

Additional problems for chapter 6

October 2, 2015

1. Approximate equation (6.26) for the case in which $X'^2 \ll L^2$. Note: You may have to use $(1 + \epsilon)^n \approx 1 + n\epsilon$ more than once to complete the approximation. Keep only terms proportional to X'/L and drop any terms containing $(X'/L)^2$ and higher.
2. A satellite is in low earth orbit, 200 km above the surface of the earth.
 - (a) From the perspective of the satellite, is a clock on the surface of the earth running faster or slower than a clock on the satellite? (Ignore the normal Doppler shift due to the velocity of the satellite.)
 - (b) Compute the fractional frequency difference $\delta \equiv (\omega_{sat} - \omega_{earth})/\omega_{sat}$ between the satellite and the earth in this case. Note: To carry out the calculation, you may need to use the approximate equation derived in the previous problem. Recall that $L = c^2/a$ where the acceleration a is equated to the earth's gravitational field g .