2300_Spring_2022_Day01

Sunday, January 9, 2022 10:22 PM

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Math 2300: Calculus **Spring 2022**

Lecture 1

Lecturer: Sarah Arpin

1.1 Day 1

Ask students if it's OK to record just this class? Beginning part, logistics, etc. - Webcams are req.

-This section is remote

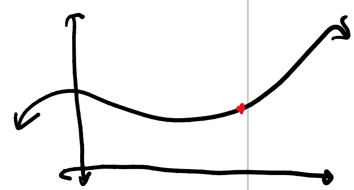
1.1.1 Logistics

1. **Syllabus:** Everyone look this over. Put the exam dates in your calendars.

1.1.2 Big Picture of Calc 1

In Math 1300 (Calc 1), you learned about derivatives (which are rate-of-change functions) and anti-derivatives (which are accumulation functions).

In general, if you have a function $f(x)$, then:



- $f'(c)$ describes the rate of change of the function f at the particular point in time c
- $\int_a^b f(x)dx$ describes the accumulation of f over the period of time from $x = a$ to $x = b$.

A common "real-world" example would be if $f(x)$ describes the velocity of a car. In this case, $f'(c)$ is the acceleration of the car at time c (the rate of change in velocity), and $\int_a^b$ is the change in position (think of this as the accumulation of distance/time over time, where distance/time = velocity).

1.1.3 Derivative Techniques

A large portion of Calc 1 focused on techniques for finding $f'(x)$ given $f(x)$. It may take some time to remember all of the derivative rules - I recommend writing them down on a reference notecard until you have them re-memorized.

1.1.3.1 Example

$$\frac{d}{dx}(3x^2 - \sin(x) + \ln(x-2)) = 6x - \cos(x) + \frac{1}{x-2}$$

1.1.4 What is an integral?

Indefinite:

$$\int f(x)dx = \overbrace{F(x) + C}^{F'(x) = f(x)}$$

End up w/ a "+C"

Describe the family of anti-derivatives of $f(x)$

Definite:

$$= \int_a^b f(x)dx = F(b) - F(a)$$

No "+C"

1.1.5 Integration Techniques

At the end of Calc 1, you started to learn some integration techniques. This is where Calc 2 picks up from.

1. $\int x^5 dx = \frac{x^6}{6} + C$
2. $\int \frac{1}{x} dx = \ln|x| + C$
3. $\int e^x dx = e^x + C$
4. $\int \sin(x) dx = -\cos(x) + C$
5. $\int \sec^2(x) dx = \tan(x) + C$
6. $\int \frac{1}{1+x^2} dx = \arctan(x) + C$

Find a piece of paper and make your own dedicated list of antiderivatives. The more examples you do, the more you look at this list, the more easily you will remember common antiderivatives.

Example 1.1 (**u-substitution**) *Evaluate the integral:* ($\int$ +C)

u-sub is about undoing chain rule: find a func. within a function.

$$\int 3x^2(x^3+1)^{100}dx = \int u^{100} du = \frac{u^{101}}{101} + C = \boxed{\frac{(x^3+1)^{101}}{101} + C}$$

$u = x^3 + 1$ look for an "inner function" in a composition

$\frac{du}{dx} = 3x^2 \longrightarrow du = 3x^2 dx$

Continue with identifying u-sub activity.