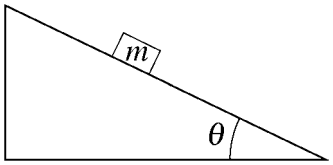
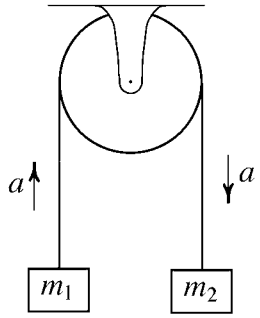
Problems Using Newton's Second Law

1. The figure to the right shows a mass m sliding down an inclined plane of angle θ. Calculate the acceleration a of m for (a) no friction and (b) sliding friction of coefficient μ.

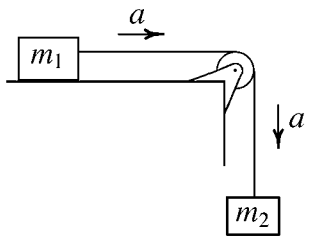


In problems 2–6, find the mutual acceleration of the masses and the tension in each string. Assume no friction and that the strings have negligible mass and extensibilty.

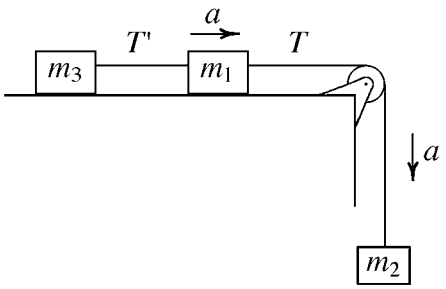
2.



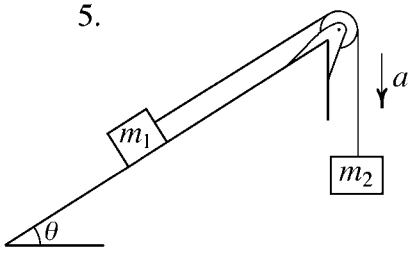
3.



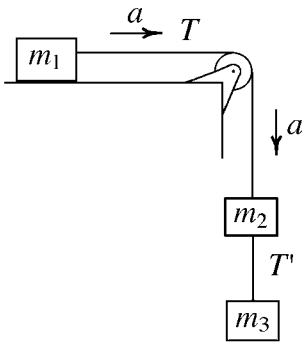
4.



5.



6.



Answers:

1. (a) $a = g \sin\theta$, (b) $a = g(\sin\theta - \mu\cos\theta)$.
2. $a = (m_2 - m_1)g/(m_2 + m_1)$, $T = 2m_2m_1g/(m_2 + m_1)$.
3. $a = m_2g/(m_2 + m_1)$, $T = m_1m_2g/(m_2 + m_1)$.
4. $a = m_2g/(m_3 + m_2 + m_1)$, $T = m_2g/(m_3 + m_2 + m_1)$, $T' = m_2(m_3 + m_1)g/(m_3 + m_2 + m_1)$.
5. $a = (m_2 - m_1\sin\theta)g/(m_2 + m_1)$, $T = m_2g[1 - (m_2 - m_1\sin\theta)g/(m_2 + m_1)]$.
6. $a = (m_3 + m_2)g/(m_3 + m_2 + m_1)$, $T = m_1(m_3 + m_2)g/(m_3 + m_2 + m_1)$, $T' = m_1m_3g/(m_3 + m_2 + m_1)$.