**Ex: Case #4:**

Assume: Frictionless pulley,  
Massless rope,  
System initially at rest  

Find: $a$, $T$

1). Draw “**free-body**” diagrams to identify the forces.

$$T_1 = T_2 = T$$
$$a_1 = a_2 = a$$

2). Write $\Sigma F$ components using Newton’s second law.

Problem simplifies if we choose coordinate system cleverly.

$$T - m_1 g \sin \theta = m_1 a$$
$$m_2 g - T = m_2 a$$

○ Add equations to find $a$:  
$$a = \left( \frac{m_2 - m_1 \sin \theta}{m_1 + m_2} \right) g$$

○ Now find $T$:  
$$T = \frac{m_1 m_2}{m_1 + m_2} g (1 + \sin \theta)$$