جامـــــعـة المـــــسـتـقـبـل
AL MUSTAQBAL UNIVERSITY

كلية العلـوم
قســـم الادلة الجنائية

Lecture (8)

INTEGRAL

Complex Analysis : المادة

المرحلة : الثانية

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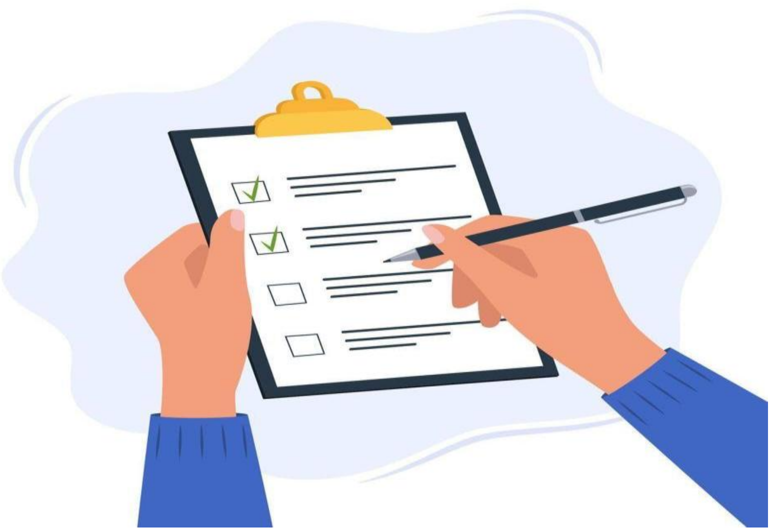
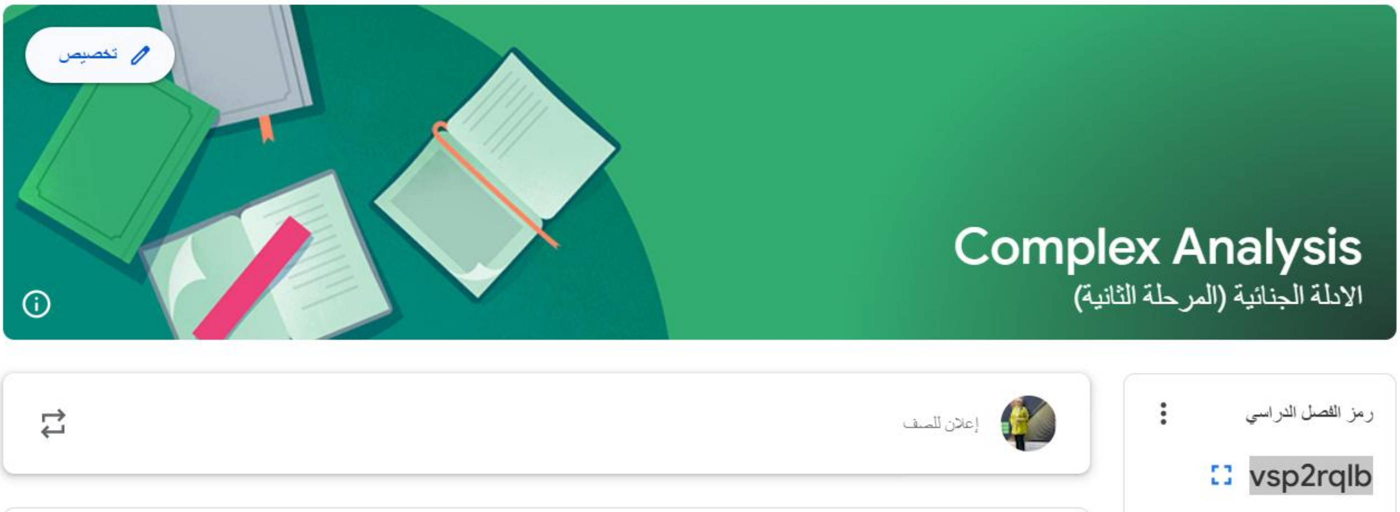
Content

- Introduction
- Indefinite integral
- Standard Integration Rule





SCAN ME!

vsp2rqlb

https://classroom.google.com/c/ODE1MDM4MzAxMzU0?cjc=vsp2rqlb

I. Introduction

The integral is one of the fundamental concepts in calculus and plays a central role in many areas of mathematics and science. The idea of integration emerged from the need to solve real-world problems, such as finding the area of irregular shapes, determining distances and displacement, and calculating the volume of complex objects. Over time, integration developed into a powerful mathematical tool used in physics, engineering, economics, biology, and computer science.

Integrals are generally divided into two main types:

1. Indefinite Integral – representing a family of functions and considered the reverse process of differentiation.
2. Definite Integral – used to compute a specific numerical value, such as the area under a curve between two bounds.

Integration is the opposite of differentiation, the equation of integration is shown below:

$$If\ {}^{d}\!/_{dx}\,(F(x)) = f(x)\ then \int f(x)dx = F(x).$$

II. Indefinite integral

$$\int f(x)dx = F(x) + C.$$

The capital letter C represents a constant value called the constant of integration.

Standard Integration Rule:

1) $\int du = u(x) + c$

2) $\int a \cdot u(x)dx = a \int u(x)\, dx$

3) $\int \big(u(x) \mp v(x)\big)\, dx = \int u(x)\, dx \mp \int v(x)\, dx$

4) $\int u^n\, du = \frac{u^{n+1}}{n+1} + c$ when $n \neq -1$ & $\int u^{-1}\, du = \int \frac{1}{u} du = \ln u + c$

5) $\int a^u\, du = \frac{a^u}{\ln a} + c \Rightarrow \int e^u\, du = e^u + c$

EXAMPLES:

[1] $\int 6\ dx = 6x + C$

[2] $\int -3\, dx = -3x + C$

[3] $\int \frac{1}{4}\, dy = \frac{1}{4} y + C$

[5] $\int x^4\ dx = \frac{x^{4+1}}{4+1} + C = \frac{x^5}{5} + C$

[6] $\int x^{-3}\, dx = \frac{x^{-2}}{-2} + C = -\frac{1}{2x^2} + C$

[7] $\int 4x^3\, dx = \frac{4x^4}{4} + C = x^4 + C$

[8] $\int -6x^{-5}\, dx = \frac{-6x^{-4}}{-4} + C = \frac{3}{2x^4} + C$

[9] $\int \sqrt{x}\ dx = \int x^{\frac{1}{2}}\,dx$

$$= \frac{2}{3}x^{\frac{3}{2}} + C$$

[10] $\int (3x^2 + 5)\,dx = \frac{3x^3}{3} + 5x + C = x^3 + 5x + C$

[11] $\int (6x^2 - 5x + 3)\,dx = \frac{6x^3}{3} - \frac{5x^2}{2} + 3x + C$

$$= 2x^3 - \frac{5}{2}x^2 + 3x + C$$

[12] $\int (x^4 - 2x^3 + x^2)\,dx = \frac{x^5}{5} - \frac{2x^4}{4} + \frac{x^3}{3} + C = \frac{x^5}{5} - \frac{2x^4}{4} + \frac{x^3}{3} + C$

Activity: Find Integral of the following equation:

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

TASK: Find derivative of the following equation:

1- $\int 6x\sqrt{x}\ dx$

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التغذية الراجعة