**Math 302: Problem Set 6**

Due: November 6, 2009

Email me your m-files and results as attachments in ONE email with each m-file having the format `firstname_lastname_prob.m`. Be sure to comment your code so I can follow it.

1. (20 points) Write a function called `midpoint.m` that uses the Midpoint Rule rather than the Left Sum or Right Sum to approximate $\int_a^b f(x)\,dx$. The function should ask the user to input a symbolic function $f$, the limits of integration $a$ and $b$, and the number of subintervals $n$. Your program should check that $n$ is a natural number and that $a < b$. The function should output the approximation of the integral.

2. (20 points) Do the same as above, except use the Trapezoid Rule and call the function `trap.m`.

3. (20 points) Do the same as above, except use Simpson's Rule and call the function `simpson.m`. In addition, your function should check that $n$ is even.

4. (10 points) Check the above program by testing it on $f(x) = x^2$ for $a = 0$, $b = 1$, and $n = 2$. Show your work on paper and evaluate by hand what each approximation should be. Make sure your programs give the same answers.

5. (30 points) Try out your programs by approximating the following integrals for the following $n$-values. Use a table of integrals or your calculus book to find the exact value of the integral to compare the accuracy, showing your work on paper. All values should have 6 digits of accuracy after the decimal point.

| Function | $n$ | Exact | Approximate | Midpoint | Trapezoid | Simpson |
|---|---|---|---|---|---|---|
| $\int_0^1 \frac{1}{25+x^2}\ \text{dx}$ | $n = 4$ | | | | | |
| $\int_0^1 \frac{1}{25+x^2}\ \text{dx}$ | $n = 10$ | | | | | |
| $\int_{\pi/2}^{\pi} e^{2x}\sin(3x)\ \text{dx}$ | $n = 4$ | | | | | |
| $\int_{\pi/2}^{\pi} e^{2x}\sin(3x)\ \text{dx}$ | $n = 10$ | | | | | |
| $\int_0^1 \sin^2(\pi x)\ \text{dx}$ | $n = 4$ | | | | | |
| $\int_0^1 \sin^2(\pi x)\ \text{dx}$ | $n = 10$ | | | | | |

**Submission**

- Your three m-files emailed to be (`midpoint.m, trap.m, simpson.m`)
- Your work and answers to problems 3 and 4 (turned in at the beginning of class)