MTH 252 Lab
Substitution

Damien Adams

Purpose

Just like differentiation, there are a lot of strategies that we will learn to integrate. Unlike differentiation, we will be tasked with having to recognize which strategy is useful in which situation, and many times multiple strategies may work (or none). Of the strategies we will learn, substitution will be the most commonly used one.

(a) What differentiation rule does substitution "undo"?

(b) How do we choose $u = g(x)$ when we use substitution?

(c) $\int_{-a}^{a} f(x)\,dx$ is very easy to integrate if we identify that f is an odd function. How can we identify if f is odd?

Prompts

1. Integrate. You do not need to show all work. *The purpose of this exercise is to increase your proficiency and speed with linear substitutions. Look for the pattern!*

   a. $\int \sin t\ dt$

   b. $\int \sin(2t)\ dt$

   c. $\int \sin(3t)\ dt$

   d. $\int \sin(4t)\ dt$

   e. $\int \sin(5t)\ dt$

   f. $\int \sin(31415t)\ dt$

   g. $\int e^{t}\ dt$

   h. $\int e^{2t}\ dt$

   i. $\int e^{3t}\ dt$

   j. $\int e^{4t}\ dt$

   k. $\int e^{5t}\ dt$

   l. $\int e^{31415t}\ dt$

2. Evaluate the following integrals.

(a) $\displaystyle\int \frac{x^3}{\sqrt{1-x^4}}\,dx.$

(b) $\displaystyle\int \sqrt{2z+1}\,dz$

(c) $\displaystyle\int_0^{12} \sqrt{2z+1}\,dz$

(d) $\displaystyle\int_2^e \frac{2}{t\ln t}\,dt$

(e) $\displaystyle\int_0^{\frac{\pi}{4}} \sin(\tan x)\sec^2 x\,dx$

(f) $\displaystyle\int_{-1}^{1} \frac{y^2\sin y}{y^4+3y^2+1}\,dy$

(g) $\displaystyle\int_{-5}^{5} (2-|x|)\,dx$

(h) $\displaystyle\int_{-12}^{0} \sqrt{144-x^2}\,dx$