Problem Set 3

Due: Thursday, September 27, at 5 pm.

1. Griffiths, 3.2
2. Griffiths, 3.10
3. Griffiths, 3.15
4. Griffiths, 3.19
5. Griffiths, 3.23. Finding all of the solutions is a subtle matter; keep in mind that you might have to treat the case in which the integer index (call it m) is zero separately from those cases where it is nonzero; in particular, there might be only one solution identified when $m = 0$, rather than two. When confronting such cases, go back to the original differential equation, set $m = 0$, and solve it directly to find both solutions.
6. Griffiths, 3.34. Solving this differential equation means coming up with an expression for v by direct integration, and then doing a second integration after separating variables to find t. You may wish to use the following integral:

$$\int \frac{u^2\,du}{\sqrt{d-u^2}} = -\frac{u\sqrt{d-u^2}}{2} + \frac{d}{2}\sin^{-1}\frac{u}{\sqrt{d}}. \tag{1}$$

7. Griffiths, 3.46