# AMATH 403/503 Homework Assignment #5

Due: May 27, 2019

1. Orthogonality of Bessel functions: Let



Show that 

2. Find the general solution to the 3-dimensional wave equation in infinite domain with spherical symmetry (i.e. does not depend on angles):



( )

By “general” solution, it is meant the solution before you apply the initial conditions. Hint: This is a one-dimensional wave equation and you can use the d’Alembert’s solution if you want.

(b) Identify which solution is the outgoing and which is the incoming, with respect to the origin, 

3. Consider the following nonhomogeneous system:

PDE: 

BC: 

IC:

Solve this problem in two ways

(a) by first finding the steady state solution to the nonhomogeneous equation and then the transient solution; the latter is the difference between the true solution and the steady state solution and should satisfy a homogeneous equation.

(b) by eigenfunction expansion; that is, expand the solution in the form of an infinite sum of eigenfunctions (in space) of the homogeneous system with unknown coefficient (which is a function of time) in front of each eigenfunction. Do the same for the forcing term, “1”. Then solve an ODE in time.