A spherical non-rotating planet (with no atmosphere) has mass $m_1$ and radius $r_1$. A projectile of mass $m_2 << m_1$ is fired from the surface of the planet at a point A with a speed $v_A$ at an angle $\alpha = 30^\circ$ with respect to the radial direction. In its subsequent trajectory the projectile reaches a maximum altitude at point B on the sketch. The distance from the center of the planet to the point B is $r_2 = (5/2)r_1$.

a) Is there a point about which the angular momentum of the projectile is constant? If so, use this point to determine a relation between the speed $v_B$ of the projectile at the point B in terms of $v_A$ and the angle $\alpha$.

b) Determine the initial speed, $v_A$, in terms of $G$, $m_1$, and $r_1$. 