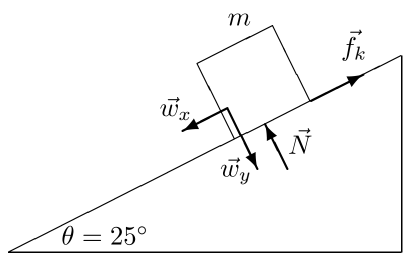
67. In the figure below, $m = 140/9.8 = 14.3$ kg is the mass of the child. We use $\vec{w}_x$ and $\vec{w}_y$ as the components of the gravitational pull of Earth on the block; their magnitudes are $w_x = mg\sin\theta$ and $w_y = mg\cos\theta$.



(a) With the x axis directed up along the incline (so that $a = -0.86\ \text{m/s}^2$), Newton's second law leads to

$$f_k - 140\sin 25° = m\,(-0.86)$$

which yields $f_k = 47$ N. We also apply Newton's second law to the y axis (perpendicular to the incline surface), where the acceleration-component is zero:

$$N - 140\cos 25° = 0 \implies N = 127\ \text{N}\ .$$

Therefore, $\mu_k = f_k/N = 0.37$.

(b) Returning to our first equation in part (a), we see that if the downhill component of the weight force were insufficient to overcome static friction, the child would not slide at all. Therefore, we require $140\sin 25° > f_{s,\,\text{max}} = \mu_s N$, which leads to $\tan 25° = 0.47 > \mu_s$. The minimum value of μ_s equals μ_k and is more subtle; reference to §6-1 is recommended. If μ_k exceeded μ_s then when static friction were overcome (as the incline is raised) then it should start to move – which is impossible if f_k is large enough to cause deceleration! The bounds on μ_s are therefore given by $\tan 25° > \mu_s > \mu_k$.