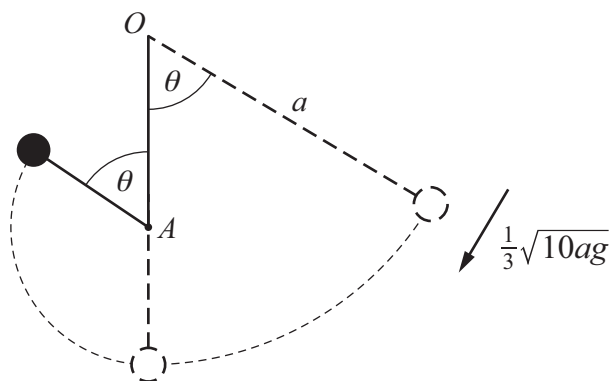




6



A particle P of mass m is attached to one end of a light inextensible string of length a . The other end of the string is attached to a fixed point O . The particle P is held with the string taut and the string makes an angle θ with the downward vertical through O . The particle P is projected at right angles to the string with speed $\frac{1}{3}\sqrt{10ag}$ and begins to move downwards along a circular path. When the string is vertical, it strikes a small smooth peg at the point A which is vertically below O . The circular path and the point A are in the same vertical plane. After the string strikes the peg, the particle P begins to move in a vertical circle with centre A . When the string makes an angle θ with the upward vertical through A the string becomes slack (see diagram). The distance of A below O is $\frac{5}{9}a$.

- (a) Find the value of $\cos \theta$. [6]

This image shows a full page of blank handwriting practice paper. It features ten sets of horizontal lines, each consisting of three parallel lines: a solid top line, a dashed middle line, and a solid bottom line. These lines are evenly spaced across the entire page, providing a guide for letter height and placement. The background is white, and there are no margins or additional markings.



- (b) Find the ratio of the tensions in the string immediately before and immediately after it strikes the peg. [4]

