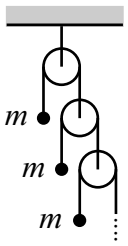
Week 43 (7/7/03)

Infinite Atwood's machine

Consider the infinite Atwood's machine shown below. A string passes over each pulley, with one end attached to a mass and the other end attached to another pulley. All the masses are equal to m, and all the pulleys and strings are massless. The masses are held fixed and then simultaneously released. What is the acceleration of the top mass?



(We'll define this infinite system as follows. Consider it to be made of N pulleys, with a non-zero mass replacing what would have been the $(N+1)$st pulley. Then take the limit as $N \to \infty$.)