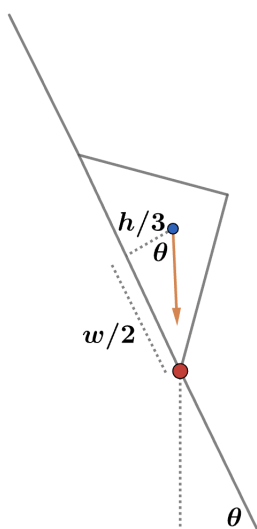# 2016 F=ma Exam: Problem 20

Kevin S. Huang

Recall the slip angle on an incline is given by

$$\tan \theta_{\text{slip}} = \mu$$

where μ is the coefficient of friction.

To find the tipping angle, note that when the triangle is about to topple over, the normal force and friction only act at the bottom right corner. If we choose this point as our pivot point, then only the weight of the triangle contributes to the torque.

At the threshold of toppling, the torque is zero so the CM lies over the pivot point (for the weight to have no moment arm). Recall the CM of a triangle is a third of the height away from the base. Then using similar triangles,

$$\tan \theta_{\text{tip}} = \frac{w/2}{h/3} = \frac{3w}{2h} = 3$$

since we are given $w = 2h$. To topple before sliding requires

$$\theta_{\text{slip}} \geq \theta_{\text{tip}}$$
$$\tan \theta_{\text{slip}} \geq \tan \theta_{\text{tip}}$$
$$\mu \geq 3$$

so the answer is $\boxed{\text{E}}$.