Math Xb Spring 2005
The Fundamental Theorem of Calculus, Version 1

April 13, 2005

1 Goals

- To understand the proof of the Fundamental Theorem of Calculus (Version 1)

2 New Terms

- Fundamental Theorem of Calculus

3 FTC Version 1

1. Last time we conjectured that

$$\frac{d}{dx}\left({}_cA_f(x)\right) = f(x), \text{for } c \text{ a constant.}$$

   Today we prove that conjecture.

2. *Fundamental Theorem of Calculus (Version 1):* If f is continuous on $[a, b]$ and $c \in [a, b]$, then the function

$${}_cA_f(x) = \int_c^x f(t)\,dt$$

   is differentiable on (a, b) and

$$\frac{d}{dx}\left({}_cA_f(x)\right) = f(x).$$

3. The proof in the case the f is a positive, increasing, continuous function is on page 757.

4. In the case the f is continuous, but not necessarily positive and increasing, we can use the Extreme Value theorem to set up our vise. This is on p. 758 of the textbook.

4 References

- §23.3 in *Calculus: An Integrated Approach to Functions and Their Rates of Change.*