Math 250 – Notes: Sect. 4.1 – Antiderivatives

Definition: A function, F, is an antiderivative of f if $F'(x) = f(x)$ for all x.

-example- Show that $F(x) = \frac{1}{3}x^3 + 6x^2 - 4x + 3$ is an **antiderivative** function for $f(x) = x^2 + 12x - 4$

-example- Name an *antiderivative* function for $f(x) = 2x$.

*When determining a general antiderivative function, you need to add a constant at the end. This is because taking the derivative of a constant is 0.

NOTATION FOR THE GENERAL ANTIDERIVATIVE: (This is called the ***indefinite integral***)

Basic Integration Rules:

1. Integral of a Constant:

2. Power Rule:

3. Constant Multiple:

4. Sum/Difference:

5. Trig Functions:

Practice: Evaluate each integral.

a. $\int (x^2 - 8x + 3)dx$

b. $\int (\sqrt{x} + \frac{3}{\sqrt[3]{x^2}} + \frac{1}{x^3} - 4x + 1)dx$

c. $\int (3x+2)(2x-5)dx$

d. $\int \frac{x^4 - 1}{x^2} dx$

e. $\int (3\sec^2 x + 2\csc x \cot x)dx$

II. Differential Equations and Initial Value Problems

A differential equation is an equation that involves a derivative of an unknown function. SOLVING a differential equation means finding that unknown function.

-example- $\frac{dy}{dx} = 4x + 3$. Find $y = f(x)$.

*An **INITIAL VALUE** (or initial condition) allows you to find the **PARTICULAR SOLUTION** – not just the general solution. In other words, it allows you to find "C".*

-example- $f'(x) = \frac{4}{\sqrt{x}}$. If $f(1) = 3$, find $y = f(x)$.

Applications: MOTION PROBLEMS.

Recall: POSITION:

VELOCITY:

ACCELERATION:

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-example- A ball is thrown upward with an initial velocity of 100 ft/sec from an initial height of 50 feet. Find the position function that gives the height, *s*, as a function of time, *t*. (note: the acceleration due to gravity is a **constant**: -32 ft/sec/sec.)

-example- A car traveling at 66 ft/sec is brought to a stop, at constant deceleration, 132 feet from where the brakes are applied.

a. Find k, the constant of acceleration.

b. How far has the car moved when its speed has been reduced to 44 ft/sec?

c. How far has the car moved when its speed has been reduced to 22 ft/sec?