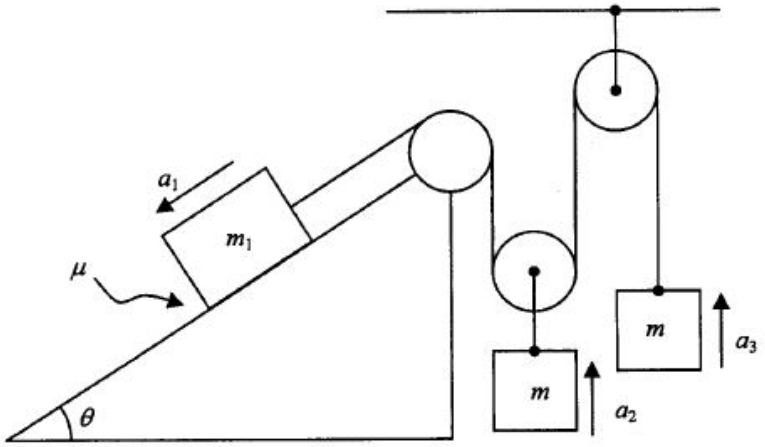
QP45



The following questions refer to the diagram above. All pulleys are assumed to be massless and frictionless and the inclined plane is fixed in place. The static and kinetic coefficients of friction between m_1 and the plane are both μ.

a) (1 point) Write the relationship between the accelerations a_1, a_2 and a_3 with the arrows above denoting the direction of positive acceleration.

b) (1 point) Sketch a free-body diagram for each of the three masses and write Newton's second law for each.

c) (2 points) Derive an expression for a_1 in terms of m_1, m, μ, θ, and g.

d) (1 point) In the case of $\mu < \tan\theta$, find the value of m_1 such that the block is just about to slide down the plane as pictured.