

# MATH 54 Homework 7

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Due Monday, July 23.

- Hill 4.3: 8, 9, 13, 15, 19, 21, 22.
- Hill 4.4: 1, 19, 23, 27, 28, 29.
- In this problem, use a symbolic manipulator such as a TI-89 or Mathematica to compute all definite integrals. 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 by computing  $\text{proj}_{P_3} \sin x$ . 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: 3, 5, 7, 11, 37, 38, 39.