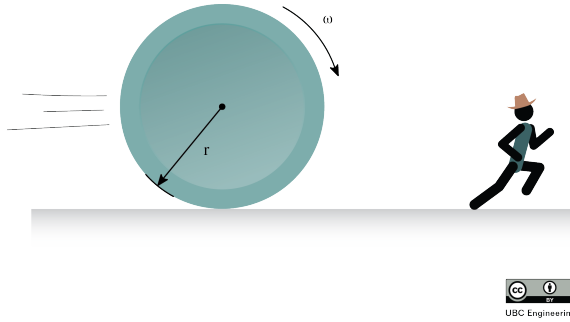# 22-R-IM-TW-31

An archaeologist is running away from a 4000 kg cylindrical boulder. If the boulder rolls with an angular speed of $\omega = 4$ rad/s without slipping and has a radius of $r = 1.5$ m, what is the linear and angular momentum of the boulder?

Solution:

$$I_G = \frac{1}{2}mr^2 = \frac{1}{2}(4000)(1.5)^2 = 4500 \ [\text{kg} \cdot \text{m}^2]$$

$$\vec{H}_G = I_G\vec{\omega} = (4500)(-4\hat{k}) = -18000\hat{k} \ [\text{kg} \cdot \text{rad/s}]$$

$$v_G = \omega r = (4)(1.5) = 6 \ [\text{m/s}]$$

$$\vec{L} = m\vec{v}_G = (4000)(6\hat{i}) = 24000\hat{i} \ [\text{kg} \cdot \text{m/s}]$$