PHYSICS 420 (SPRING 2006)
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HOMEWORK # 1
DUE TUESDAY, 2/7/06

PROBLEMS

1. **During the course we will often meet mathematical expressions of the type $(1+x)^n$ where $|x| << 1$. Show that in this case $(1+x)^n \approx 1+nx$, and that the next term that we usually ignore is $1/2n(n-1)x^2$. Explain all your steps. Assume nothing on the part of the grader.**

2. **In a laboratory frame of reference, an observer notes that Newton's 2nd law is valid. (a) Show that it is also valid for an observer moving at constant speed relative to the laboratory frame *(we did this in class)* & (b) Show that it is not valid in a reference frame moving past with constant acceleration.**

3. **SMM Chapter 1, Problem 3.**

4. **Generalize the Galilean transformation of coordinatestoo motion in three dimensions by showing that $\vec{r}\,' = \vec{r} - \vec{v}t$ and $t'=t$.**

5. ***Michelson– Morley experiment.* Show that we were justified in keeping only the first term of the binomial expansion when deriving the *expected* fringe shift. If you recall, Shift$=2L\nu^2/\lambda c^2$. In other words, calculate what the fringe shift would b if you kept the next term and compare it to the resolution of the experiment (σ_{Fringe}= .01 fringe). Are we justified?**

6. **Synchronized clocks are stationed at regular intervals, 1million km apart, along a straight line. When the clock next to you reads 12 noon. What time do you *see* (assuming you have a really powerful telescope) on the 90th clock down the line?**

7. **SMM Chapter 1, problem 10.**