SHOW ALL WORK!!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

In the drawing shown the external force $F$ acts on block 1 parallel to the plane. The boundary between block 2 and the plane is frictionless, and the boundary between blocks 1 and 2 has the coefficients given.

(a) Draw clearly labeled free body and force diagrams for each block.
(b) Calculate the maximum value of $F$ such that block 1 does NOT slide with respect to block 2 when the system slides up the plane.

$m_1 = 11.0 \text{ kg}$
$m_2 = 7.0 \text{ kg}$
$\mu_s = 0.70$
$\mu_k = 0.55$

\begin{align*}
\text{(a) } & \begin{align*}
\text{FBD } m_1 & : F, N_1, f, m_1g, N \text{ block 1} \\
\text{FBD } m_2 & : N_2, f_{\text{max}}, m_2g, N_2 \text{ block 1} \\
\end{align*} \\
\end{align*}

\begin{align*}
\text{(b) Write down Force Equations:} \\
\text{ } \sum F_x = m_1a = F - f_s - m_1g \sin \theta = F - \mu_s N_1 - m_1g \sin \theta \Rightarrow m_1a \\
\sum F_y = 0 = N_1 - m_1g \cos \theta \Rightarrow N_1 = m_1g \cos \theta \\
\sum F_x = m_2a = f_{\text{max}} - m_2g \sin \theta = \mu_s N_2 - m_2g \sin \theta \Rightarrow m_2a \\
\sum F_y = 0 = N_2 - N_1 - m_2g \cos \theta \Rightarrow N_2 = N_1 + m_2g \cos \theta
\end{align*}
Taking our four equations and eliminating $N_1$ and $N_2$ by substitution we get:

\[ m_1: \quad F - (m_1g\cos\theta)u_5 - m_1gsin\theta = m_1a \quad ① \]

\[ m_2: \quad N_2u_5 - m_2gsin\theta = m_2a \quad N_2 = m_1g\cos\theta + m_2g\cos\theta \]

\[ N_2 = (m_1+m_2)g\cos\theta \]

\[ (m_1+m_2)g\cos\theta)u_5 - m_2gsin\theta = m_2a \quad ② \]

Solve this for $a$ and plug into eq ①

\[ a = \frac{u_5((m_1+m_2)g\cos\theta - m_2gsin\theta)}{m_2} \]

\[ F = m_2u_5m_1g\cos\theta + m_1gsin\theta = m_1\left[ \frac{m_2((m_1+m_2)g\cos\theta - m_2gsin\theta)}{m_2} \right] \]

\[ F = \frac{m_1}{m_2}(u_5(m_1+m_2)g\cos\theta - m_2gsin\theta) + m_1g(u_5g\cos\theta + sin\theta) \]

\[ = \frac{11.0 \text{ kg}}{70 \text{ kg}}(0.7)(11.0+7.0)(4.8)cos25^\circ - (0.0)(4.8)sin25^\circ + (11.0)(4.8)(0.7)cos25^\circ + sin25^\circ \]

\[ = -26.049 + 113.95 = 87.899 \text{ N} = 87.9 \text{ N} \]