Problem 8.2

I want you to evaluate the situation for $R = 6800$ km, $f = 0.04$, $n_s = 2$ and $n_a = 2$.

a) How many km are Mary and Peter apart (measured along the circumference of their orbit)?

b) Will Peter have to throw the sandwich backwards or forward (relative to his orbital velocity).

c) How many hours will it take before Mary will make the catch?

d) Calculate the length of the semi-major axis of the sandwich's orbit and compare this with R.

e) Make a sketch of the orbit of Peter (and Mary) and of the sandwich. Indicate point X (the point of release) and the direction of motion in both orbits.

f) Calculate the velocity v_s - v_a with which Peter will have to throw the sandwich. If this is in excess of what a human can do (a baseball pitcher can throw ~90 miles/h), suggest (without further calculations) numbers (integers) for n_a and n_s which you think might work.

I only request a 3-digit precision for your answers. For the sandwich to actually "hit" Mary's spacecraft would require a very high precision of the earth's mass, of G and of various perturbing forces that we have ignored.

Also, for a "catch", the direction in which Peter will have to throw relative to his orbital velocity will have to be 0° (or 180°?) to an extremely high precision.

I hope this was useful.

walter lewin