Pod J: Finding the mass of the sun

This pod is made to be completed with the problem set *Finding the Mass of the Sun*

Quiz

-This questions will ask you to derive new formulas for circular motion.
You must not only find correct answers but defend them.
For every formula you use, please write this formula in its canonical form before completing any algebraic operations.
When you make a substitution, please describe briefly in words why you made this particular substitution.

In space, one astronomical object revolves in a nearly circular orbit of radius *r* around another object of mass *M* with a period *T*.
The object of mass *M* is much greater and is not affected by the mass of the first object.

1. Derive an equation for *M* in terms of the universal gravitational constant, the radius of orbit r, and the period T.

2. Demonstrate that the equation you derived in dimensionally correct.
Note that you must know the correct units for the universal gravitational constant to complete this.

3. Write each of the formulas used in your derivation in its canonical form.
Identify in one sentence why this equation was relevant.
For each mass variable in these equations, identify it as inertial or gravitational mass.

4. The procedure for the derivation involves setting two seemingly disparate formulas equal to each other. Write about 3 -4 sentences and draw a well-labeled diagram defending this decision. Your defense should refer to the principles of circular motion and use proper vocabulary of circular motion.

5. Explain why the mass of the moving object is not a part of this operation. To do so, make use of the terms *inertial mass* and *gravitational mass*.

6. This procedure is used to find the mass of any object in space, as long as something is orbiting it, *with some conditions*. Refer to one of Kepler's Three Laws of Planetary Motion. Describe when this procedure can be used, and when it cannot.