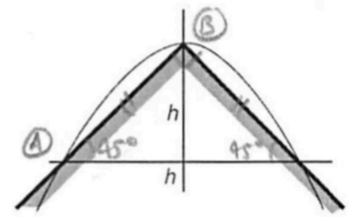
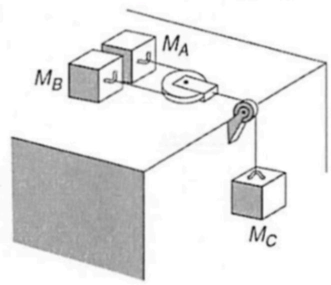
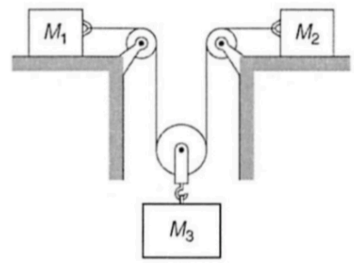
YILDIZ PHYSICS 7A Spring 2020 MT1

1. A peaked roof is symmetrical and subtends a right angle, as shown. Standing at a height of distance h below the peak, with what initial speed v_0 must a ball be thrown so that it just clears the peak and hits the other side of the roof at the same height? Your answer should depend on g and h.



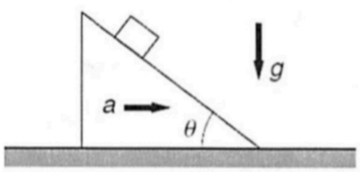
2. (a) (Left) Two masses, A and B, lie on a frictionless table, as shown. They are attached to either end of a light rope of length l which passes around a pulley of negligible mass. The pulley is attached to a rope connected to a hanging mass, C. Find the acceleration of each mass. (You can check whether or not your answer is reasonable by considering special cases—for instance, the cases $M_A = 0$, or $M_A = M_B = M_C$.)





(b) (Right) The system of masses M_1, M_2, and M_3 in the sketch uses massless pulleys and ropes. The horizontal table is frictionless. Gravity is directed downward. Draw force diagrams, and show all relevant coordinates. How are the accelerations related?

3. A block rests on a wedge inclined at angle θ. The coefficient of friction between the block and plane is μ.
   (a) Find the maximum value of θ for the block to remain motionless on the wedge when the wedge is fixed in position.
   (b) The wedge is given horizontal acceleration a, as shown. Assuming that tan θ > μ, find the minimum acceleration for the block to remain on the wedge without sliding.
   (c) Repeat part (b), but find the maximum value of the acceleration.



4. An automobile of mass M drives onto a loop-the-loop at *constant speed*, as shown.
   (a) Assuming that there is enough friction between the automobile and the road (i.e. the automobile does not slip), what is the minimum speed v_0 for going completely around the loop without falling off?
   (b) If the automobile drives at constant speed v, where $v < v_0$. The coefficient of static friction between the automobile and the track is μ. In this case, the automobile does not complete the loop, and slips downward. Draw a force diagram. Find an equation for the angle θ where the auto starts to slip. There is no need to solve the equation.