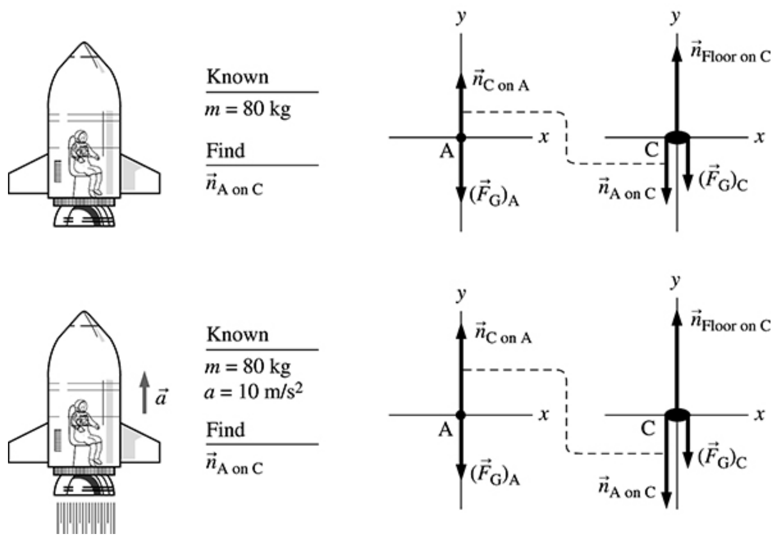
7.7. Model: We will model the astronaut and the chair as particles. The astronaut and the chair will be denoted by A and C, respectively, and they are separate systems. The launch pad is a part of the environment.

Visualize:

Pictorial representation



Solve: **(a)** Newton's second law for the astronaut is

$$\sum (F_{\text{on A}})_y = n_{\text{C on A}} - (F_G)_A = m_A a_A = 0\text{ N} \Rightarrow n_{\text{C on A}} = (F_G)_A = m_A g$$

By Newton's third law, the astronaut's force on the chair is

$$n_{\text{A on C}} = n_{\text{C on A}} = m_A g = (80\text{ kg})(9.8\text{ m/s}^2) = 7.8 \times 10^2\text{ N}$$

(b) Newton's second law for the astronaut is:

$$\sum (F_{\text{on A}})_y = n_{\text{C on A}} - (F_G)_A = m_A a_A \Rightarrow n_{\text{C on A}} = (F_G)_A + m_A a_A = m_A (g + a_A)$$

By Newton's third law, the astronaut's force on the chair is

$$n_{\text{A on C}} = n_{\text{C on A}} = m_A (g + a_A) = (80\text{ kg})(9.8\text{ m/s}^2 + 10\text{ m/s}^2) = 1.6 \times 10^3\text{ N}$$

Assess: This is a reasonable value because the astronaut's acceleration is more than g.