Preparing for Class 7

Reading: Review *CiC Handouts* , Section 6.1.

Problems: *CiC Handouts* , pp. 305 ff. #1, 2, 9, 10.

Wednesday, February 7

Class 7:

More Accumulation Functions

We will spend more time today investigating applications which lead to accumulation functions. We will also gain some graphical insight on the relationship between an accumulation function and the function used in constructing the accumulation.

Take-Home Quiz handed out: Definite Integrals and Accumulation Functions

Lab 2: Discovering the Fundamental Theorem of Calculus

Preparing for Class 8

Reading: *CiC Handouts* , pp. 353-359.

Problems: *CiC Handouts* , p. 353 # 17, 18.

Friday, February 9

Class 8:

The Fundamental Theorem of Calculus: Part 1

This is a Calculus course, and we spent the whole first semester working with differentiation. So, to understand a new function you come across, one thing you may try to do is differentiate it, right? We'll try this with accumulation functions and find that

$$F'(x) = \frac{d}{dx}\int_a^x f(t)dt = f(x), \quad \text{if } f \text{ is continuous at } x.$$

The accumulation function *also* satisfies the "initial condition" $F(a) = 0$, so $y(x) = F(x)$ is a solution of the initial value problem

$$y'(x) = f(x), \quad y(a) = 0, \quad f \text{ is continuous.}$$

In fact, it is the *unique* solution of this IVP. Since you already know a lot about initial value problems, this is a very useful observation. It is *so* useful that it is the first part of a famous theorem, THE FUNDAMENTAL THEOREM OF CALCULUS.

The theorem is called "Fundamental" for a few reasons: first, it explains the relationship between differentiation and integration, the two main operations of study in calculus; second, it provides a method for evaluating many different integrals; third, it is an existence and uniqueness theorem for IVPs of the form above.

Take-Home Quiz Due at the Beginning of Class 8.

Preparing for Class 9

Reading: *CiC Handouts* , pp. 359-365, *H-H*, Section 3.4.

Problems: *CiC Handouts* , pp. 365 ff., # 1, 2, 3, 4, 8.

Monday, February 12

Class 9:

The Fundamental Theorem of Calculus: Part 2

The first part of the Fundamental Theorem of Calculus implies the following:

If $F'(x) = f(x)$ for $a \leq x \leq b$ and if f is continuous on $[a, b]$, then

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

In this case, F is said to be an *antiderivative* of f, and this "Part 2" of the Fundamental Theorem of Calculus gives us a way to evaluate a definite integral *exactly* if we can find an antiderivative for its integrand.

Week 3 Homework Due: Hand in homework preparing for Classes 7, 8, 9