WORKSHEET 32

1. Let $\mathbf{R}$ be the position vector of an object moving in a central force field. Compute

$$\frac{d}{dt}(\mathbf{R} \times \mathbf{R}').$$

   Why is this significant?

2. Kepler's first law shows us that the path of an object moving in an inverse square central force field is a conic section.

   a) The phrase "inverse square central force field" is a mouthfull. State exactly what this means.

   b) What are the different shapes of the conic sections. Give algebraic conditions for when the object's path will be each of these shapes. Then interperet those conditions physically.

   c) Consider a central force field in which an object is placed at some distance from the origin with no initial velocity. What will happen? Does this path fit Kepler's first law?

3. Our formulation of Kepler's first law gives the path of a planet moving about the sun, but cannot be used to predict the position at a given time. How could you determine a planet's position at a given time t.

4. If the force of gravity acts on all bodies in proportion to their masses, why doesn't a heavy body fall correspondingly faster than a light body?

5. State the two differential equations that lead to Kepler's laws and explain how they are a result of Newton's laws.

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