(9/30/08)

Math 10B. Lecture Examples.

Section 7.1. Integration by substitution[†]

Example 1 **Find the antiderivative** $\int (\mathbf{x^2+1})^{\mathbf{5}}(\mathbf{2x})\,\mathbf{dx}$.

Answer: $\int (x^2+1)^5(2x)\,dx = \frac{1}{6}(x^2+1)^6 + C$

Example 2 **Perform the integration** $\int \mathbf{x^3}\sqrt{\mathbf{x^4+16}}\,\mathbf{dx}$.

Answer: $\int x^3\sqrt{x^4+16}\,dx = \frac{1}{6}(x^4+16)^{3/2} + C$

Example 3 **Find the antiderivative** $\int \frac{\cos(\sqrt{\mathbf{x}})}{\sqrt{\mathbf{x}}}\,\mathbf{dx}$.

Answer: $\int \frac{\cos(\sqrt{x})}{\sqrt{x}}\,dx = 2\sin\left(\sqrt{x}\right) + C$

Example 4 **Find the area of the region in Figure 1.**

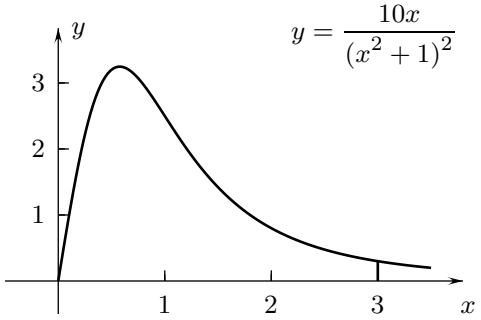

FIGURE 1

Answer: [Area] $= \frac{9}{2}$

Example 5 **Evaluate** $\int_{\mathbf{0}}^{\mathbf{1}} \mathbf{sin}(\pi\mathbf{x})\,\mathbf{dx}$.

Answer: $\int_0^1 \sin(\pi x)\,dx = \frac{2}{\pi}$

Example 6 **Evaluate** $\int_{\mathbf{0}}^{\mathbf{1}} \mathbf{e^{-2x}}\,\mathbf{dx}$.

Answer: $\int_0^1 e^{-2x}\,dx = \frac{1}{2}(1-e^{-2})$

Interactive Examples

Work the following Interactive Examples on Shenk's web page, http//www.math.ucsd.edu/~ashenk/:[‡]

Section 6.8: Examples 1 through 5

Section 7.1: Example 4

[†]Lecture notes to accompany Section 7.1 of *Calculus* by Hughes-Hallett et al.

[‡]The chapter and section numbers on Shenk's web site refer to his calculus manuscript and not to the chapters and sections of the textbook for the course.