

MIDTERM 1

Physics 9A Section A

NAME:

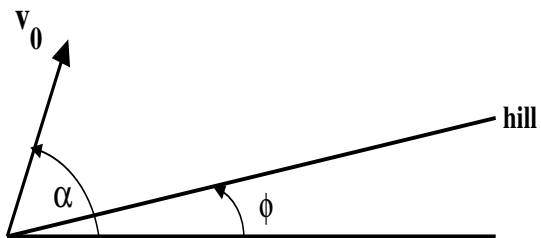
April 18, 2007

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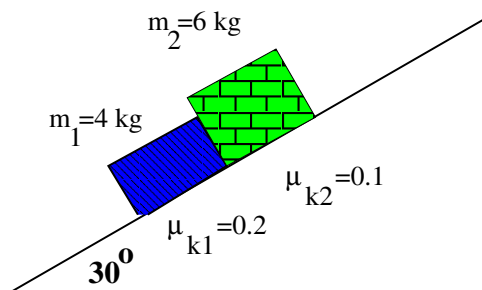
General Instructions: This examination is closed book. Only a calculator is allowed. Please show all your work and box your answers. Credit will only be given for *complete* solutions. Answers must have correct units. There are four problems on four pages. Note that not all the problems are worth the same number of points. The acceleration due to gravity is $g=9.8 \text{ m/s}^2$.

- [25 points] 1. A puck moves from point A to point B at constant velocity while under the influence of several forces. (a) What can you say about the forces? (b) Graph the puck's path from A to B. (c) On the graph, continue the path to point C if a new constant force is added to the puck at point B, where the new force is perpendicular to the puck's velocity at point B. (d) Continue the path to point D if at point C the constant force added at B is replaced by one of constant magnitude but in a direction always perpendicular to the path. *Make sure you indicate clearly the nature of each trajectory, if known, i.e. give the name for each segment of the curve: ellipse, parabola, etc.*

- [25 points] 2. A person stands at the base of a hill that is a straight incline making an angle ϕ with the horizontal. (See figure.) A ball is thrown with initial speed v_0 at an angle α with the horizontal. What are the x and y coordinates of the ball as a function of time? At what time t will the ball hit the hill?



- [30 points] 3. Two blocks $m_1 = 4$ kg and $m_2 = 6$ kg are sliding down an inclined plane tilted at an angle of 30° as shown in the figure. (a) Compute the acceleration of the masses when the coefficients of kinetic friction are $\mu_{k1} = 0.2$ between m_1 and the plane and $\mu_{k2} = 0.1$ between m_2 and the plane. What is the force (magnitude and direction) of block 2 on block 1? (b) What is the force (magnitude and direction) of block 2 on block 1 if the coefficients of friction are reversed, $\mu_{k1} = 0.1$ and $\mu_{k2} = 0.2$? Hint: To do this part of the problem does not require any equations. To receive credit, however, you must *explain* your answer clearly.



- [20 points]** 4. The largest helicopter ever built in the United States was the Sikorski CH-53E “Super Stallion”. The four blades of its main rotors each has a radius of 24.1 m. If the rotors are turning at 50 rpm, what is the velocity at the tip of the blade? What is the acceleration? Give your answer for the acceleration both in m/s^2 and as a multiple of g .