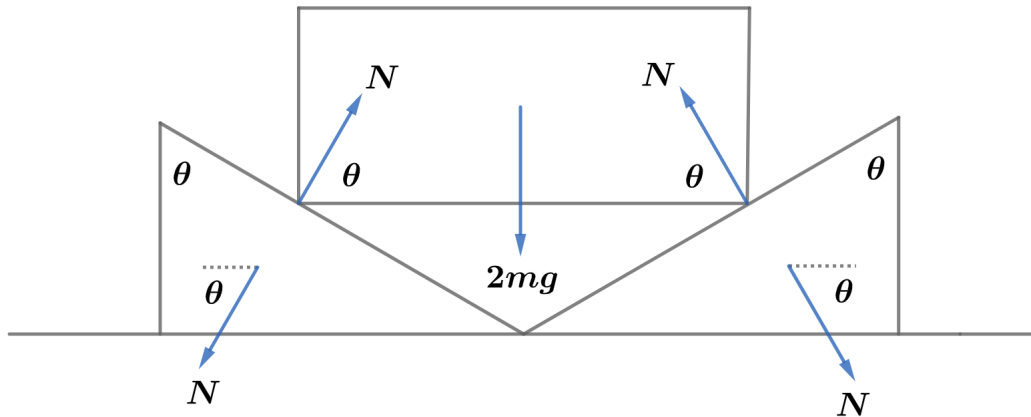


# 2022A F=ma Exam: Problem 22

Kevin S. Huang

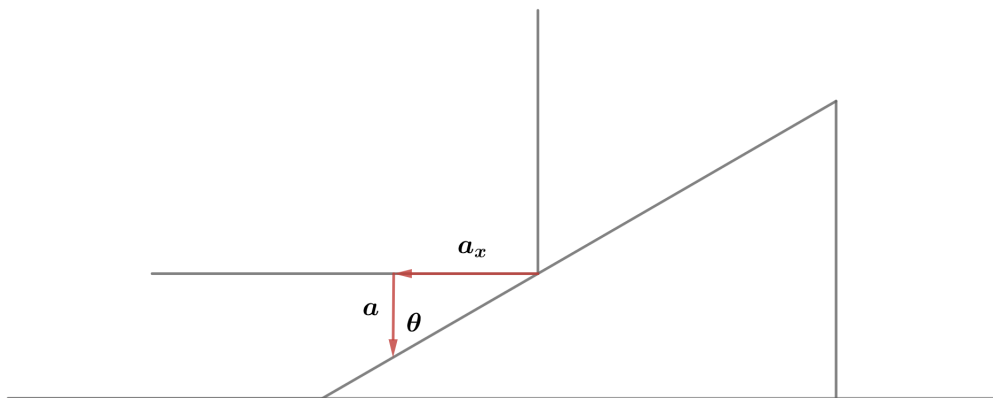


Applying Newton's 2nd law to the block, we have

$$2mg - 2N \sin \theta = 2ma$$

For an inclined plane, we have

$$N \cos \theta = ma_x$$



In the frame of the plane, the block has horizontal acceleration  $a_x$  and vertical acceleration  $a$ . To stay on the plane, we have the constraint:

$$\tan \theta = \frac{a_x}{a}$$

Thus,

$$N \cos \theta = ma \tan \theta$$
$$N = \frac{ma \sin \theta}{\cos^2 \theta}$$

Substituting into the first equation,

$$2mg - 2 \left( \frac{ma \sin \theta}{\cos^2 \theta} \right) \sin \theta = 2ma$$
$$2mg = 2ma(1 + \tan^2 \theta) = 2ma \sec^2 \theta$$

The acceleration of the block is

$$a = g \cos^2 \theta$$

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