***Sample Problems for the 1st Midterm.*** These are problems from 222 midterms given in the past. Old exams are available on the web, but be warned that the syllabus changes every year, so that problems which were on the 1st midterm 2 years ago may show up on this year's 2nd midterm. Don't prepare for last year's midterm!

Look for similar problems in the problem section in the notes. Do not assume that the exam will be exactly like these problems. This is just a sample of what the level will be.

(1) Compute the following integral, in which $a$ may be any constant.

$$\int e^x \cos ax \, dx.$$

(2) Find a reduction formula for

$$I_n = \int_0^1 \bigl(1+x\bigr)^n e^{-x} \, dx,$$

and compute $I_3$.

(3) (a) Find the partial fraction decomposition of $\dfrac{x^2}{x^2-3x+2}$.

(b) Find the partial fraction decomposition of $\dfrac{x^2-3x+2}{(x^2+1)(x-4)^3}$. You do not have to find the unknown coefficients "$A$,$B$, $\cdots$"

(4) Compute $\displaystyle\int_1^2 (6x^2-2x)\ln(x)\, dx$.

Then compute $\displaystyle\int_1^2 (6x^2-2x)\ln(x^2)\, dx$.

(5) Find the term containing $x^{13}$ in the Taylor series $T_\infty f(x)$ of $f(x) = \cos(x+\pi/6)$.

(6) Let $f(x) = \ln(5+x)$.

(a) Compute the Taylor series $T_\infty f(x)$.

(b) Give an upper estimate for the error when using $T_2 f(x)|$ instead of $f(x)$ if $|x| \le 0.1$.

(7) Show that $\cos x$ is equal to its Taylor series for all $x$.

(8) Compute the Taylor polynomial of order 6 for the function $f(x) = (x^2+4x+1)e^x$. Be sure to use little-oh to show that your answer is indeed the Taylor polynomial.