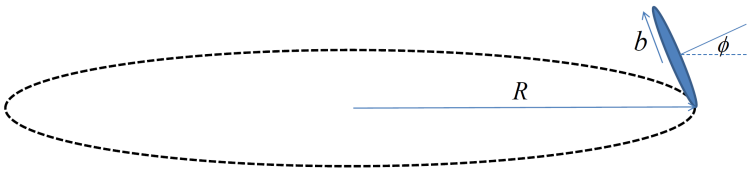
2. (Rolling Coin)



A coin (uniform solid cylinder) of mass M and radius b rolls without slipping on a horizontal table such that the axis perpendicular to its face makes a constant angle ϕ with respect to the table top (see diagram). The point of contact moves in a counter-clockwise (as viewed from above) circular path of radius R with constant linear speed v. What is the relationship between ϕ and the given quantities? In your solution, do **not** assume that ϕ is a small angle.