Physics 464/511   Homework #9
Due: Nov. 23, 2016 at 1:40 P. M.

For November 23 the assignment consists of two parts, first an ordinary homework, but with only one problem, to be done and handed in as usual for homeworks, individually.

The second part is a project, to be done in two groups of three, with higher standards, as was requested for Project 1. You need to form your groups, divide up the calculation, interact with the members of your group to polish it up, and present a single, consistent, neat, coherent, and preferably typeset submission.

I am willing to consider delaying the due date for the project to Wednesday November 23, in class. Note this will be on the Friday schedule, at 1:40.

The project is described separately as Project 2. Here is the one homework problem:

1   [10 pts]   Show, by direct differentiation, that

$$J_\nu(x) = \sum_{s=0}^{\infty} \frac{(-1)^s}{s!\,(s+\nu)!} \left(\frac{x}{2}\right)^{\nu+2s}$$

where $(s+\nu)!$ means $\Gamma(s+\nu+1)$ whether ν is an integer or not, satisfies the two recurrence relations

$$J_{\nu-1}(x) + J_{\nu+1}(x) \;=\; \frac{2\nu}{x} J_\nu(x)$$
$$J_{\nu-1}(x) - J_{\nu+1}(x) \;=\; 2J_\nu'(x)$$

[Note that we showed in class that Bessel's differential equation

$$x^2 J_\nu''(x) + x J_\nu'(x) + (x^2 - \nu^2) J_\nu(x) = 0,$$

follows from these two equations.]