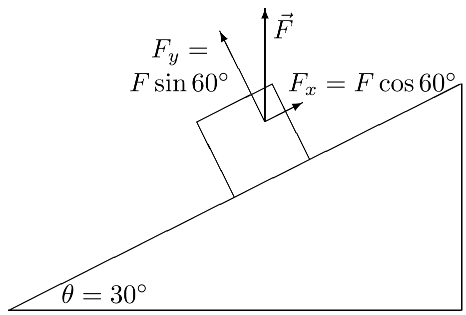
85. (Third problem in **Cluster 1**)

The coordinate system we wish to use is shown in Figure 5-18(c) in the textbook, so we resolve this vertical force into appropriate components.



(a) Assuming the block is not pulled entirely off the incline, Newton's second law applied to the x axis yields

$$F_x - mg \sin\theta = ma \ .$$

This leads to $a = -1.9\,\text{m/s}^2$, which we interpret as a acceleration of $1.9\,\text{m/s}^2$ directed *downhill*.

(b) The assumption stated in part (a) implies there is no acceleration in the y direction. Newton's second law along the y axis gives

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

Therefore, $N = 32.9$ N. We note that a negative value of N would have been a sure sign that our assumption was incorrect.

(c) The equation in part (a) can be used to solve for the equilibrium ($a = 0$) value of F:

$$F \cos 60° = mg \sin 30° = 49 \text{ N} \ .$$

Therefore, $F = 98$ N.

(d) There are three forces acting on the block: $\vec{N}, \vec{F}$, and $m\vec{g}$. Equilibrium generally suggests that the "vector triangle" formed by three such vectors closes on itself. In this case, however, two sides of that "triangle" are vertical! $\vec{F}$ is *up* and $m\vec{g}$ is *down*! The insight behind this "squashed triangle" is that $\vec{N}$ (the only vector that is not vertical) has zero magnitude. Thus, the block is not "bearing down" on the incline surface. In fact, in this circumstance, the incline is not needed at all for support; the value $F = 98.0$ N is just what is needed to hold the block (which weighs 98.0 N) aloft.