

PHZ 3113, Mathematics Physics, Spring 2004

April 12<sup>th</sup>, 2004

Assignment # 22:

due *Friday* April 14<sup>th</sup> (at the beginning of class).

1. Expand the (rectified sine wave) function

$$f(x) = |\sin(x)|,$$

in a series of Legendre polynomials  $P_n(x)$  on the interval  $x \in [-1, 1]$ . Find at least the first four non-zero coefficients, and plot your result for the series, and  $f(x)$ , using *Maple* over the interval  $[-1, 1]$  to check your answer.

2. (Boas Ch. 13, §2, #1.) Show that the steady-state temperature distribution for a semi-infinite plate, with the temperature of the bottom edge  $T = f(x) = x$  (in degrees, so at  $x = 10$ ,  $T = 10$ ), the temperature of the other sides zero, and the width of the plate 10 cm, is

$$T(x, y) = \frac{20}{\pi} \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} e^{-n\pi y/10} \sin(n\pi x/10).$$

Plot this solution (with 30 non-zero terms in the sum) along the boundary  $y = 0$  using *Maple*, and then make a 3-dimensional plot of the solution for all  $0 < x < 10$  and  $0 < y < 20$ .