

MATH 134 – Calculus with Fundamentals 2
Practice Day on Consequences of FTC, “Part I”
February 1, 2018

Background

Recall that the “FTC, part I” says: If f is continuous on $[a, b]$ and F is any function satisfying $\frac{d}{dx}F(x) = F'(x) = f(x)$ for all x in $[a, b]$ (called an *antiderivative* of f), then

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

This means that we have a “shortcut method” for computing $\int_a^b f(x) dx$ as long as we have or can find a suitable *antiderivative* F – a function with $F'(x) = f(x)$ for the function $f(x)$ we are integrating.

Questions

- (1) Verify that

$$\frac{d}{dx}(e^{x^2}) = 2xe^{x^2}.$$

- (2) Use part (1) to evaluate:

$$\int_0^1 2xe^{x^2} dx$$

- (3) Verify that

$$\frac{d}{dx}(\ln(x^2 + 5x + 6)) = \frac{2x + 5}{x^2 + 5x + 6}.$$

- (4) Use part (4) to evaluate:

$$\int_1^2 \frac{2x + 5}{x^2 + 5x + 6} dx.$$

- (5) Verify that

$$\frac{d}{dx} \left(\frac{1}{2} (1 + \sin(x) \cos(x)) \right) = \cos^2(x)$$

(You’ll need a trig identity here – ask if you don’t recall identities using $\sin^2(x)$ and $\cos^2(x)$!)

(6) Use part (5) to evaluate:

$$\int_0^{\pi/2} \cos^2(x) dx.$$