Math 4329, Test II

Name _____

Solve any 3 of the first 4 problems, plus problems 5 and 6. Clearly mark which problem is not to be graded.

1. Use Taylor series expansions to determine the error in the approximation $u'''(t) \approx \frac{u(t+3h)-3u(t+2h)+3u(t+h)-u(t)}{h^3}$. (Hint: expand out to the h^4 terms.)

2. What is the degree of precision of the approximation:

   $\int_0^h f(x)dx \approx \frac{2}{3}hf(\frac{1}{4}h) - \frac{1}{3}hf(\frac{2}{4}h) + \frac{2}{3}hf(\frac{3}{4}h)$

3. A table of values for $f(x)$ is:

x	$f(x)$
100	0.0
110	3.0
120	0.0
130	1.0

Use cubic interpolation to estimate $f(125)$.

4. If it is known that $|f^{iv}(x)| < 0.001$ for all x, obtain a reasonable bound on the error in your estimate of $f(125)$ in problem 3.

5. Define a natural cubic spline.

6. Approximately how many multiplications are done by the section of MATLAB code below, which does back substitution in solving an N by N linear system?

```
X(N) = B(N)/A(N,N);
for I=N-1:-1:1
   SUM = 0.0;
   for J=I+1:N
      SUM = SUM + A(I,J)*X(J);
   end
   X(I) = (B(I)-SUM)/A(I,I);
end
```