YTÜ Physics Department 2015-2016 Fall	Exam Date :			Exam Time : 90 min.	
FIZ1001 Physics-1 Midterm Exam 1	1.S	2.S	3.S	4.S	TOPLAM

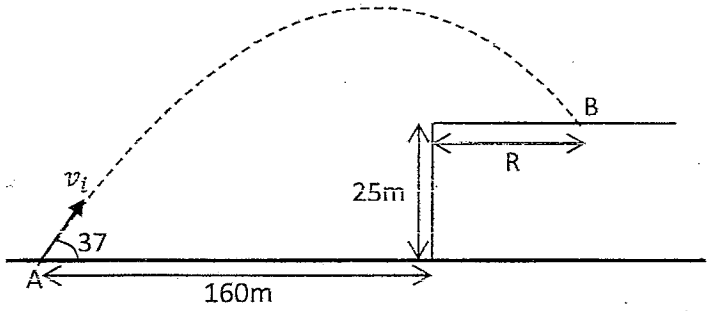
Name Surname		
Registration No		
Department		
Group No	Exam Hall	Signature of the Student
Lecturer's Name Surname		

The 9th article of Student Disciplinary Regulations of YÖK Law No.2547 states ***"Cheating or helping to cheat or attempt to cheat in exams"*** de facto perpetrators takes one or two semesters suspension penalty. Calculators are not allowed. Do not ask any questions about the problems. There will be no explanations. Use the allocated areas for your answers and write legible.

PROBLEM 1

A stone is thrown up onto a roof of a building of height $25m$ with an initial speed of $v_i = 50\,m/s$ directed at an angle $\theta = 37°$ above the horizontal from point A as shown in the figure. The horizontal distance between the point A and the building is $160m$. The stone strikes the roof at point B.
$(g = 10\,m/s^2, \quad Cos37 = 0.8, \; Sin37 = 0.6)$
Solutions using the conservation of energy will not be accepted.

a) Calculate the horizontal distance R from the edge of the roof and point B.



b) Calculate the direction and magnitude of velocity of the stone just before impact at B.

PROBLEM 2

A particle starts from the origin at t=0 and moves in the xy-plane with a velocity as a function of time given by $\vec{v} = (3t^2)\hat{\imath} + (2t + 1)\hat{\jmath}$ m/s.

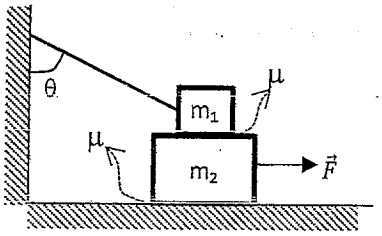
a) Find the velocity, acceleration and position vectors of the particle at t=1s.

b) Find the angle between the velocity and acceleration vectors of the particle at t=1 s.

c) Find the tangential and radial accelerations of the particle at t=1 s.

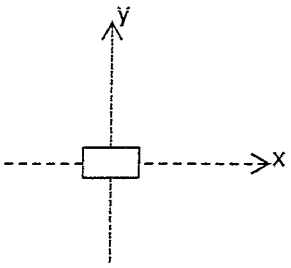
PROBLEM 3

A block of mass m_1 is placed on top of a block of mass m_2 on a horizontal rough surface as shown in the figure. A horizontal force of $\vec{F}$ is applied to m_2, and m_2 eventually slips on the direction of applied force. m_1 is tied to the wall with a string with the vertical angle of θ. The coefficient of friction between all surfaces is μ.
(Express your answer in terms of quantities given)

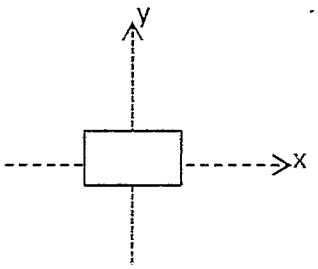


a) Draw a free-body diagram and write the equation of motion for each block.

m_1:



m_2:



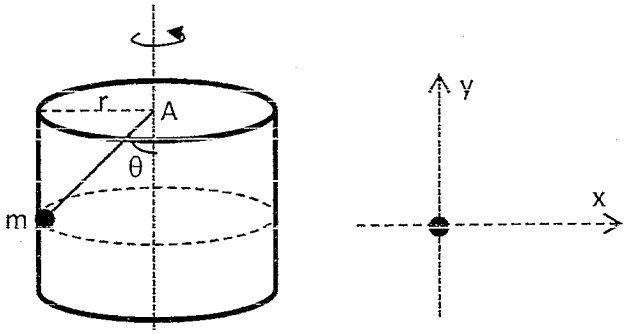
b) Determine the tension in the string.

c) Find the minimum magnitude of force $\vec{F}$ when the mass m_2 is on the verge of slipping.

ROBLEM 4

I) A vertical cylinder with the radius of $r = 1m$ spins about its axis with constant speed. An object of mass $m = 2kg$ is held up against the frictionless wall. The mass is tied from the point A on the cylinder with a lightweight string as in the figure. The vertical angle between the string and the axis is θ=37°. The object remains stationary relative to the cylinder during the motion. Reaction force acting on the object by the wall is $5\ N$.
(Take $g = 10\ m/s^2, Cos37 = 0.8,\ Sin37 = 0.6$)

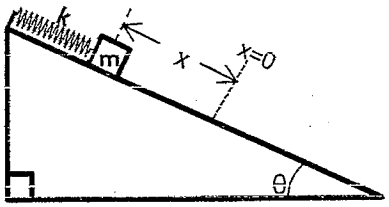
a) Draw a free-body diagram and write the equation of motion for the object according to the given axes in the figure.



b) Find the speed of the object.

II) A block with mass $m = 10kg$ is placed against a spring, with spring constant $k = 600\ N/m$, on a rough incline with angle $\theta = 37°$ (see figure). The block is attached to the spring. Kinetic friction constant between the block and the inline is $\mu_k = 0{,}5$. The spring is compressed $x = 20cm$ from its unloaded equilibrium position ($x = 0$) and then released from rest.

a) After spring released, calculate the work done by all forces acting on the block between its compressed position and the equilibrium position.



b) Calculate the speed of the block when it passes from the equilibrium position.