4-5)

First, work out the relationship between the acceleration of m₂ and the angle, theta.



b)

Write NII for each of the masses, using the fractured co-ordinate system shown:

 $M_1: \quad x: \ +T = M_1 a_x \qquad \qquad y: \ +F_N - g M_1 = M_1 a_y = 0$

M₂: x: $-T + gM_2 = M_2a_x$ y: No Forces

Add the x equations:

 $+T \textbf{-}T + gM_2 = M_2a_x + M_1a_x$

Solving, $a_x = [M_2/(M_1 + M_2)]g = g \tan\theta$ so, $\tan\theta = M_2/(M_1 + M_2) = 25/(25 + 125) = 0.17$ so, $\theta = \arctan(0.17) = 9.5^{\circ}$.

c)

The largest angle will be when $M_1 \ll M_2$. Then a = g and $tan\theta = 1$ so that $\theta_{MAX} = \frac{45^\circ}{10^\circ}$.