In class today (9-1-00), I made three math errors. Please go back to correct your notes.

The first has to do with the time delays for the two orientation of the interferometer. I said that they were

$$\begin{aligned} \Delta T_0 &\approx \Delta T_{rest} + \frac{v^2}{c^2}\frac{2L_1 - L_2}{c} \\ \Delta T_{90} &\approx \Delta T_{rest} + \frac{v^2}{c^2}\frac{2L_2 - L_1}{c} \end{aligned}$$

It should have been

$$\begin{aligned} \Delta T_0 &\approx \Delta T_{rest} + \frac{v^2}{c^2}\frac{2L_1 - L_2}{c} \\ \Delta T_{90} &\approx \Delta T_{rest} - \frac{v^2}{c^2}\frac{2L_2 - L_1}{c} \end{aligned}$$

(the sign was wrong in the second expression).

Later, I wrote on the board that the fringe shift was given by

$$shift \propto \Delta T_0 - \Delta T_{90} \approx \frac{v^2}{c^2}(L_2 + L_1)$$

It should have been

$$shift \propto \Delta T = \Delta T_0 - \Delta T_{90} \approx \frac{v^2}{c^2}\frac{L_2 + L_1}{c}$$

(the units don't work out correctly the way I wrote it on the board).

Later, I said that the expresion for $\Delta T_0 - \Delta T_{90}$, without approximations, is given by

$$\begin{aligned} \Delta T_0 - \Delta T_{90} &= \frac{2L_1}{c}\frac{1}{1 - v^2/c^2} - \frac{2L_2}{c}\frac{1}{\sqrt{1 - v^2/c^2}} \\ &\quad -\frac{2L_1}{c}\frac{1}{\sqrt{1 - v^2/c^2}} + \frac{2L_2}{c}\frac{1}{1 - v^2/c^2} \end{aligned}$$

This expression is correct!!! At first, I said the first two terms come about from the 0^o orientation, and the second two terms come from the 90^o orientation. I then switched what I said. I was correct the first time!!!

Finally, I said that the length in the moving frame (in which Michelson did the experiment) is contracted to fix the 'problem' with classical relativity. That is, I said that

$$L(v) = \frac{L(0)}{\sqrt{1 - v^2/c^2}},$$

where $L(0)$ is the length as measured in the stationary frame. This is wrong!!! I had it inverted!!!! It should be

$$L(v) = L(0)\sqrt{1 - v^2/c^2}.$$

This properly explains Michelson's experimental result that $\Delta T = 0$ (no shift in fringes).