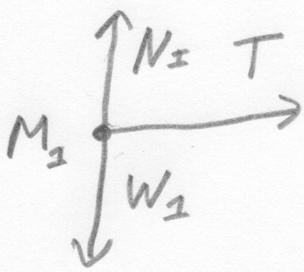
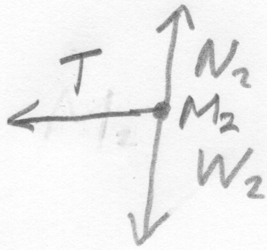
# Solution 3.2

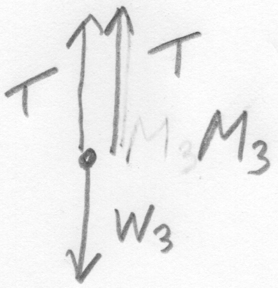
**Problem 1.** A coordinate system fixed to the space station is *not* an inertial system, since an isolated object does not follow the circular trajectory of the space station around the earth. The contents of the space station are at rest with respect to the space station, but they are not isolated since they experience the gravitational interaction from the earth.

## 2.9

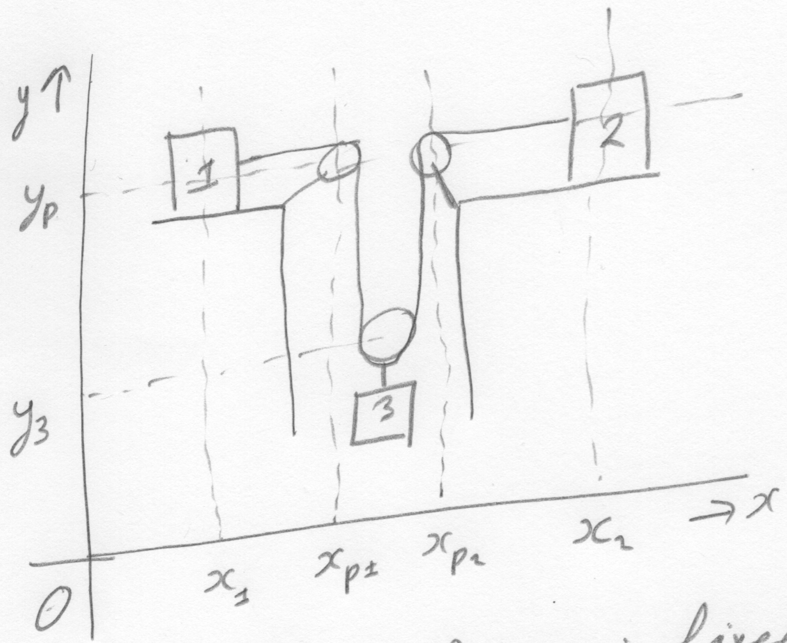
1.




2.




The length of the rope is fixed

$$\Rightarrow \quad L = (x_{p1} - x_1) + 2(y_p - y_3) + x_2 - x_{p2}$$

Differentiate twice

$$0 = -\ddot{x}_1 - 2\ddot{y}_3 + \ddot{x}_2$$

$$\Rightarrow \quad \boxed{2\ddot{y}_3 = \ddot{x}_2 - \ddot{x}_1}$$

3. Eqs of motion

$$T = M_1 \ddot{x}_1$$

$$T = -M_2 \ddot{x}_2$$

$$2T - W_3 = M_3 \ddot{y}_3$$

$$\Rightarrow 2T - W_3 = \frac{M_3}{2}(\ddot{x}_2 - \ddot{x}_1)$$

$$= \frac{M_3}{2}\left(-\frac{T}{M_2} - \frac{T}{M_1}\right)$$

$$\Rightarrow T\left(2 + \frac{M_3}{2}\left(\frac{1}{M_1} + \frac{1}{M_2}\right)\right) = W_3$$

$$\Rightarrow T = \frac{g}{\left(\frac{2}{M_3} + \frac{1}{2}\left(\frac{1}{M_1} + \frac{1}{M_2}\right)\right)}$$