Physics 380H - Wave Theory **Homework #12**

Fall 2004 Due 12:01 PM, Monday 2004/12/13

[30 points total]

"Journal" questions:
– What aspects of this course do you think you are most likely to use in the future, both in your "physics" existence and in your "day-to-day" life?
– Any comments about this week's activities? Course content? Assignment? Lab?

---

1. Please complete the anonymous end of course survey online on WebCT. Constructive feedback will hopefully allow us to have the best possible courses in the future, and provide the instructor and department with useful information about student reactions to many aspects of the program. In addition to the bonus assignment marks, survey participation may count towards overall class participation scores. [5.01-bonus]

2. (From Towne P2-13, pg 37) When a sound wave is passing through air the temperature will be a function of x and t. Let $\tau = T - T_0$.

   (a) Show that for an acoustic wave the one-dimensional wave equation is satisfied by $\tau(x,t)$. [5]

   (b) What restriction is placed on the value of τ by the acoustic approximation? [5]

3. (From Towne P15-18, pg 375) The homogeneous wave equation is

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 y}{\partial t^2}.$$

   For the boundary and initial conditions:

$$y(0,t) = A\cos\omega t, \qquad \frac{\partial y}{\partial x}(l,t) = 0;$$
$$y(x,0) = 0, \qquad \dot{y}(x,0) = 0,$$

   find the particular solution $y(x,t)$ of the homogeneous wave equation which satisfies them. [10]

4. (From Towne P15-24, pg 376) Let the initial conditions on a semi-infinite string be

$$y(0,t) = 0$$
$$\dot{y}(x,0) = \begin{cases} 0, & x < a, \\ v, & a < x < b, \\ 0, & b < x. \end{cases}.$$

   Find the Fourier integral representation of $y(x,t)$. [10]

Headstart for next week, Week 13, starting Monday 2004/12/13:
– Review notes, review texts, review assignments, learn material, do well on exam