Phys 410 – Homework #9

All problems from Taylor.

1) 10.15 (part (b) only)
2) 10.31 (a, b, & c)
3) 10.32 (a & b)
4) 10.35 (a & b)

Extra Credit (3 pts): The theory of rigid body rotations teaches us that all solid objects have three (or more) principal axes. Therefore, it is always possible to find a coordinate system where the three products of inertia are zero.

This is a remarkable fact. The mathematical proof is contained in Taylor's Appendix A.1, and it concerns the properties of real symmetric matrices. Unfortunately, the proof does not provide us with much insight. Can we find a more intuitive explanation about why this must be true?

Try it in two dimensions. Suppose we have a thin pancake object located in the xy plane. The origin is located arbitrarily; it may be within the object, or it may be outside the object. Argue that it must be possible to find a rotated coordinate system $x'y'$ where

$$I_{x'y'} = -\int x'y' dm = 0.$$

Optional problems, for further study. If you attempt one of these, we will read your solution and give you written feedback. No extra credit. Solutions will be posted.

5. 10.22
6. 10.23
7. 10.37
8. 10.38