Section 4.10 *Antiderivatives*

Learning outcomes

After completing this section, you will inshaAllah be able to

1. explain what is meant by anti-derivative of a function
2. find simple anti-derivatives and apply them to solve some equations involving derivatives

Antiderivative

A function F is called an antiderivative of f on an interval I if $F'(x) = f(x)$

Just a process which is reverse of differentiation

Example Guess few antiderivatives of the following and give reason for your answer.

1. $f(x) = x^2$
2. $f(x) = e^x$

Do we get unique antiderivatives?

$F(x)$ is antiderivative of $f(x)$ on I

$\Leftrightarrow$

$F(x) + C$ is antiderivative of $f(x)$ on I

See the examples 1, 2, 3 done in class

Finding antiderivatives using fundamental antiderivative formulas

Function	Antiderivative
$x^n \qquad (n \neq -1)$	$\dfrac{x^{n+1}}{n+1} + C$
$\dfrac{1}{x}$	$\ln\lvert x\rvert + C$
e^x	$e^x + C$
$\cos x$	$\sin x + C$
$\sin x$	$-\cos x + C$
$\sec^2 x$	$\tan x + C$
$\sec x \tan x$	$\sec x + C$
$\dfrac{1}{\sqrt{1-x^2}}$	$\sin^{-1} x + C$
$\dfrac{1}{1+x^2}$	$\tan^{-1} x + C$

See the examples 4, 5, 6, 7 done in class

Simple Applications

- To solve problems involving derivatives we need to use idea of antiderivatives
  - This naturally involves arbitrary constant(s).
- If some specific condition(s) are given we can use these to find value(s) of these constant(s).
- Hence, we get solution satisfying given condition(s).

See the examples 8, 9 done in class

End of 4.10