PHYS-2100 Introduction to Methods of Theoretical Physics **Fall 1998**

Extra Credit Problem II

This problem is worth two full homework assignments. It will count as extra credit towards your final course grade. It is due Monday, Sept. 28, in the grader's box in the Physics Department.

Nettel starts an interesting problem, but does not finish it. Figure 3.3a shows an initial displacement of a string, and Figure 3.3b shows what happens when the displacement is released from rest. As you argued on a previous homework assignment, superposition and the general solution to the wave equation implies that after the string is released, the displacement splits into two pieces, one of which moves to the left, and the other to the right.

In Equations 3.21, Nettel derives the Fourier coefficients for the initial displacement shown in Figure 3.3a. The forumulae given in Table 3.1 are then sufficient to determine the time development of the pulse. Indeed, it should look like Figure 3.3b.

In a time $t = 2(a/s)$ the pulse should move left or right by a distance $2a$, so the two pulses in Figure 3.3b should be well separated. Plot the first several terms of the Fourier series you get by using the formulae and show that you indeed get something that looks like Figure 3.3b.

Repeat the procedure for a time $t = (1/2)(a/s)$. Does the figure look like what you might expect?