M 111 Ref.: Calculus by SWOKOWSKI, "6th Edition" and et.al.

- Lecture (1)

Indefinite Integral

- **EX.1** Let $f(x) = 2x$, Find the function F such that

$$F'(x) = f(x)$$

Ans:

$F(x) = x^2$, $F(x) = x^2 + 5$, $F(x) = x^2 - 7/3$, ...

i.e. $F(x) = x^2 + C$, C is any Constant

$F(x)$ is called antiderivative of $f(x)$

Definition

A function F is an antiderivative of the function f on an interval I if $F'(x) = f(x)$ for every x in I.

* the process of finding $F(x)$ is called antidifferentiation or Integration.

The Indefinite Integral can be defined as

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

Indefinite integral

Integration

Integrand

antiderivative of $f(x)$

Constant of Integration

* Power Rule for the indefinite Integral

$$\int x^r\,dr = \frac{x^{r+1}}{r+1} + C, \quad r \in \mathbb{Q} \text{ and } r \neq -1$$

- **EX. 2** Evaluate (i) $\int 2x\,dx$ (ii) $\int \left(x^3 + 3x^5 - \frac{7}{3}x^6\right)dx$

Ans: (i) $\int 2x\,dx = 2\int x\,dx$

$= 2\left(\frac{x^2}{2}\right) + C$

as obtained before $= x^2 + C$, in EX.1 #

(ii) $\int \left(x^3 + 3x^5 - \frac{7}{3}x^6\right)dx$

$= \frac{x^4}{4} + 3\left(\frac{x^6}{6}\right) - \frac{7}{3}\left(\frac{x^7}{7}\right) + C$

$= \frac{1}{4}x^4 + \frac{1}{2}x^6 - \frac{1}{3}x^7 + C$ #