

## Practice Problems Related to Relativity

1. Show explicitly that  $-c^2 dt^2 + dx^2 + dy^2 + dz^2 = -c^2 dt'^2 + dx'^2 + dy'^2 + dz'^2$  if the primed and unprimed frames are related by equation (2) in the notes.
2. The rest-frame mean lifetime of a muon is  $2.2 \times 10^{-6}$  seconds. In that time, light travels approximately  $3 \times 10^4$  cm. Determine the speed needed for the mean muon to survive a trip along a  $5 \times 10^5$  cm linear track (we assume the speed is constant). Analyze that trip in the frame of the muon, and in the frame of an observer standing by the side of the track; note that both must conclude that the muon will reach the end of the track, but they have different interpretations about why it is possible.