



Subject Area: Calculus
Unit Title: Integration
Grade Level: 12
Lesson Number: 1 of 10

Duration: 60 minutes
Date: March 10, 2024
Teacher: John Doe
Room: 101

Curriculum Standards Alignment

Content Standards:

- Apply the power rule and constant multiple rule to integrate functions.
- Use integration to solve real-world problems.

Skills Standards:

- Analyze functions to determine the appropriate integration rule.
- Evaluate the integral of a function using the power rule and constant multiple rule.

Cross-Curricular Links:

- Physics: center of mass, work, and energy.
- Engineering: optimization problems.

Essential Questions & Big Ideas

Essential Questions:

- What is the power rule and how is it used in integration?
- What is the constant multiple rule and how is it used in integration?

Enduring Understandings:

- The power rule and constant multiple rule are fundamental concepts in calculus.
- Integration is used to solve a wide range of mathematical problems.

Student Context Analysis

Page 0

Class Profile:

- Total Students: 25
- ELL Students: 5
- IEP/504 Plans: 3
- Gifted: 2

Learning Styles Distribution:

- Visual: 40%
- Auditory: 30%
- Kinesthetic: 30%



Introduction to the Power Rule and Constant Multiple Rule

Introduction

Welcome to this lesson on the power rule and constant multiple rule for integration! In this lesson, we will explore two fundamental concepts in calculus that are used to solve a wide range of mathematical problems.

What are the Power Rule and Constant Multiple Rule?

The power rule states that for a function of the form x^n , the integral is $\frac{x^{(n+1)}}{(n+1)} + C$, where n is a constant and C is the constant of integration. The constant multiple rule states that the integral of a constant multiple of a function is equal to the constant times the integral of the function.

Importance of the Power Rule and Constant Multiple Rule

The power rule and constant multiple rule are essential tools for any student of calculus. Understanding these rules is crucial for success in this subject, as they are used to solve a wide range of mathematical problems.

Steps to Apply the Power Rule

1. Identify the function to be integrated.
2. Check if the function is of the form x^n .
3. If the function is of the form x^n , apply the power rule by increasing the exponent by 1 and dividing by the new exponent.
4. Add the constant of integration to the result.

Example: Find the Integral of x^2

Using the power rule, we get: $\int x^2 dx = (x^3)/3 + C$

Practice Problems

1. Find the integral of x^3 .
2. Find the integral of x^4 .

Steps to Apply the Constant Multiple Rule

1. Identify the function to be integrated.
2. Check if the function is of the form $k \cdot f(x)$, where k is a constant and $f(x)$ is a function.
3. If the function is of the form $k \cdot f(x)$, apply the constant multiple rule by multiplying the integral of $f(x)$ by k .
4. Add the constant of integration to the result.

Example: Find the Integral of $2x^2$

Using the constant multiple rule, we get: $\int 2x^2 \, dx = 2 \int x^2 \, dx = 2(x^3)/3 + C$

Practice Problems

1. Find the integral of $3x^2$.
2. Find the integral of $2x^3$.

Practice Problems

1. Find the integral of $x^3 + 2x^2$.
2. Find the integral of $3x^2 + 2x$.
3. Find the integral of $x^4 - 2x^3$.

Answers to Practice Problems

1. $\int (x^3 + 2x^2) dx = (x^4)/4 + (2x^3)/3 + C$
2. $\int (3x^2 + 2x) dx = (3x^3)/3 + (2x^2)/2 + C$
3. $\int (x^4 - 2x^3) dx = (x^5)/5 - (2x^4)/4 + C$

Real-World Applications

The power rule and constant multiple rule have numerous applications in physics, engineering, and economics. For example, the power rule can be used to calculate the area under curves, volumes of solids, and centers of mass. The constant multiple rule can be used to model population growth, chemical reactions, and electrical circuits.

Case Studies

1. A company is producing a new product and wants to calculate the total cost of production. The cost function is given by $C(x) = 2x^2 + 3x$, where x is the number of units produced. Use the power rule and constant multiple rule to find the total cost of producing 100 units.
2. A physicist wants to calculate the center of mass of a solid object. The density function is given by $\rho(x) = 3x^2$, where x is the distance from the origin. Use the power rule to find the center of mass.

Conclusion

In conclusion, the power rule and constant multiple rule are two fundamental concepts in calculus that are used to solve a wide range of mathematical problems. By understanding these rules, students can develop a deep understanding of calculus and apply these concepts to solve real-world problems.

Assessment

1. Quiz: Use the power rule and constant multiple rule to find the integral of the following functions:
 1. $x^2 + 2x$
 2. $3x^2 - 2x$
 3. $x^4 + 2x^3$
2. Test: Use the power rule and constant multiple rule to solve the following problems:
 1. A company is producing a new product and wants to calculate the total cost of production. The cost function is given by $C(x) = 2x^2 + 3x$, where x is the number of units produced. Use the power rule and constant multiple rule to find the total cost of producing 100 units.
 2. A physicist wants to calculate the center of mass of a solid object. The density function is given by $\rho(x) = 3x^2$, where x is the distance from the origin. Use the power rule to find the center of mass.