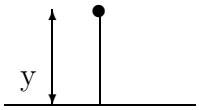
Question
A rubber ball is dropped from rest onto a tile floor a distance h_1 away. The ball bounces up to a height h_2. What is the coefficient of restitution?

Answer
The ball falls under gravity:



By Newton's 2nd law:

$$\begin{aligned} m\ddot{y} &= -mg \\ mv\frac{dv}{dy} &= -mg \quad (v = \dot{y}) \\ \frac{1}{2}v^2 &= -gy + gh_1 \end{aligned}$$

Hence on impact with the floor $v = v_0 = \sqrt{2gh_1}$
Also if the ball has speed v_1 (upwards) just after impact, $v_1 = \sqrt{2gh_2}$
Now by differentiation $v_1 = ev_0 \Rightarrow e = \dfrac{v_1}{v_0} = \sqrt{\dfrac{h_2}{h_1}}$