

HW5-6 Soln)

Let up and to the right each be positive

Consider one of the hanging masses, M. Use NII:

x: No Forces

$$y: +T - gM = Ma_y = 0 \rightarrow T = gM$$

This is true for all three of the identical masses. Since the string and wheel are magic, the tensions of each string at the knot are all also the same T.

At the knot, we need to do components:

$$x: +T\cos(\theta_1) - T\cos(\theta_2) = m_{\text{knot}}a_x = 0$$

$$y: +T\sin(\theta_1) + T\sin(\theta_2) - T = m_{\text{knot}}a_y = 0$$

Then, from the x equation, we have that

$$T\cos(\theta_1) = T\cos(\theta_2)$$

$$\cos(\theta_1) = \cos(\theta_2)$$

$$\theta_1 = \theta_2$$

Let these angles be called simply θ . Then, from the y equation:

$$+T\sin(\theta) + T\sin(\theta) = T$$

$$2\sin(\theta) = 1$$

$$\sin(\theta) = \frac{1}{2}$$

$$\theta = \arcsin\left(\frac{1}{2}\right) = 30^\circ$$