Exam # 2 – Physics 151

October, 10, 2008

Be sure to include pictures, coordinate systems, etc. where reasonable.

1. (10pts) Consider the following vectors: $\vec{A} = 2.0m\hat{i} - 2.5m\hat{j} + 1.8m\hat{k}$ and $\vec{B} = 1.0m\hat{i} + 1.0m\hat{j} - 4.0m\hat{k}$

   (a) Find $\vec{C} = \vec{A} + \vec{B}$ using components.

   (b) Find the magnitudes of $\vec{A}$ and $\vec{C}$.

2. (20pts) An Atwoods machine consists of two masses connected by a string over a pulley (see figure). Block A has a mass $M_A = 5.0kg$ and block B has a mass $M_B = 2kg$. Ignore friction and assume the pulley is massless.

   (a) Determine the acceleration of block B.

   (b) How fast is block A moving just before it hits the ground?

3. (20pts) You are planning to build a log cabin in central Pennsylvania. You will pull the logs up a long, smooth hill to the building site by means of a rope attached to a winch. You need to buy a rope for this purpose, so you need to know how strong the rope must be. Stronger ropes cost more. You know that the logs weigh a maximum of $200kg$. You measure that the hill is at an angle of 30^o with respect to the horizontal, and the coefficient of kinetic friction between a log and the hill is 0.90. When pulling a log up the hill, you will make sure that the rope stays parallel to the surface of the hill and the acceleration of the log is never more than $0.80m/s^2$. How strong a rope should you buy?

(20pts) Pick *one of the following* two problems:

4. Melinda rides a bicycle around a flat (not banked) circular track that is $1km$ around. The combined mass of her and her bicycle is 80kg and the coefficent of static friction is 0.29 between her wheels and the track.

   (a) She wishes to go $25m/s$, is this safe?

   (b) What is the smallest track she can safely go $25m/s$ on?

5. A block of mass M is pushed with a force $\vec{F}$ against a wall with a force small enought that it slides down the wall. The coeffiecent of kinetic friction between the block and the wall is μ_k. What is the acceleration of the block? Your result should be in terms of g, M, and the size and/or the diretion of $\vec{F}$.