Now, differentiate the expanded expression with respect to :

Step 3: Apply the power rule and constant rule

Using the power rule and the constant rule , we get:

Step 4: Factor out common terms

Factor out from the expression:

Final Answer:

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(iii) Find the derivative of .

Step 1: Apply the quotient rule

Use the quotient rule: , where and **.**

Step 2: Find the derivatives of u and v

and

Step 3: Substitute into the quotient rule formula

Step 4: Simplify the expression

Final Answer:

ANSWER

(i) 2x - a - b

(ii) 4ax(ax^2+b)

(iii) (a-b)/((x-b)^2)

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Question 8

QUESTION

Find the derivative of

x^n-a^nx-a

for constant a.

SOLUTION

We need to find the derivative of the function with respect to , where is a constant.

Step 1: Identify the appropriate rule

Since the given function is a quotient of two functions of , we will use the quotient rule for differentiation. The quotient rule states that if , then

Step 2: Define and

Let and .

Step 3: Find the derivatives of and

We have:

(since is a constant)

Step 4: Apply the quotient rule

Using the quotient rule, we have:

Step 5: Simplify the expression

Final Answer:

The derivative of is .

ANSWER

nx^n-anx^n-1-x^n+a^n(x-a)^2

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Question 9

QUESTION

Find the derivative of the following:

(i) 2x - (3)/(4)

(ii) (5x^3+3x-1)(x-1)

(iii) x^-3(5+3x)

(iv) x^5(3-6x^-9)

(v) x^-4(3-4x^-5)

(vi) (2)/(x+1) - x^23x-1

SOLUTION

This question requires us to find the derivatives of several functions using basic differentiation rules such as the power rule, constant multiple rule, and the product/quotient rule where applicable.

(i)

Step 1: Apply the derivative operator

We need to find .

Step 2: Use the linearity of the derivative

The derivative of a sum/difference is the sum/difference of the derivatives. Also, the derivative of a constant times a function is the constant times the derivative of the function.

Step 3: Apply the power rule and constant rule

and .

Final Answer: 2

(ii)

Step 1: Apply the product rule

Let and . Then .

Step 2: Find the derivatives of u and v

and .

Step 3: Substitute into the product rule formula

Step 4: Simplify

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Final Answer:

(iii)

Step 1: Expand the expression

Step 2: Apply the derivative operator

Step 3: Use the linearity of the derivative and power rule

Step 4: Factor out

Final Answer:

(iv)

Step 1: Expand the expression

Step 2: Apply the derivative operator

Step 3: Use the linearity of the derivative and power rule

Final Answer:

(v)

Step 1: Expand the expression

Step 2: Apply the derivative operator

Step 3: Use the linearity of the derivative and power rule

Final Answer:

(vi)

Step 1: Apply the derivative operator

Step 2: Use the linearity of the derivative

Step 3: Apply the quotient rule to each term

For the first term, and . So,

For the second term, and . So,

Step 4: Combine the results

Final Answer:

ANSWER

(i) 2

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(ii) 20x^3 - 15x^2 + 6x - 4

(iii) -(3)/(x^4)(5+2x)

(iv) 15x^4 + (24)/(x^5)

(v) -(12)/(x^5) + (36)/(x^10)

(vi) -(2)/((x+1)^2) - (x(3x-2))/((3x-1)^2)

Question 10

QUESTION

Find the derivative of \cos x from first principle.

SOLUTION

We need to find the derivative of using the first principle of derivatives.

Step 1: Recall the definition of the derivative from the first principle

The derivative of a function is defined as:

Step 2: Apply the definition to

We have , so . Substituting these into the definition of the derivative:

Step 3: Use the trigonometric identity for

Recall the identity: . Substituting this into the limit:

Step 4: Rearrange the terms

Step 5: Split the limit

Step 6: Evaluate the standard limits

We know that and . Substituting these values:

Step 7: Simplify

Therefore, the derivative of is .

ANSWER

-\sin x

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Question 11

QUESTION

Find the derivative of the following functions:

(i) \sin x \cos x

(ii) \sec x

(iii) 5\sec x + 4\cos x

(iv) \csc x

(v) 3\cot x + 5\cosec x

(vi) 5\sin x - 6\cos x + 7

(vii) 2\tan x - 7\sec x

SOLUTION

This question tests our knowledge of basic trigonometric derivatives and the application of derivative rules like the product rule and the sum/difference rule.

(i) Find the derivative of

Step 1: Recognize the product rule is needed.

The product rule states:

Let and .

Step 2: Find the derivatives of and .

and

Step 3: Apply the product rule.

Step 4: Simplify using the trigonometric identity .

Answer:

(ii) Find the derivative of

Step 1: Rewrite as .

Step 2: Use the quotient rule:

Let and .

Step 3: Find the derivatives of and .

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and

Step 4: Apply the quotient rule.

Step 5: Rewrite the result.

Answer:

(iii) Find the derivative of

Step 1: Apply the sum rule:

Step 2: Find the derivative of .

(using the result from part (ii))

Step 3: Find the derivative of .

Step 4: Combine the results.

Answer:

(iv) Find the derivative of

Step 1: Rewrite as .

Step 2: Use the quotient rule:

Let and .

Step 3: Find the derivatives of and .

and

Step 4: Apply the quotient rule.

Step 5: Rewrite the result.

Answer:

(v) Find the derivative of

Step 1: Apply the sum rule:

Step 2: Find the derivative of .

Step 3: Find the derivative of .

(using the result from part (iv))

Step 4: Combine the results.

Answer:

(vi) Find the derivative of

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Step 1: Apply the sum/difference rule:

Step 2: Find the derivative of .

Step 3: Find the derivative of .

Step 4: Find the derivative of .

Step 5: Combine the results.

Answer:

(vii) Find the derivative of

Step 1: Apply the difference rule:

Step 2: Find the derivative of .

Step 3: Find the derivative of .

(using the result from part (ii))

Step 4: Combine the results.

Answer:

ANSWER

(i) \cos 2x

(ii) \sec x \tan x

(iii) 5\sec x \tan x - 4\sin x

(iv) -\csc x \cot x

(v) -3\csc^2x - 5\csc x \cot x

(vi) 5\cos x + 6\sin x

(vii) 2\sec^2x - 7\sec x \tan x

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Key Formulas

Important Formulas for Exercise 12.2

Formula / Concept	Description
Algebra of Limits of Functions	Let f and g be two functions such that both \lim_x \to a f(x) and \lim_x \to a g(x) exist.
\lim_x \to a [f(x) + g(x)] = \lim_x \to a f(x) + \lim_x \to a g(x)	The limit of the sum of two functions is the sum of their limits.
\lim_x \to a [f(x) - g(x)] = \lim_x \to a f(x) - \lim_x \to a g(x)	The limit of the difference of two functions is the difference of their limits.
\lim_x \to a [f(x) · g(x)] = \lim_x \to a f(x) · \lim_x \to a g(x)	The limit of the product of two functions is the product of their limits.
\lim_x \to a (f(x))/(g(x)) = \lim_x \to a f(x)\lim_x \to a g(x), provided \lim_x \to a g(x) ≠ 0	The limit of the quotient of two functions is the quotient of their limits, provided the limit of the denominator is not zero.
\lim_x \to a [k · f(x)] = k · \lim_x \to a f(x), where k is a constant.	The limit of a constant times a function is the constant times the limit of the function.
Limits of Polynomial and Rational Functions	These rules are fundamental for evaluating limits in Exercise 12.2.
\lim_x \to a p(x) = p(a)	For a polynomial function p(x), the limit as x approaches a is found by direct substitution.
\lim_x \to a (p(x))/(q(x)) = (p(a))/(q(a)), provided q(a) ≠ 0	For a rational function, if the denominator is not zero at x = a, the limit is found by direct substitution.
Indeterminate Form (0)/(0)	If direct substitution results in (0)/(0), the expression must be simplified by factoring the numerator and denominator and canceling common factors before taking the limit.
Important Standard Limits	These are some fundamental limits used in calculus.
\lim_x \to a (x^n - a^n)/(x - a) = n a^n-1	This is a standard formula for a specific type of rational function.

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❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 12 Limits and Derivatives Exercise 12.2?

NCERT Solutions for Class 11 Maths Chapter 12 Limits and Derivatives Exercise 12.2 contains exactly 11 questions. These questions focus on applying the Algebra of Limits and evaluating limits using standard limit formulas, which carry significant weightage in CBSE board exam 2025-26.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 12 Limits and Derivatives Exercise 12.2 with step by step solutions?

You can download free PDF of NCERT Solutions for Class 11 Maths Chapter 12 Limits and Derivatives Exercise 12.2 from the official NCERT website or various educational platforms offering step by step solutions. These PDFs are updated as per the CBSE syllabus 2025-26 and include detailed explanations for all 11 questions covering Algebra of Limits and Standard Limits concepts.

Q3. How many marks does Limits and Derivatives carry in CBSE Class 11 board exam 2025-26 for Chapter 12 Exercise 12.2?

Limits and Derivatives (Unit IV - Calculus) carries 8 marks in CBSE Class 11 board exam 2025-26. Exercise 12.2 of Chapter 12 specifically covers Algebra of Limits, which is crucial for scoring well in this unit, and students should practice all 11 questions with step by step solutions.

Q4. Which is the most difficult question in Exercise 12.2 of NCERT Solutions Class 11 Maths Chapter 12 Limits and Derivatives?

Most students find questions involving complex algebraic manipulation and application of multiple standard limit formulas simultaneously in Exercise 12.2 to be challenging. Questions 9, 10, and 11 in NCERT Solutions for Class 11 Maths Chapter 12 Exercise 12.2 are typically considered difficult as they require thorough understanding of Algebra of Limits and rationalization techniques for CBSE board exam 2025-26 preparation.

Q5. What is Algebra of Limits explained in NCERT Solutions for Class 11 Maths Chapter 12 Limits and Derivatives Exercise 12.2?

Algebra of Limits refers to the rules for evaluating limits of algebraic combinations of functions including sum, difference, product, quotient, and scalar multiplication as covered in Exercise 12.2. NCERT Solutions for Class 11 Maths Chapter 12 provides step by step solutions demonstrating how to apply these limit laws along with Standard Limits to solve all 11 questions, which is essential for CBSE board exam 2025-26.

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