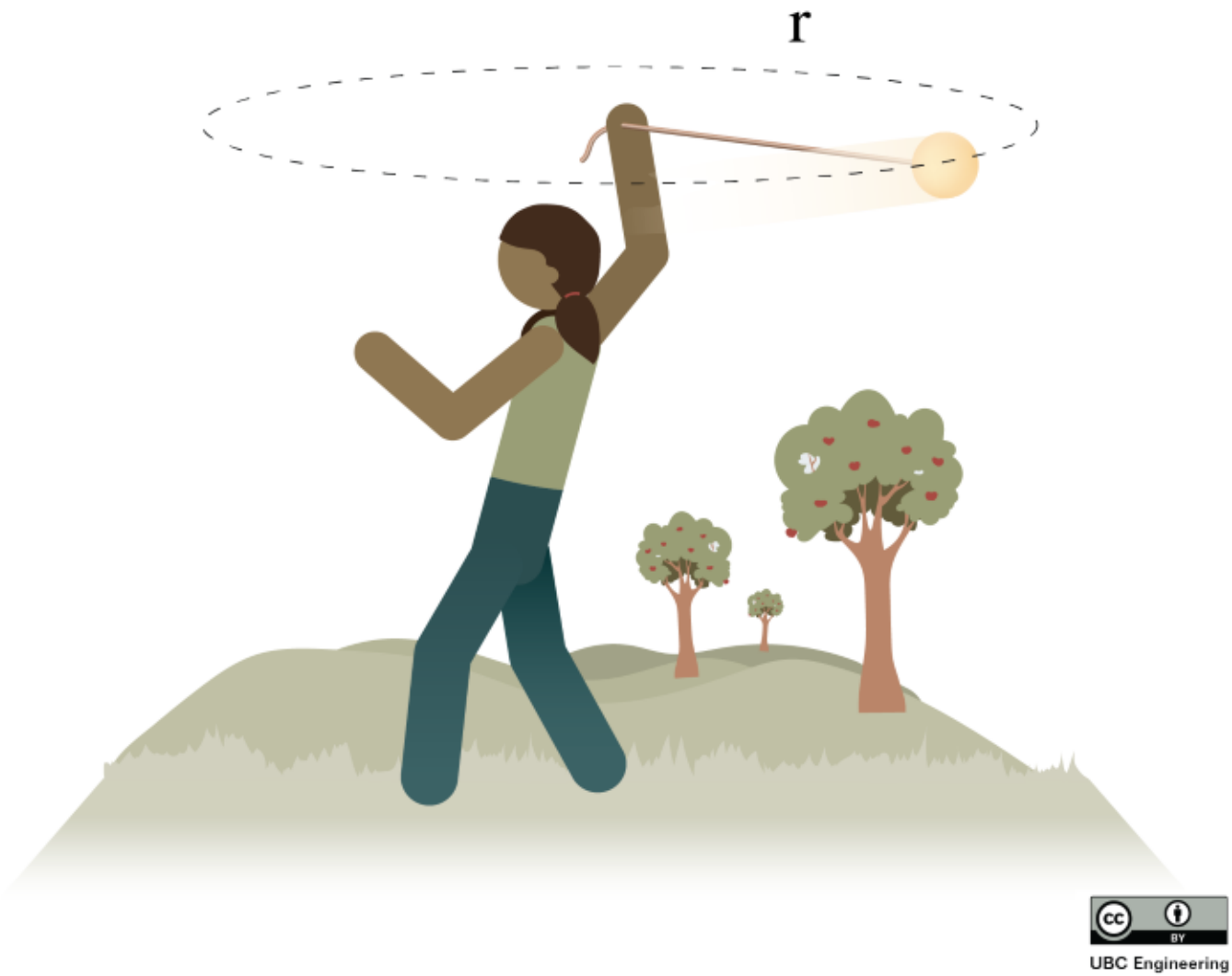
21-P-MOM-GD-009



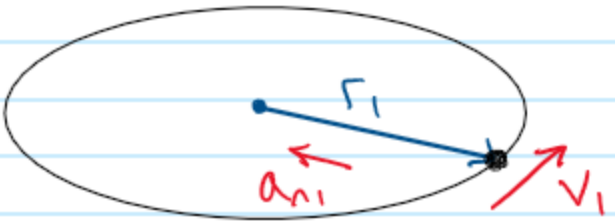
A child is swinging a ball attached to a rope in a circle. The radius of curvature is initially $\vec{r}_1$ m, then the child briefly loosens their grip on the rope, extending the radius to $\vec{r}_2$ m, lowering the ball's speed to $\vec{v}_2$ m/s. What was the ball's centripetal acceleration before the rope is extended?

(Neglect the effect of gravity, assume the motion is purely in the horizontal plane)

given r_1, r_2, V_2

find a_{n_1}

state 1



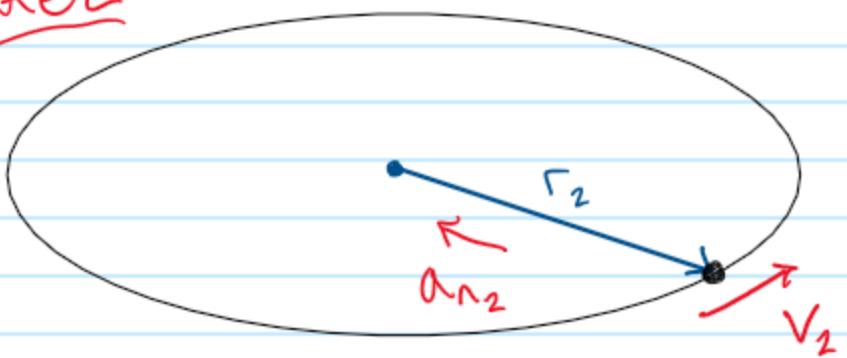
Conservation of Angular Momentum

$$H_1 + \Sigma \int M\,dt = H_2$$

$$r_1 M V_1 = r_2 M V_2$$

$$V_1 = \frac{r_2 V_2}{r_1}$$

state 2



Find Acceleration

$$a = \frac{V_1^2}{r_1}$$