Name, Surname: «Name»	Signature:
Exam Room: «Exam_Room»	ID Number: «ID»

KOÇ UNIVERSITY

College of Sciences
PHYS 101 General Physics 1
Fall Semester 2017
Midterm 2 Exam
November 21st, 2017 Tuesday, 19:00-20:40

Please read.

- Count to make sure that there are 5 pages in this question booklet
- Check your **name, number, on front page, and student ID on each page.**.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
- You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct).
- Write neatly and clearly; unreadable answers will not be given any credit.
- If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
- Make sure that you include units in your results.
- Make sure that you label the axis and have units in your plots.
- You are allowed to use calculators during this exam.
- Turn off your mobile phones, and put away.
- You are not allowed to leave the class during the first 15 minutes, and last 15 minutes.
- Write your final answers into the boxes. No points will be given to unjustified answers. Incomplete calculations will not be graded.

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1	2	3	4	Total

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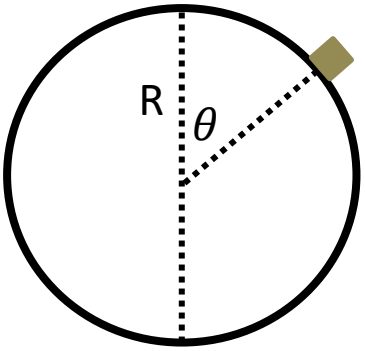
Q1-(25 pts) A block can slide on a sphere of radius R without friction (see figure). We push the block from the top of the sphere with initial speed $\boldsymbol{v_0}$ in the horizontal direction.



a) What is the speed of the block when it is at angle θ? Assume the block is still on the sphere.

b) At what angle θ does the block stop touching the sphere?

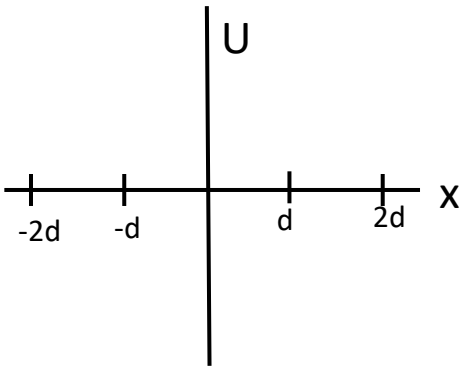
c) For what values of v_0 does the block **not** slide on the sphere at all?

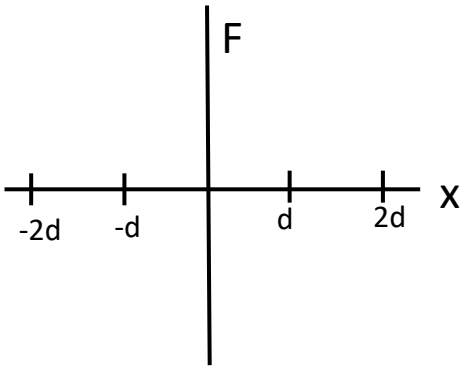
Solution continues on the back side of the page **Yes** □ **No** □

Q2-(25 pts) The potential energy of a particle of mass m which can move on the x axis is given by $U(x) = C(-\frac{x^2}{2d^2} + \frac{x^4}{4d^4})$. C, d are known *positive* constants.

a) Find all the equilibrium positions of the particle.

b) *Qualitatively* plot $U(x)$ and the related conservative force $F(x)$ for $-2d < x < 2d$ on the graphs given below. You do not need to show your calculations.





c) If the particle is at $x = -d$, what is the minimum initial speed it needs to reach $x = d$?

Q3-(25 pts)

Solution continues on the back side of the page **Yes** □ **No** □

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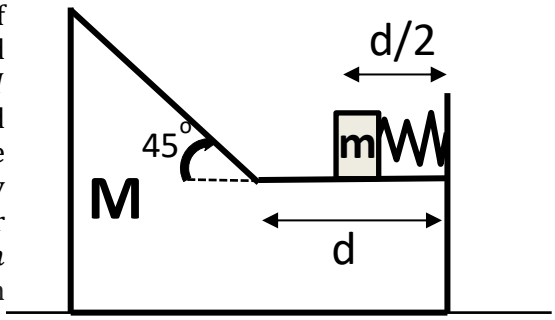
Q3-(25 pts) A block of mass m can slide on a platform of mass M which has a spring of uncompressed length d and spring constant k attached at one end. The surface of M consists of a horizontal part of length d and an inclined plane of angle 45^o as in the figure. M can also slide horizontally on the ground, and there is no friction on any surface. We initially compress the spring by $d/2$ together with m, and release the masses with no initial velocity (m is not tied to the spring). Assume that m always stays on M, and m can smoothly move from the horizontal surface to the inclined plane without loss of energy.



a) What is the speed of m with respect to the ground at the moment it reaches the bottom of the inclined surface?

b) What are the velocities of m and M at the moment m reaches its highest point on the inclined surface?

c) What is the maximum height m can reach on the inclined surface? Take the initial height to be 0.

d) What is the maximum displacement of M from its initial position?

Solution continues on the back side of the page **Yes** □ **No** □

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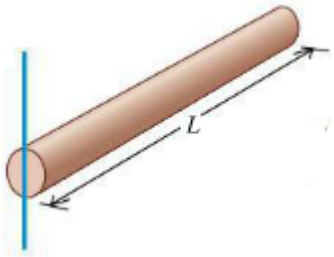
Q4-(25 pts)

a) Find the moment of inertia of a uniform rod with mass M and length L about the axis that goes through one end of the rod.



b) Find the moment of inertia of a uniform right triangular shaped plate with mass *M* about the axis that coincides with the right side that has length *h*. Consider that the other right side has length *d* (See figure on the side). Express your answer as a function of *M, d* and *h*.

Solution continues on the back side of the page **Yes** □ **No** □