



Department of Mathematics and Natural Sciences

PHY111 - Principles of Physics-I

Midterm Assessment, Summer 2021

Time: 2 Hours (5:00 pm to 7:00 pm)

Total Marks: 30

Answer all questions.

1. The position of a particle which moves along the straight line is define by the relation $x(t) = t^3 - 6t^2 - 15t + 40$ where x and t are expressed in meters and seconds respectively. Note that the coefficients of t have dimensions accordingly.

- (a) (4 marks) Determine when the velocity of the particle is zero.
- (b) (4 marks) Calculate the position vector and distance travelled by the particle when the acceleration is zero. Consider that at the starting point time $t = 0$ sec.
- (c) (2 marks) Does the particle move at constant velocity or constant acceleration? Justify your answer.

2. A block of mass $m_1 = 20\text{ kg}$ which lies on an incline frictional surface is connected to another block of mass $m_2 = 100\text{ kg}$ by two massless ropes and two massless, frictionless pulleys as shown in Fig. 1. The inclined surface makes 30° angle with the horizontal line. The coefficient of kinetic friction between the block m_1 and the inclined surface is 0.12.

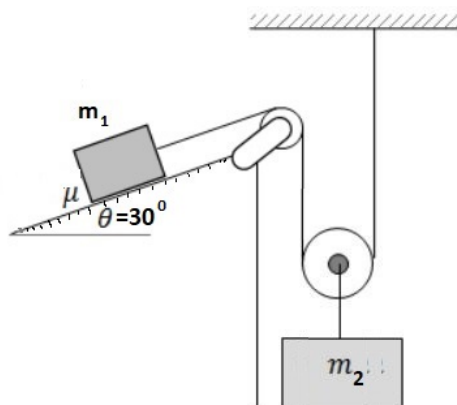


Fig. 1

- (a) (2 marks) Draw the free body diagram of block m_1 , block m_2 and the hanging pulley.
- (b) (5 marks) Find the accelerations of block m_1 and block m_2 .
- (c) (3 marks) Calculate the tensions in the two massless ropes.

3. In a Bangladesh-Australia cricket match, Sakib Al Hasan throws a ball towards the batsman. The ball starts to spin with 18.0 rev/s . The radius of the ball is 7.1 cm .

- (a) (2 marks) Find the tangential speed of the outer periphery of the ball as it spins.
- (b) (2 marks) What is the centripetal acceleration of the cricket ball?
- (c) (6 marks) Let's consider, due to air friction, the spin of the ball decays at the rate of 0.6 rev/s^2 . Now find how long it will take for the ball to stop spinning and the total angle through which it will rotate during this time. (Consider the rate as constant).