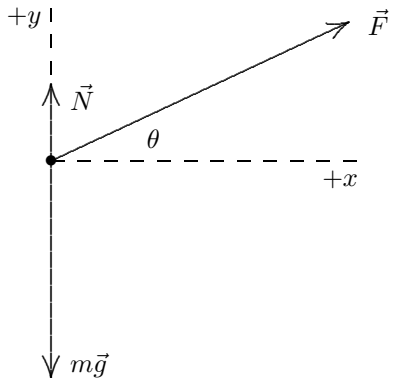
49. The force diagram (not to scale) for the block is shown below. $\vec{N}$ is the normal force exerted by the floor and $m\vec{g}$ is the force of gravity.

(a) The x component of Newton's second law is $F\cos\theta = ma$, where m is the mass of block and a is the x component of its acceleration. We obtain

$$a = \frac{F\cos\theta}{m} = \frac{(12.0\,\text{N})\cos 25.0^\circ}{5.00\,\text{kg}} = 2.18\,\text{m/s}^2\,.$$

This is its acceleration provided it remains in contact with the floor. Assuming it does, we find the value of N (and if N is positive, then the assumption is true but if N is negative then the block leaves the floor). The y component of Newton's second law becomes $N + F\sin\theta - mg = 0$, so $N = mg - F\sin\theta = (5.00)(9.8) - (12.0)\sin 25.0^\circ = 43.9\,\text{N}$. Hence the block remains on the floor and its acceleration is $a = 2.18\,\text{m/s}^2$.



(b) If F is the minimum force for which the block leaves the floor, then $N = 0$ and the y component of the acceleration vanishes. The y component of the second law becomes $F\sin\theta - mg = 0$, so

$$F = \frac{mg}{\sin\theta} = \frac{(5.00)(9.8)}{\sin 25.0^\circ} = 116\ \text{N}\,.$$

(c) The acceleration is still in the x direction and is still given by the equation developed in part (a):

$$a = \frac{F\cos\theta}{m} = \frac{116\cos 25^\circ}{5.00} = 21.0\ \text{m/s}^2\,.$$