Homework 2: Wave equations
Math 456/556

1. Text, problem 1.2.1.

2. Text, problem 1.2.9. This is easiest by first making the change of variables in equation (3).

3. (*Step initial condition*) Consider the wave equation $u_{tt} = u_{xx}$ on the whole real line. Find the solution with the initial conditions $u(x, 0) = \text{sign}(x)$ and $u_t(x, 0) = 0$. Graph the solution at times $t = 0, 1, 2, 3$ to obtain a "movie" of what is happening.

4. Consider the equation

$$u_{xx} - 3u_{xt} - 4u_{tt} = 0.$$

A. Factor the operator as we did for the wave equation, and obtain two first order equations.
B. Find a general solution for u.
C. Find a d'Alembert - type formula using the initial conditions

$$u(x, 0) = u_0(x), \quad u_t(x, 0) = v_0(x).$$

5. Text, problem 2.2.5.