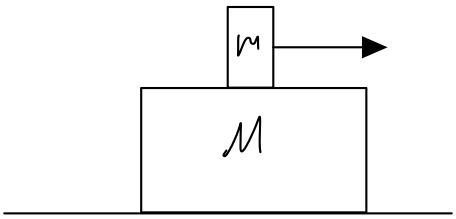
(1)

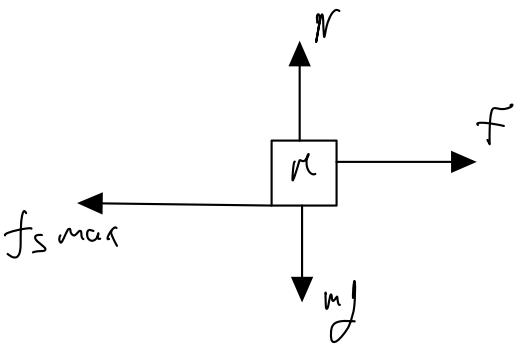
Given μ

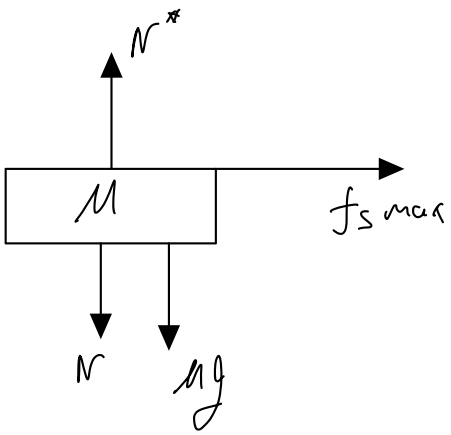


frictionless floor

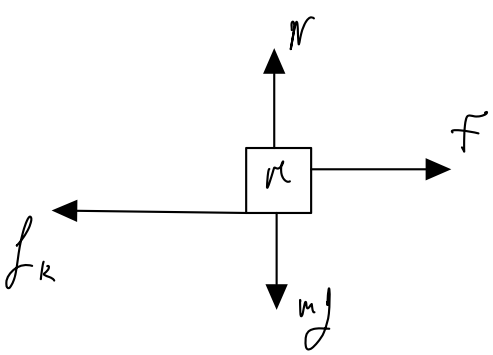
what is the minimum F required to start the block m to slide on block M

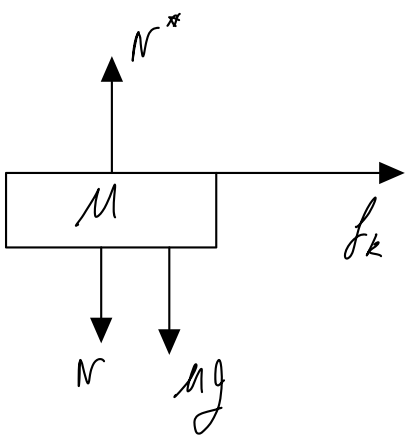
free diagram body





The two blocks will move as 1 block with same acceleration untill $F > f_{smax}$ and:





and the blocks will move with two different acceleration.

So i would solve:

$$\sum F_x = ma$$

$$\sum F_y = 0$$

$$N - mg = 0$$

$$N = mg$$

(1) $F_{minimum} - f_{s\,max} = ma$

(2) $f_{s\,max} = Ma \longrightarrow \frac{f_{s\,max}}{M} = a$

(3) $f_{s\,max} = \mu_{s\,max} \cdot mg$

$$F_m - f_{s\,max} = m \cdot \frac{f_{s\,max}}{M}$$

$$F_m = f_{s\,max}\left(1 + \frac{m}{M}\right)$$

(3) $\longrightarrow$ $F_m = \mu_{s\,max}\, mg\left(1 + \frac{m}{M}\right)$