

Midterm Exam No. 03 (2017 Fall)

PHYS 205A-001: University Physics

Date: 2017 Nov 13

(Name)

(Signature)

Instructions

1. Seating direction: Please be seated on seats with seat-numbers divisible by 4.
2. Total time = 50 minutes.
3. There are 7 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. **(10 points.)** The velocity of a 25 kg object changes from $\vec{v}_i = (4.0\hat{\mathbf{i}} + 3.0\hat{\mathbf{j}})$ m/s to $\vec{v}_f = (6.0\hat{\mathbf{i}} + 8.0\hat{\mathbf{j}})$ m/s while it traverses along a path. What is the total work done by all the forces acting on the object during this change in velocity.

2. (10 points.) Figure 1 shows a pendulum of length $L = 1.0$ m and mass $m = 5.0$ kg. It starts from rest after it is moved a height $h = 0.40$ m. Neglect air resistance.

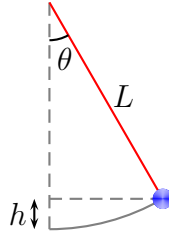


Figure 1: Problem 2.

- Determine the work done by the force of tension due to the string on the mass.
- Determine the work done by the force of gravity on the mass.
- Determine the change in kinetic energy while the mass falls the height h .

3. (10 points.) Consider the potential energy curve shown in the figure below.

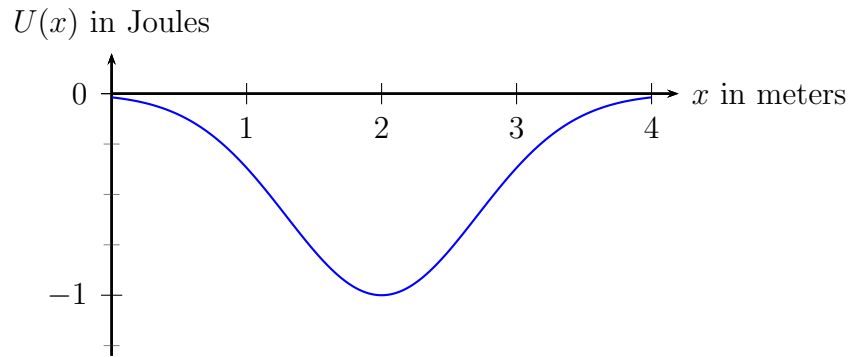


Figure 2: Problem 3.

- (a) Determine whether the component of force F_x is positive, negative, or zero, at $x = 3$ m.
- (b) Sketch the curve for F_x versus x from $x = 0$ m to $x = 4$ m.

4. (10 points.) A 690 N Marine in basic training climbs a 8.0 m vertical rope at a constant speed in 6.00 s. What is his power output from the gravitational force?

5. (10 points.) A 69.0 kg boy and his 36.0 kg sister, both wearing roller blades, face each other at rest. The girl pushes the boy hard, sending him backward with a velocity 3.00 m/s toward the west. Ignore friction. Determine the magnitude and direction of the velocity of the girl after she pushes the boy.

6. (10 points.) A rod of length $L = 5.00$ m has uniform density (mass per length) given by

$$\frac{dm}{dx} = a, \quad (1)$$

where x is the distance from one end, and $a = 3.00$ kg/m.

- (a) Determine the mass of the rod.
- (b) How far from the $x = 0$ end is its center of mass?

7. (10 points.) In the Atwood machine shown in Fig. 3, the masses m_1 and m_2 are connected by a string that goes around a pulley. The pulley has mass m_3 and radius R , with moment of inertia of a solid cylinder $I = \frac{1}{2}m_3R^2$. Assume the mass of the string is negligible by comparison. Determine the expression for the acceleration of the masses.

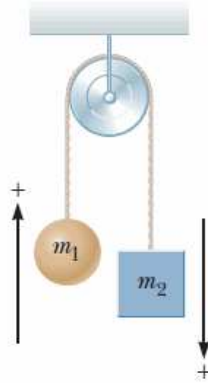


Figure 3: Problem 7.