

MATH 54 Homework 8

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July 19, 2006

Due Friday, July 21.

- Hill 4.3: 8, 9, 13, 15.
- Hill 4.4: 27, 28, 29.
- Consider the inner product on $C[-\pi, \pi]$ given by

$$\langle f, g \rangle = \int_{-\pi}^{\pi} f(x)\overline{g(x)} dx.$$

1. Find the polynomial in P_3 which is closest to $\sin x$ with respect to the above inner product. Call this polynomial $f(x)$.
 2. Find the Taylor polynomial of degree 3 for $\sin x$, centered at 0. Call this polynomial $g(x)$. (You should be able to find the formula for it in any calculus textbook.)
 3. On a computer or graphing calculator, plot the following two graphs.
 - (a) Graph 1: Plot $\sin x$, $f(x)$, and $g(x)$, all on the same axes.
 - (b) Graph 2: Plot $f(x) - \sin x$ and $g(x) - \sin x$ on the same axes.
 4. How many places in the interval $[-\pi, \pi]$ do $f(x)$ and $\sin x$ cross? How many places in the same interval do $g(x)$ and $\sin x$ cross?
- Hill 4.7: 37, 38, 39.