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CMSE821
Numerical Methods

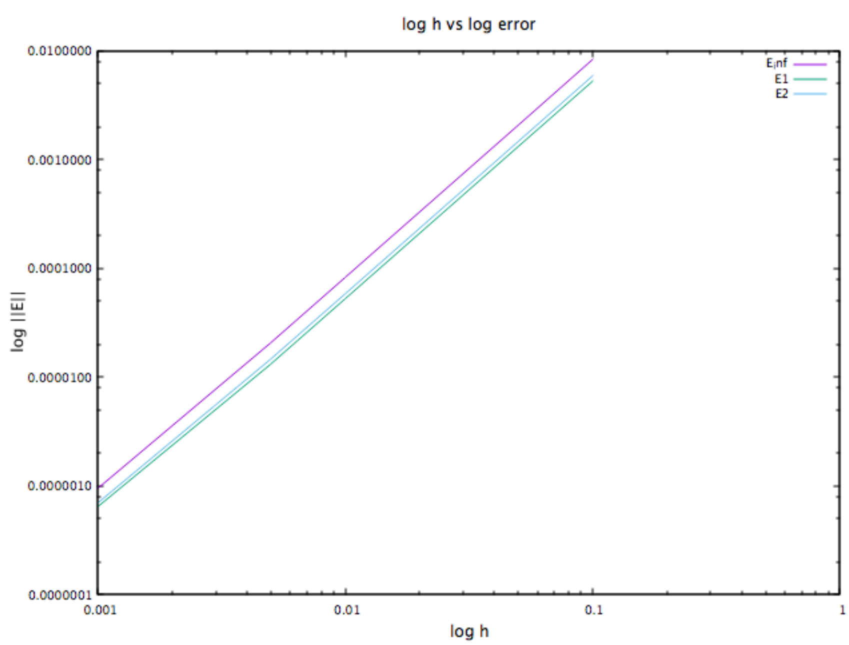
HW2

1 Fill table provided and make a log-log graph of h and the error.

Given: $\begin{cases} U''(x) = f(x) \\ U(0) = U(1) = 0 \\ U_{exact} = sin(\pi x) \\ f(x) = -\pi^2 sin(\pi x) \end{cases}$

h	$\|E\|_\infty$	$\|E\|_1$	$\|E\|_2$
0.1	8.26548534890E-003	5.21864014926E-003	5.84459323606E-003
0.05	2.05877419693E-003	1.30798145773E-003	1.45578604624E-003
0.01	8.22593651723E-005	5.23666699681E-005	5.81678158028E-005
0.005	2.05705312614E-005	1.30984200301E-005	1.45472249897E-005
0.001	9.44239060607E-007	6.41800506164E-007	6.93375191318E-007

Table 1: These are the values I acquired using the attached Fortran code.



1.1 Comments on Graph and table

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Final set of parameters            Asymptotic Standard Error
=======================            ==========================
a               = 1.97547          +/- 0.01292       (0.6541%)
b               = -0.274946        +/- 0.06095       (22.17%)

correlation matrix of the fit parameters:
                a      b
a               1.000
b               0.937  1.000
```

I fit the graph with "a" as the slope of the log-log plot. It was very close to 2. Each type of error norm seems to have the same slope of 2. The only difference was in the "b" variable, the y intercept on this axis scaling as can be seen from the graph. This is probably because $D_2U(\overline{x}) - U''(\overline{x}) \sim h^2$, so regardless of what norm we choose the h^2 relation will be the same. The only thing that changes with what norm we choose is the constant C in front in Ch^2.