Math 202 Practice Exam 2 25 March 2002

Instructions: This is a self-timed, take-home exam. The time limit is 90 minutes. This means that you must stop working on the exam ninety minutes after you first look at the exam questions.

To complete the exam, you will need a calculator capable of computing sums of sequences. The following formulas may be useful, and will be provided for you on the actual exam:

$$|E_T| \le \frac{K_2(b-a)^3}{12n^2}, \quad |E_M| \le \frac{K_2(b-a)^3}{24n^2}, \quad |E_S| \le \frac{K_4(b-a)^5}{180n^4}.$$

The exam is otherwise closed-book. No reference to books or notes is allowed.

1. Compute $\displaystyle\int \frac{6x^2+23x+16}{(x+2)^2(x-1)}\,dx$.
2. Compute $\displaystyle\int \frac{x^5+5x^3+5x+4}{x^2+1}\,dx$.
3. Use the midpoint rule with 50 sub-intervals to estimate $\displaystyle\int_0^{\frac{1}{2}} \frac{1}{\sqrt{1-x^2}}\,dx$. (Note that the upper limit of integration is $\frac{1}{2}$, not 1.) Round your answer to six decimal places.
4. Consider $\displaystyle\int_0^2 \tan^{-1} x\,dx$.
   (a) Estimate the value of the integral using trapezoids with $n = 10$. Round your answer to six decimal places.
   (b) Find an upper bound for the absolute value of the error in your approximation.
   (c) What is the smallest value of n we may use in a trapezoid approximation to guarantee an error of less than 10^{-4}?
5. Rewrite the integral $\displaystyle\int_3^\infty xe^{-x}\,dx$ as a limit, and then find its value.
6. Evaluate the definite integral $\displaystyle\int_1^3 \frac{1}{x^2-2x}\,dx$.