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General Physics I, Midterm 1
PHYS10000AA, AB, AC, Class year 109
11-05-2020

SN:_____, Name:_____

Note: You can use pencil or any pen in answering the problems. Dictionary, calculators and mathematics tables **are** allowed. Please hand in both solution and this problem sheet. ***ABSOLUTELY NO CHEATING!***

**Problems (20% each, total 6 problems, 120%)**

1. **Moving object:** An object moves along the *x* axis as shown in the following figure. At which point or points is the magnitude of its velocity at a minimum? Explain your answer.
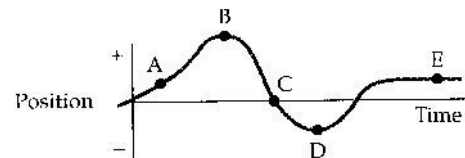

2. **Projectile:** A projectile is launched at speed ν at an angle θ (with respect to the horizontal) from the bottom of a hill of constant slope α as shown in following figure. Prove the range of the projectile up the slope is $\nu^2\sin(\theta - \alpha)/g\cos^2\alpha$
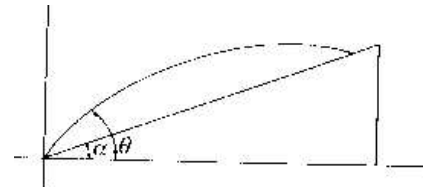

3. **Rolling down the hill:** In the figure to the right, a solid cylinder of mass M, radius R rolling without slipping down the ramp of height h. (a) What is the moment of inertia of the cylinder when it rolls down? (b) Prove the center mass speed V_{cm} when it reaches the ground is $[(4/3)gh]^{1/2}$
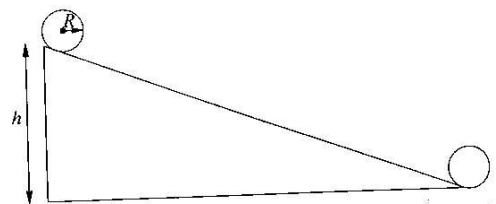
4. **Rotational moment of inertia:** Prove the rotational inertia of the cone in the figure to the right rotating symmetrically along the z-axis is $3/10\ MR^2$
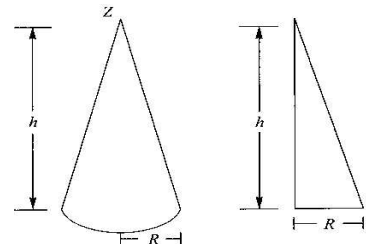
5. **Conservation of energy:** An object of mass ***m*** is raised to a height, as shown in the figure to the right, and falls down to the floor. At the lowest position, what is its change in kinetic energy? (b) What is its change in potential energy? (c) What is its total energy change?
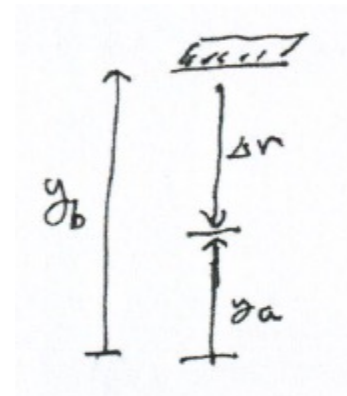
6. **Circular Motion:** A hawk flies in a horizontal arc of radius R=12.0 m at constant speed V=4.00 m/s. (a) Find its centripetal acceleration. (b) It continues to fly along the same horizontal arc, but increases its speed at the rate of 1.20 m/s^2. Find the acceleration (magnitude and direction) in this situation at the moment the hawk's speed is 4.00 m/s.

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Dept. of Physics, NDHU.

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