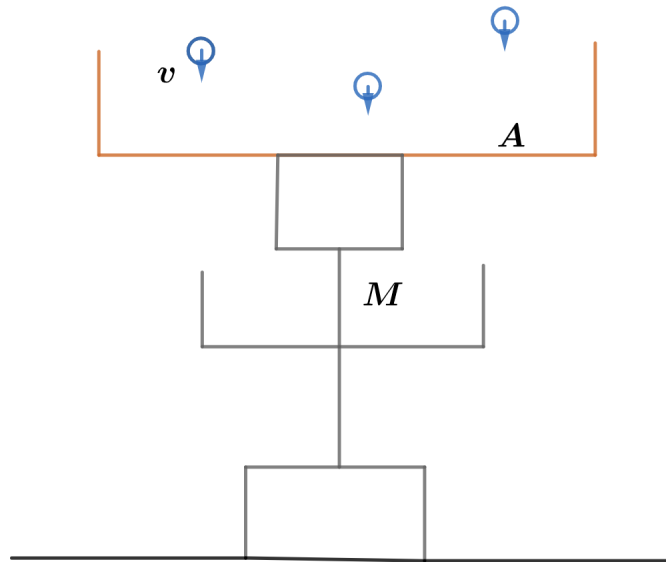# 2020A F=ma Exam: Problem 17

Kevin S. Huang

The normal force holds up the weight of the giant, the weight of the water accumulated, and changes the momentum of the incoming rain. Thus,

$$N = Mg + mg + \frac{\Delta p}{\Delta t}$$

We have

$$m = \rho V = \rho(Art)$$

where r is the rate of accumulation. For a given amount of rain, the velocity is brought to zero on impact with the hat.

$$\Delta p = \Delta m\, v$$

Using the mass accumulation rate,

$$\frac{\Delta p}{\Delta t} = \frac{\Delta m}{\Delta t} v = (\rho Ar)v$$

Thus,

$$N = Mg + \rho Argt + \rho Arv = 5000 + 10t + 1 = \boxed{5001 + t}$$