ASTR340 (Fall 2018) Homework 1
Early ideas and the Newtonian Universe

(Due at the start of class on the 13th Sept 2018)

Foundations of Modern Cosmology 2nd Ed. (FMC),
1) FMC, Q3.1
2) FMC, Q3.4
3) FMC, Q3.5
4) FMC, Q3.6
5) FMC, Q3.9

6) Briefly explain why Newton's laws of motion and gravity are more fundamental than Kepler's laws of planetary motion.

7) The Earth goes around the Sun in an elliptical orbit with a period of P=365.256 days at a semi-major axis of R=149,597,871 kilometers. Use the appropriate equation from the lectures to work out a precise mass for the Sun. ***[Hint: you will need to convert the above numbers to basic "SI" units, i.e., seconds and meters, respectively. You will also need to know that the value of the Newton's Constant of Gravitation in "SI" units is*** $G=6.673\times10^{-11}$ $N\ m^2\ kg^{-2}$***]***

8) You decide to try a new propulsion system. At the nearest ice rink, while wearing your skates, you try throwing baseballs. Every time you throw a ball, the reaction moves you in the opposite direction. Assume a baseball's mass is 0.145 kg and your mass is constant at 80 kg. You are pretty good at throwing, and you consistently reach speeds of 100 km per hour for the balls.
A. How fast do you move after you throw your first baseball? (Assume there is no friction)
B. After this disappointing first result, and because you know about Galilean transformations, you decide that you can keep adding to your velocity by throwing more balls. How many baseballs do you have to throw to reach "walking speed" (6 km per hour). Again, neglect the effect of friction.