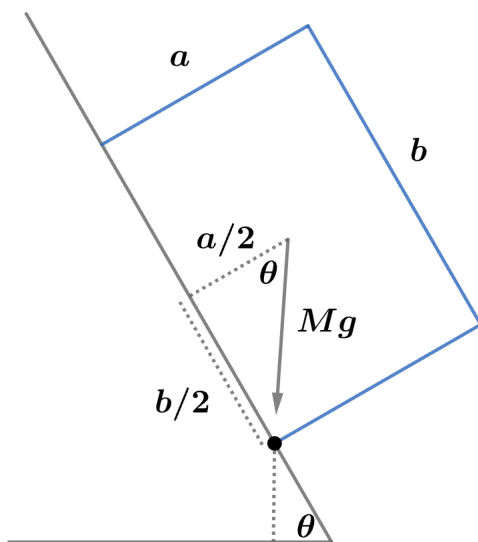# 2009 F=ma Exam: Problem 24

Kevin S. Huang

Recall the slip angle on an inclined plane is given by

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

To find the tip angle, note that when the block is about to tip over, the only point in contact with the plane is the bottom corner. If we choose this as our pivot point, then the block's weight is the only force that contributes to the torque.

For the block to stay at rest, there should be no torque. This means the weight vector (acting at the center of mass) should pass through the pivot point to have zero moment arm. By using similar triangles in the figure, we find

$$\tan \theta_{\text{tip}} = \frac{b/2}{a/2} = \frac{b}{a}$$

To tip over first, we need

$$\theta_{\text{tip}} < \theta_{\text{slip}}$$
$$\tan \theta_{\text{tip}} < \tan \theta_{\text{slip}}$$
$$\frac{b}{a} < \mu_s$$

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