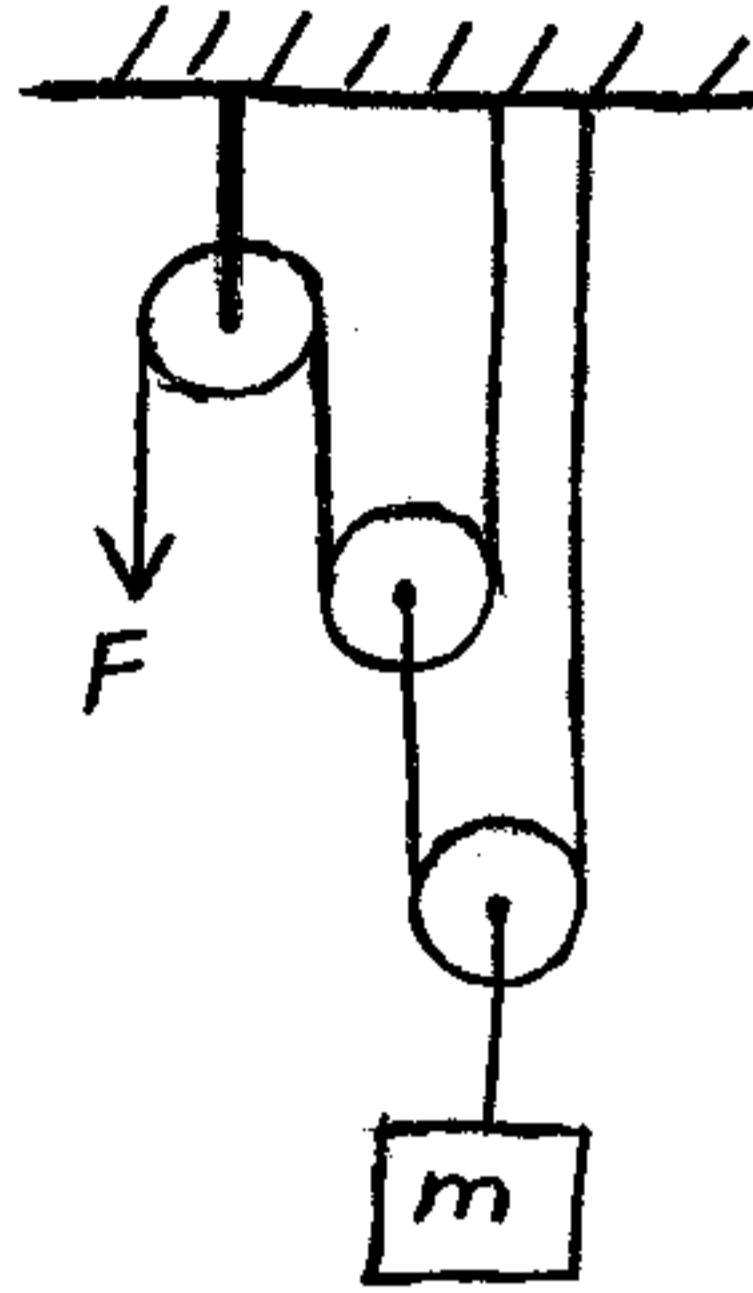
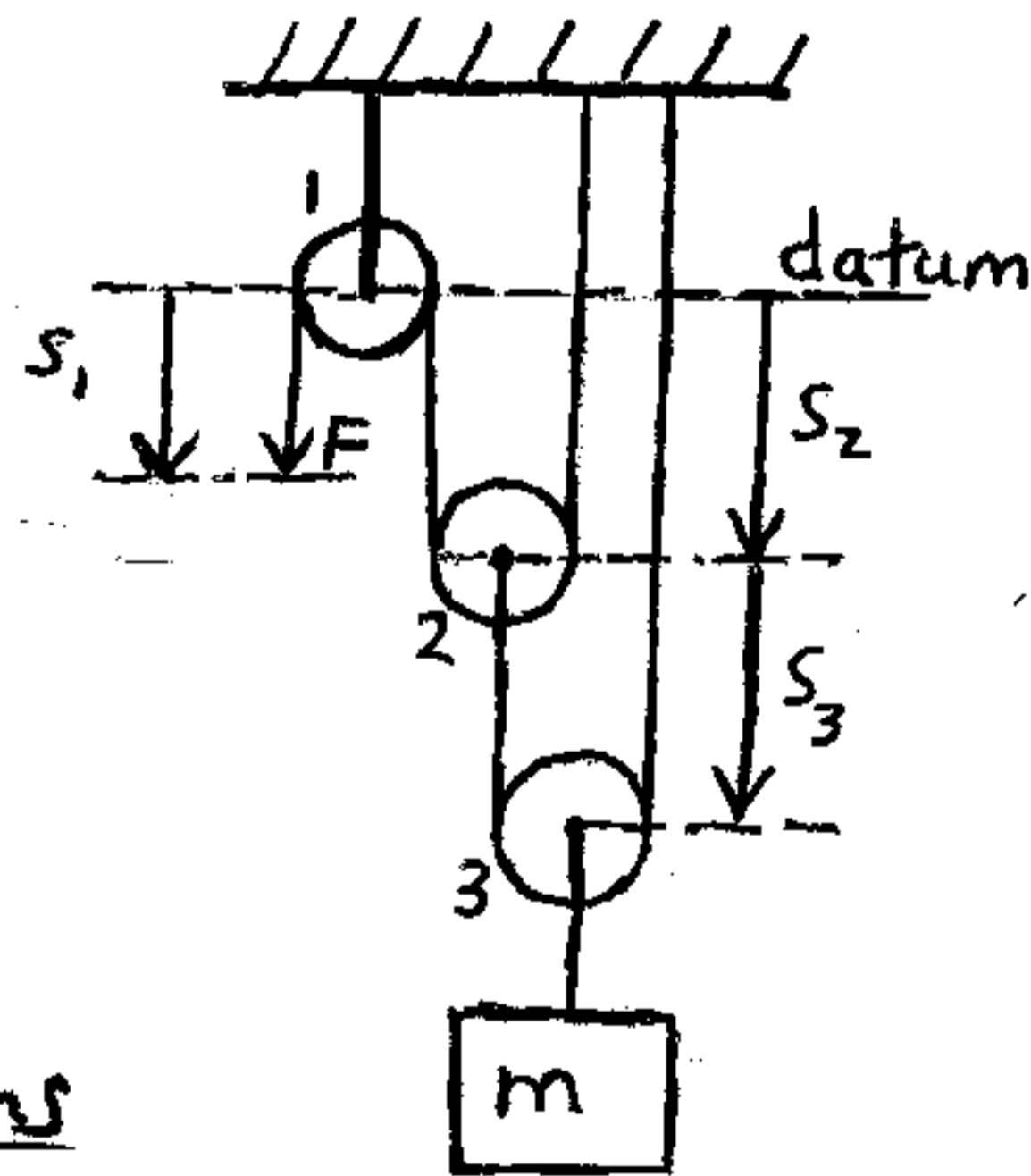


This is a force and motion problem involving pulleys.



In the pulley system shown, block  $m$  has a mass of 16 kg. What is the constant force  $F$  that must be applied to the rope so that the block has an upward acceleration of  $2 \text{ m/s}^2$ .

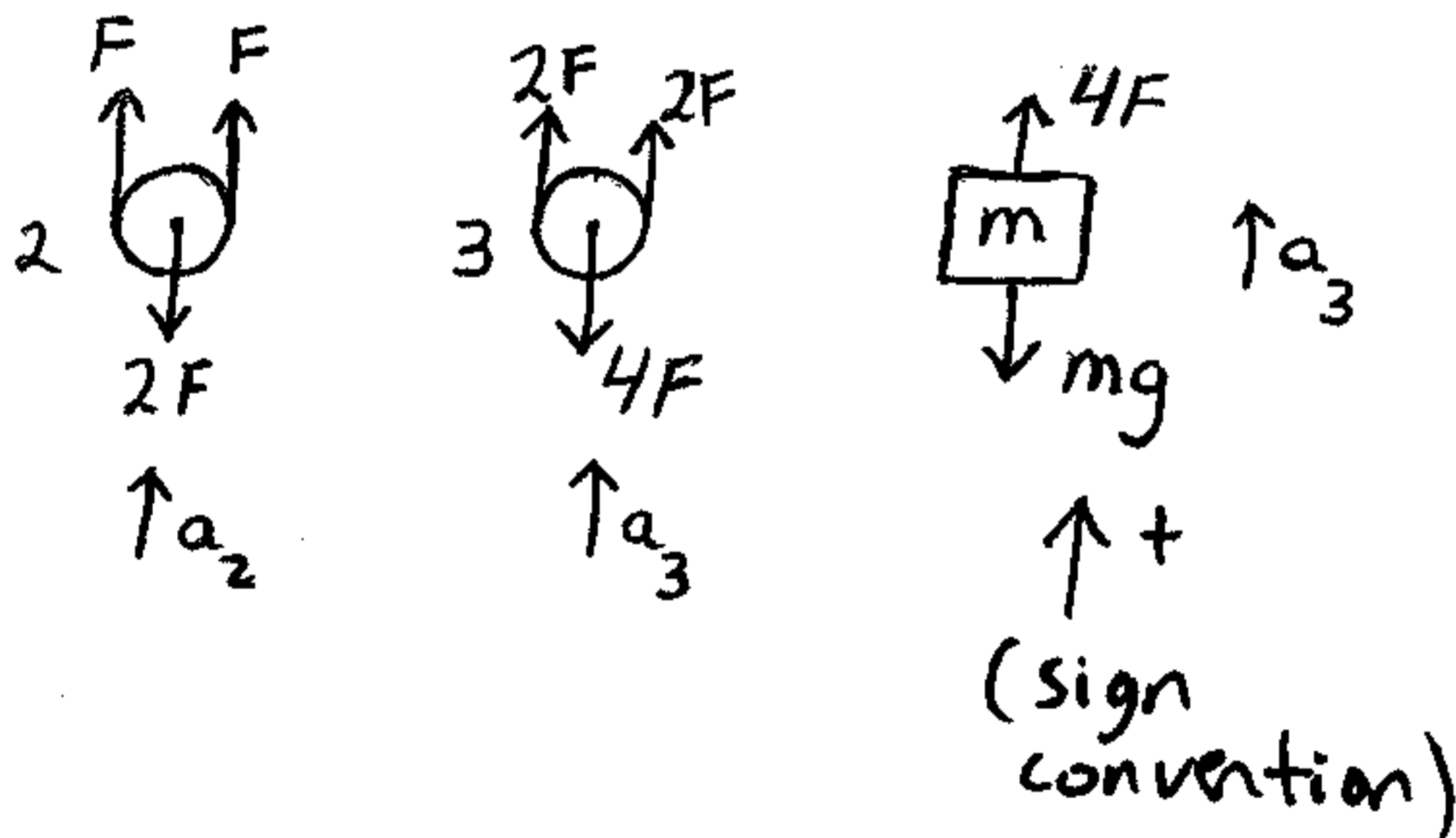
Solution:



Neglect the mass of the pulleys and rope.

$$\left. \begin{aligned} s_1 + 2s_2 &= L_1 \\ s_2 + 2s_3 &= L_2 \end{aligned} \right\} \begin{array}{l} \text{These} \\ \text{equations} \\ \text{are not} \\ \text{actually} \\ \text{needed} \end{array}$$

Free-body diagrams



Apply Newton's second law to the block:

$$\begin{aligned} 4F - mg &= ma_3 \\ \rightarrow 4F - 16(9.8) &= 16(2) \\ \rightarrow F &= 47.2 \text{ N} \\ &\text{(answer)} \end{aligned}$$