HW5-5 Soln)

Rule One is not applicable (no acceleration) and Rule Two is difficult, so let's just make up +y and to the right be +x.

For the hanging mass:

x: No Forces

y: +T₃ − gM = Ma_y = 0 \rightarrow T₃ = gM = 250 N.

Now, let's look at the knot:

x: $-T_1\cos\theta_1 + T_2\cos\theta_2 = ma_x = 0 \rightarrow T_1\cos\theta_1 = T_2\cos\theta_2$

y: $T_1 \sin \theta_1 + T_2 \sin \theta_2 - T_3 = ma_y = 0$

Eh, let's do substitution:

 $T_1 = T_2 \cos\theta_2 / \cos\theta_1$

 $(T_2\cos\theta_2/\cos\theta_1)\sin\theta_1 + T_2\sin\theta_2 = T_3 = gM$

 $T_2 (tan \theta_1 cos \theta_2 + sin \theta_2) = gM$

 $T_2 = gM / (tan\theta_1 \cos\theta_2 + \sin\theta_2) = 250 / (tan 53 \cos 30 + \sin 30) = \frac{151.8 N}{151.8 N}$

Returning to the x: equation above,