Lesson 4-1a

Antiderivatives
And
Indefinite Integration

Objective

Students will…

- Be able to find the antiderivatives.
- Be able to use integral notation.
- Be able to come up with general and particular solutions to differential equations.

Antiderivatives

Summation $\Rightarrow \Sigma$

One of the key components in mathematics is being able to revert a process. So, naturally, if we can take the derivatives of a function, we should be able to "undo" it. This is what **antiderivatives** are. "$\int$"

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

$F(x) = x^3 + 5$

Ex. If $f(x) = 3x^2$, then possibly, $F(x) = x^3$ $\Rightarrow F'(x) = 3x^2 = f(x)$

Note: Notice the word "possibly," because there are almost always multiple antiderivatives. From the above example,

If $f(x) = 3x^2$, then it is also possible that $F(x) = x^3 - 89$

The "Anti-Power Rule"

The Power Rule is probably the easiest and the simplest derivative rule. The antiderivatives involving the Power Rule is also quite simple.

Consider…

Ex. $f(x) = 3x^2$ $= 2(3x^{2-1}) = 6x^1$

$f(x) = ca^x = (x)\,ca^{x-1}$ $\Rightarrow F(x) = \cancel{\frac{x}{x}}\,ca^x = ca^x$

$f'(x) =$

Thus, the "Anti-Power Rule" is as follows:

If $f(x) = cx^a$, then $F(x) = \frac{c}{a+1}x^{a+1}$

Example

Find the antiderivatives of the following:

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

b. $f(x) = 5x^3 - 8x^2 + 9x^0$

$F(x) = \frac{1}{3}x^3 + C$

Constant.

$F(x) = \frac{5}{4}x^4 - \frac{8}{3}x^3 + 9x + C$

Differential Equations

Finding the antiderivatives can be presented in multiple ways. One of the ways is by way of differential equations.

Ex. Find the general solution of the differential equation $y' = 2$

Example

Find the particular solution of $f(x) = \frac{1}{x^2}$, with $x > 0$ and the initial condition $F(1) = 0$.

Homework 11/28

~~3.7 #3-11, 18-20, 22, 23~~

4.1 #15-39 (e.o.o), 43-46.