Chapter 7. Integration Techniques, l'Hôpital's Rule, and Improper Integrals

7.5 Integral Tables, Computer Algebra Systems, and Monte Carlo Integration

Note. We now use the Table of Integrals on pages T1–T5 to solve some integral problems (each equation given in T1–T5 can be derived by the methods of Chapter 7).

Example. Page 576 number 20 (see T-3 number 62c).

Example. Use the TI-89 to do page 577 number 48.

Note. Monte Carlo Numerical Integration. In general, a "Monte Carlo" method is a process based on analyzing randomly generated data. Here, we discuss how to use randomly generated points to estimate the area under a function. Suppose we wish to evaluate $\int_a^b f(x)\,dx$ for nonnegative function $f(x)$. We can randomly generate points (x, y) where $x \in [a, b]$ and $y \in [0, M]$ for M an upper bound of $f(x)$ for $x \in [a, b]$. We then

count the percentage of these randomly generated points which lie below $y = f(x)$, and estimate the area below the curve as this percentage times the area of the rectangle with base $b - a$ and height M:

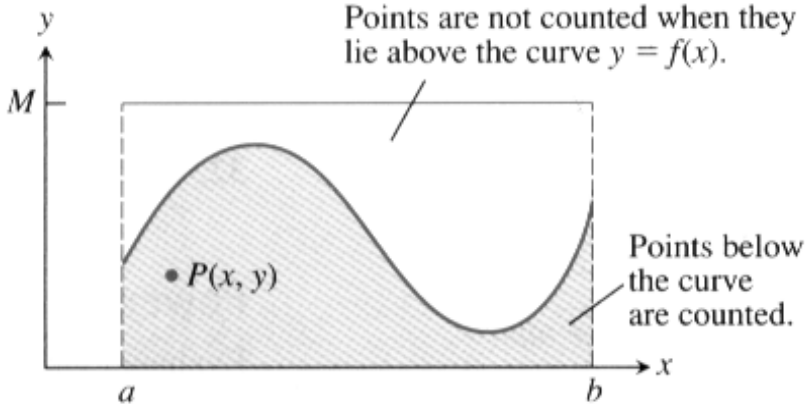

Figure 7.10 Page 575

Example. Notice Table 7.3. 100's, 1,000's, and 10,000's of random points are generated and the area under $y = \cos x$ for $x \in [-\pi/2, \pi/2]$ is estimated at around 2.0 (the actual value is precisely 2).