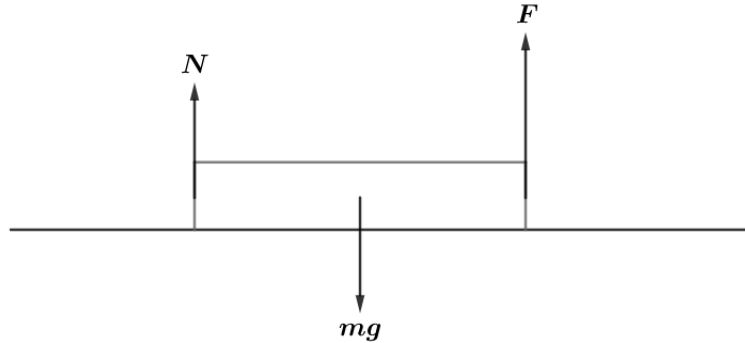


2018A F=ma Exam: Problem 9

Kevin S. Huang



Applying our force equation,

$$F + N - Mg = Ma$$

Applying our torque equation about the contact point (left end),

$$FL - Mg\frac{L}{2} = \tau = I\alpha = \frac{1}{3}ML^2\alpha$$

with

$$\alpha = \frac{a}{L/2}$$

Thus,

$$F = \frac{1}{3}ML\alpha + \frac{1}{2}Mg = \frac{2}{3}Ma + \frac{1}{2}Mg$$

$$N = Ma + Mg - F = \frac{1}{3}Ma + \frac{1}{2}Mg$$

Our constraint is $0 < a < g$. Therefore,

$$\frac{1}{2}Mg < N < \frac{5}{6}Mg$$

so N satisfies

$$\frac{Mg}{2} < N < Mg$$