Physics 3344
Homework 1 17 Jan 2008
Due Tues, Jan 29

1. Read Marion through section 2.3 (Frames of Reference)

2. Marion (4th ed) Ch 1, Problems 1, 4, 8, 9(c) and (d), 11, 22

   Use the antisymmetric tensor ϵ_{ijk} to answer 11.

3. For a vector $\mathbf{r}$ at an angle α, β and γ with respect to the 1, 2, and 3 axes in cartesian coordinates, show:

   (a) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$.

   For a second vector at angles α', β' and γ', show that the angle θ between them satisfies

   (b) $\cos\theta = \cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma'$.

   (These are equations 1.10 and 1.11 in ed. 4.) If you use the properties of the dot product, you can do these in a few lines. If you use just trig, no telling.

4. Two useful properties of determinants are (1) the determinant of the product of matrices equals the product of their determinants, and (2) a matrix and its transpose have the same determinant. (Prove these first if you like; the properties of the antysymmetric tensor are useful.)

   (a) Use these facts to show that $|\boldsymbol{\lambda}| = \pm 1$.

   (b) Give a simple argument (a line or two) why it should be +1 for a proper rotation. (Think about what happens as you let the angles that specify the amount of rotation go to zero.)