Notre Dame University
Faculty of Engineering
Mechanical Engineering Department
Dr. Eng. Pierre Rahmé

April 2013
Exam 1
1 hour
Men201

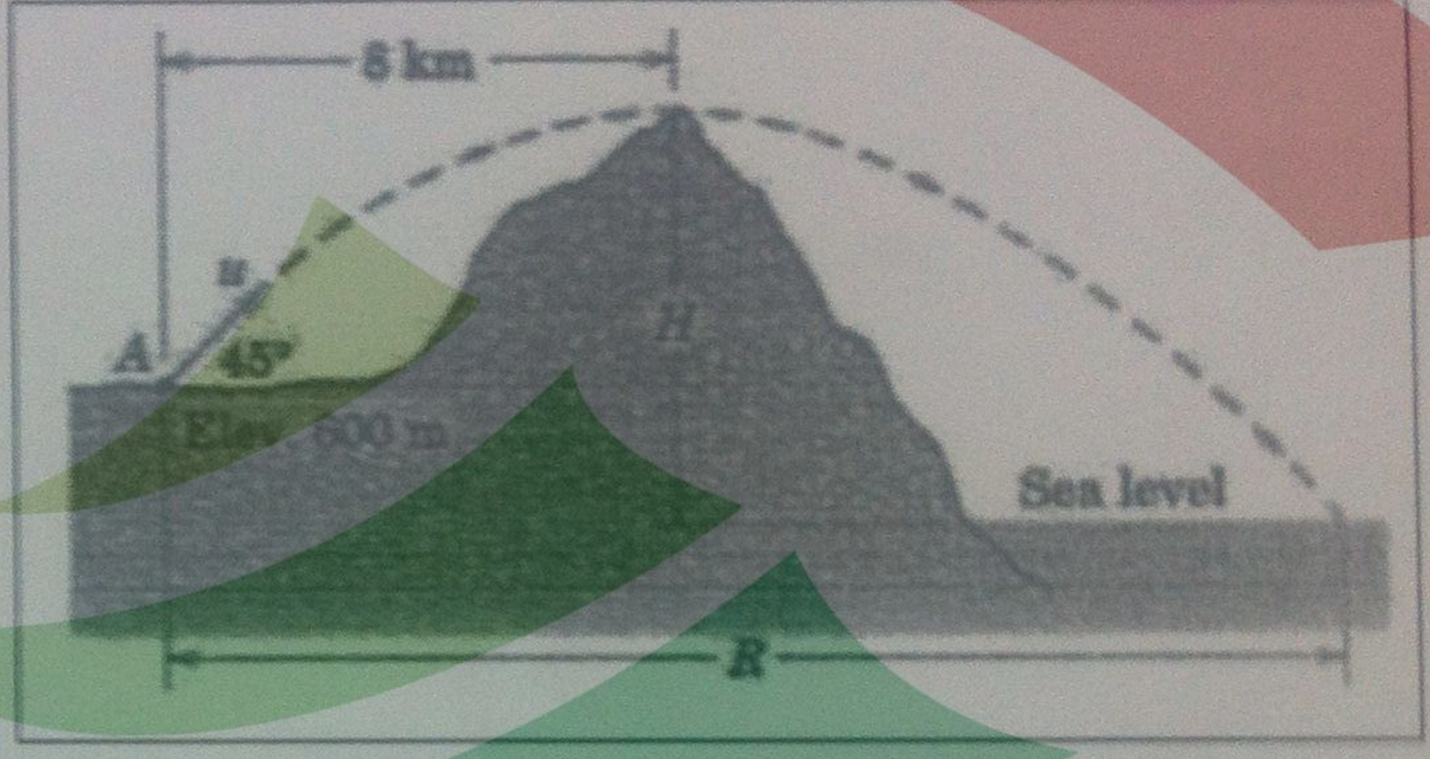
Name : .....

Section :	
A : 10h – 11h	☐
B : 11h – 12h	☐

100

Problem 1 *(35 pts)*

A long-range artillery rifle at A is aimed at an angle of 45° with the horizontal, and its shell just able to clear the mountain peak at the top of its trajectory.

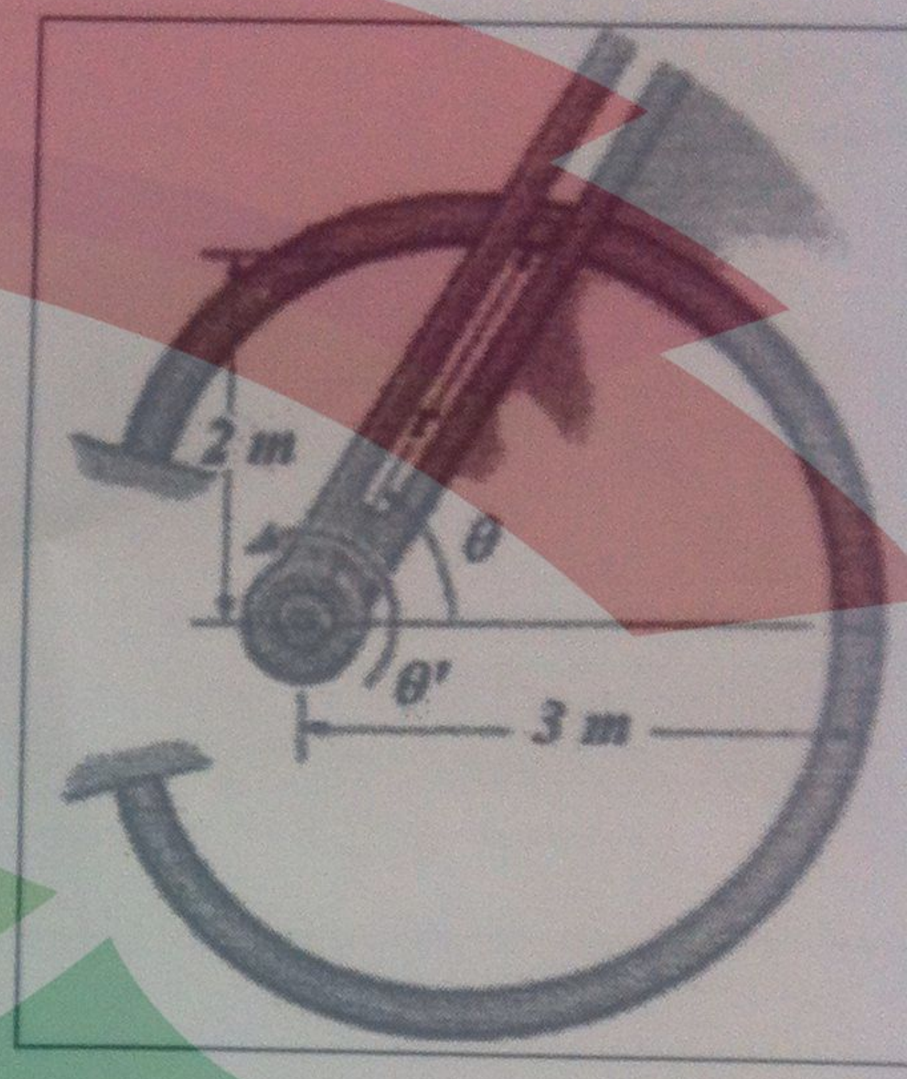


a. Write the equation of the trajectory y(x) as a function of the magnitude u of the muzzle velocity and x.

b. Determine the magnitude u, the height H of the mountain above sea level and the range R to the sea.

Problem 2 (35 pts)

The forked rod is used to move the smooth particle of weight 20-N around the horizontal path in the shape of a limaçon, $r = (2 + \cos\theta)$ m. If $\theta = (0.5\,t^2)$ rad, where t is in seconds, determine the force which the rod exerts on the particle at the instant $t = 1.5$ s. The fork and path contact the particle on only one side.



Problem 3 *(30 pts)*

The 50-kg block at A is mounted on rollers so that it moves along the fixed horizontal rail with negligible friction under the action of the constant 300-N force in the cable. The block is released from rest at A, with the spring to which it is attached extended an initial amount $x_1 = 0.233$ m ($= s_1 = \Delta l_1$). The spring has a stiffness $k = 80$ N/m. Calculate the velocity v of the block as it reaches position B.