Name:	Student ID Number:
Surname:	Exam Room:

KOÇ UNIVERSITY
College of Sciences
PHYS 101 General Physics 1
Spring Semester 2022
Midterm 2 Exam
April 24, 2022 Sunday, 17:15-19:15

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.
- You are not allowed to use calculators during this exam.
- 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.

I hereby certify that I have completed this exam on my own without any help from anyone else.

Signature

P101_Index:

1	2	3	4	Total

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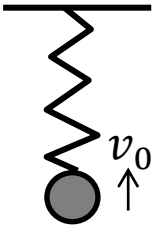
Q1-(25 pts) An object of mass m is attached to a vertical spring of spring constant k as in the figure. The spring is initially not compressed or extended, and we release the object with upwards vertical speed v_0. The gravitational acceleration is g.



a) What is the maximum speed the object achieves during its motion? (10pts)

b) What are the maximum compression and maximum extension of the spring? (15pts)

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

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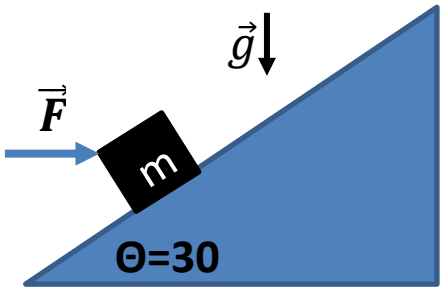
Q2-(25 pts) A mass m is pushed by the constant horizontal force $\vec{F}$ a distance of d up along the 30° fixed incline. The kinetic friction coefficient between mass and the incline is μ_k.
$(\cos 30 = \frac{\sqrt{3}}{2}, \sin 30 = \frac{1}{2})$



a) How much work is done by the constant horizontal force $\vec{F}$ on the block with mass m during this motion? (6pts)

b) How much work is done by the gravitational force on the block during this displacement? (6pts)

c) How much work is done by the friction force on the block during this displacement?(6 pts)

d) What is the speed of the block (assume that it is zero initially) after this displacement? (7 pts)

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

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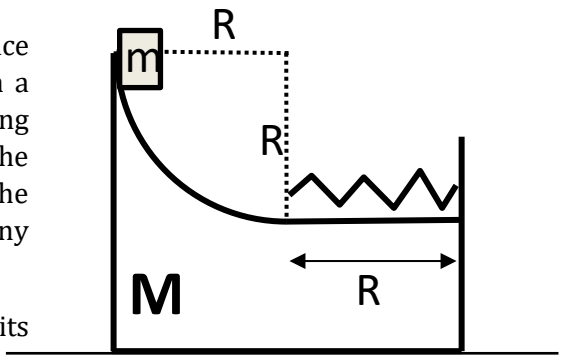
Q3-(25 pts) A platform of mass M is free to move and has a surface that is shaped like a quarter circle of radius R together with a horizontal piece of length R, as in the figure. A spring of spring constant k and unstretched length R is attached to one end of the platform. A small block of mass m is released from the top of the platform with no initial velocity. There is no friction on any surface, gravitational acceleration is g.



a) What is the maximum speed of the small block during its motion? (7 pts)

b) What is the maximum compression in the spring? (5 pts)

c) What is the maximum displacement of the platform from its initial position? (8 pts)

d) What is the maximum height from the horizontal surface of the platform that the block can reach after it is pushed back by the spring? (5 pts)

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

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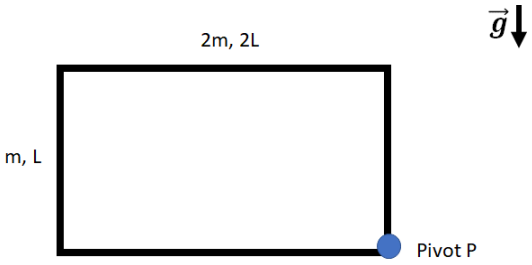
Q4-(25 pts) A rectangle shaped frame is formed by uniform rods. The mass of the rod that forms the short edge has mass m and length L, mass of the rod that forms the long edge has the mass $2m$ and length $2L$. The frame can rotate freely around pivot point P. The frame is released from rest in a horizontal position and rotates under the action of gravitational force. (I_{cm} for a rod of mass M and length L = $\frac{1}{12}ML^2$)



a) Find the moment of inertia of the frame around the pivot axis. (7 pts)

b) Calculate the maximum angular velocity of the frame. (10 pts)

c) Calculate the maximum center of mass velocity of the frame. (8 pts)

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