PARTIAL DIFFERENTIAL EQUATIONS
SPRING 2012

ASSIGNMENT 2.2
DUE JANUARY 24

Exercise 1. Find the solution to the wave equation that satisfies the initial conditions

$$u(x,0) = e^{-x^2} \ , \ u_t(x,0) = \frac{x}{(1+x^2)^2} \ , \ -\infty < x < \infty.$$

Exercise 2. Show that the only solution to the wave equation that satisfies the initial conditions

$$u(x,0) = 0 \ , \ u_t(x,0) = 0 \ , \ -\infty < x < \infty$$

is the function $u = 0$.

Exercise 3. Textbook exercises 3.4.2 and 3.4.8. [*Note:* In both of these exercises the functions f and g giving the initial conditions are *already* odd and $2L$-periodic (why?), so they don't need to be "extended."]

Exercise 4. Textbook exercise 3.4.4.

Exercise 5. Show that d'Alembert's solution to the vibrating string problem satisfies

$$u\left(x, t + \frac{2L}{c}\right) = u(x,t)$$

for all x and t. That is, the solution is $2L/c$-periodic in t.

Exercise 6. Textbook exercise 3.4.15(c). [*Suggestion:* Graph the necessary extension of $f(x)$ and think about what happens as this graph is translated to the left and right.]