Homework 3
Due Tuesday, January 29

Instructions: write up solutions to all problems below. Neatness counts: be sure to follow guidelines for homework in the syllabus.

Reading assignment: chapter 4.5 (read 4.4 if you are interested).

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1. There is always more than one way to do a problem. In class, we did the integral $\int x\sqrt{x+5}\,dx$ by substituting $u = x + 5$, and we got the answer $F(x) = \frac{2}{5}(x+5)^{5/2} - \frac{10}{3}(x+5)^{3/2} + C$.

   (a) Do the same integral, but this time using the subtitution $u = \sqrt{x+5}$. Hint: try to get as many things in terms of u, and not x. Do you get the same answer?

   (b) Do the same integral, but instead do integration by parts, choosing $f(x) = x$ and $g'(x) = \sqrt{x+5}$. Does your answer match with the previous answers?

   (c) Graph the antiderivatives you found for both (a) and (b), and verify they are indeed the same function. The moral here is antiderivatives are (essentially) unique, no matter which method you use!

   (d) 2 Point Extra Credit: show that the antiderivatives are actually the same algebraically.

2. Compute the integrals below.

   (a) $\int \dfrac{e^x}{1 + e^x}\,dx$

   (b) $\int \tan(\theta)\,d\theta$

   (c) $\int x \cos(3x)\,dx$

   (d) $\int x^2 e^x\,dx$

   (e) $\int \ln(t)\,dt$

3. Chapter 4.3, # 28. Hint: recall the trig identity $\sin^2(\theta) + \cos^2(\theta) = 1$.

4. Find the indefinite integral of $\dfrac{\ln(x)}{x}$ using integration by parts. [Hint: you will have to use the "algebra trick" from class.]

5. Chapter 4.3, # 46.