[mex220] From sliding to rolling motion

A billiard ball (rigid homogeneous sphere of mass $m$ and radius $R$) is initially at rest on a flat table. A cue then imparts a horizontal impulse $P$ in a very short time at height $R$. The coefficient of kinetic friction between table and ball is $\mu$. (a) Find the time $t_r$ that elapses before the motion of the billiard ball turns into pure rolling. (b) Find the speed $v_r$ of the rolling billiard ball.

Solution: