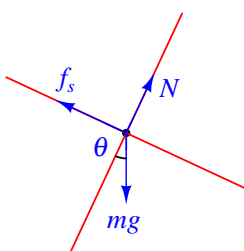
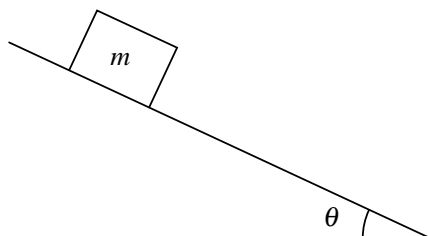


2. (25 pts) An object with mass m is placed on a rough surface. In order to determine the coefficient of static friction (μ_s), the incline of the surface is slowly increased to angle θ at which the object just barely starts to slide (at this angle, static friction has reached its greatest value). Determine the coefficient of static friction (assume that m and θ are “given” values).



First, make a free-body diagram of the box, as shown above. Then, since we know that at angle θ the box just barely starts to move, the net force on it is still zero. So use Newton's 2nd Law to sum the forces and set them equal to zero.

$$F_y = N - mg \cos \theta = 0$$

$$F_x = f_s - mg \sin \theta = 0$$

Of course, we need to know f_s before we can solve for μ_s . So solve the y component for N , and calculate the frictional force:

$$N = mg \cos \theta$$

$$f_s = \mu_s N = \mu_s mg \cos \theta$$

Now substitute this into the x component equation, giving

$$\mu_s mg \cos \theta - mg \sin \theta = 0$$

Solving for μ_s gives

$$\mu_s = \frac{\sin \theta}{\cos \theta} = \tan \theta$$