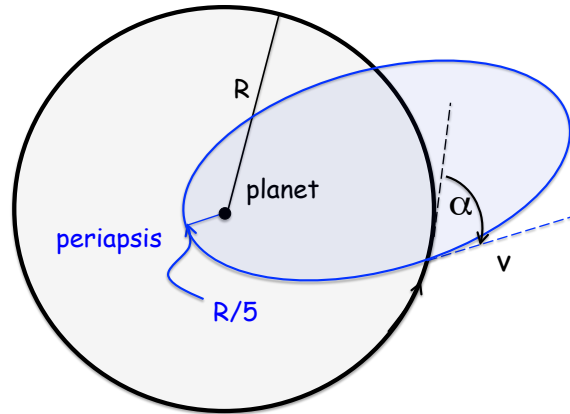## Section A. Mechanics

1. A satellite of mass m moves in a circular orbit of radius R about a much more massive planet (of unspecified mass). The satellite has speed v.

At a specific point in the satellite's circular orbit, the velocity of the satellite is abruptly rotated without changing the magnitude of its velocity. (The nature of this external impulse is not specified.) As shown in the figure, this causes the satellite to enter an elliptical orbit with its distance of closest approach = $R/5$. (This point in the elliptical orbit is called the periapsis in general.) The elliptical orbit is in the same plane as the circular orbit.

   (a) What is the speed v_p of the satellite at the periapsis in terms of v?

   (b) Through what angle α was the satellite turned? See figure for the definition of α.