

College of Science.  
Department of Physics & Astronomy

Mid Term Exam  
Academic Year 1444 Hijri- 1<sup>st</sup> Semester

Exam Information معلومات الامتحان		
Course name	Classical Mechanics 2	
Course Code	Phys. 312	
Exam Date	2022-09-29	1444-03-03
Exam Time	08: 00 AM – 09:05 AM	
Exam Duration	1 hour	
Classroom No.		
Instructor Name	Dr. Abdelhay Salah	

Student Information معلومات الطالب		
Student's Name		
ID number		
Section No.		
Serial Number		

**General Instructions:**

تعليمات عامة:

- Your Exam consists of 4 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.

- عدد صفحات الامتحان 7 صفحة. (باستثناء هذه الورقة)
- يجب إبقاء الهواتف والساعات الذكية خارج قاعة الامتحان.

هذا الجزء خاص بأستاذ المادة

*This section is ONLY for instructor*

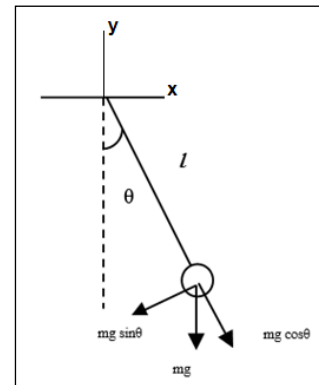
#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	CLO 1.2	Q1	10	
2	CLO 1.1	Q2	10	
3	CLO 2.1	Q 3	10	
4				30

EXAM COVER PAGE

**Solve all parts. All the parts carry equal marks**

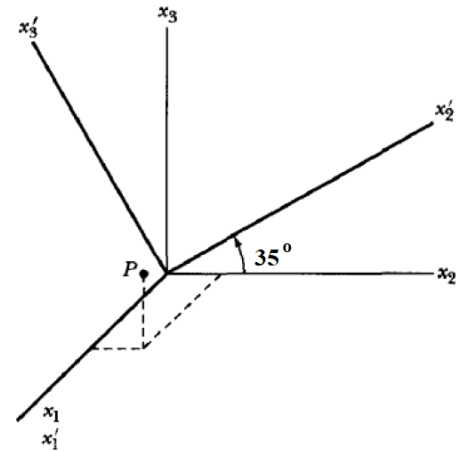
**Part 1: [10 Marks]**

**Question 1:** Consider a simple pendulum that oscillates with a small angle. Derive the equation of motion using Lagrangian mechanics





**Question 2:** A point P is represented in the  $(x_1, x_2, x_3)$  system by P (3, 2, 1) . In another coordinate system the same point is represented as P  $(x_1', x_2', x_3')$  where  $x_2$  has been rotated towards  $x_3$  around  $x_1$ -axis by an angle  $35^\circ$  . Find the rotation matrix and determine P  $(x_1', x_2', x_3')$  .





**Question 2:** Consider a particle moving in a constant force field starting at rest from some point  $(x_1, y_1)$  to some lower point  $(x_2, y_2)$ . Prove that the path that allows the particle to accomplish the transit in the least possible time can be represented by the following equation ( $a = \text{constant}$ ).

$$y = \int \frac{x dx}{(2ax - x^2)^{1/2}}$$

