PHYS 703 - Bessel Functions.

1.

(a) Plot, **by hand**, the first few integer-indexed Bessel functions $J_m(x)$ and $N_m(x)$, as well as $I_m(x)$ and $K_m(x)$.

(b) Discuss under what circumstances you would pick the $(J_m(x), N_m(x))$ combination of solutions and when you would use the $I_m(x)$ and $K_m(x)$ solutions.

(c) What are the asymptotic forms of the above four Bessel functions? What do they tell you about the zeros of the functions at large values of their arguments?

(d) Write down the wave equation for the displacement of the surface of a drum as a function of ρ, ϕ and t. [You need not derive this equation, just start with it.] Use what you know about the Laplace equation in cylindrical coordinates to write down a general solution for this equation. Which combination of Bessel function solutions would you pick for the radial functions and why?