Name: ____________________ Student ID #: ____________________

You must show your work to get credit

Examination 1 | Fall 2004 | Physics 211 | Professor: Philip Cole
Date: 24 Sept. 2004

Test Time: 50 minutes
Possible Score: 100 points.

Write your name on each page. Do the easier problems first. If a problem seems too difficult, skip it, and return to it once you have completed all of the other problems first. There are five pages to this test. **Write Neatly**

Good Luck!

Problem 1	________	(50 pts)
Problem 2	________	(50 pts)
Total	________	(100 pts)

Name: ______________________

Problem 1

(a) State Newton's First Law.
(b) State Newton's Second Law *mathematically*.
(c) Define what an inertial reference frame is.

A weight hangs from a vertical cable tied to two other cables, each of which is fastened to a support attached to the ceiling. Each of the two upper cables makes an angle of θ with respect to the vertical. The magnitude of the weight of the box is W. The three cables join at a knot and the whole system is in static equilibrium.

(d) Draw the free-body diagram for the knot joining the cables and show your coordinate system.
(e) Now write down the sum of the forces in the x and y directions, *i.e.* $\sum F_x$ and $\sum F_y$.
(f) Calculate the tension in each of the three cables.

The weight is now supported in the same fashion to the ceiling within an elevator. Assume the cables do not break.

(g) For the following, determine the tensions in each of the three cables, when the elevator is

i: accelerating upwards at 4.9 m/s^2,
ii: accelerating downwards at 4.9 m/s^2,
iii: moving at a constant upward velocity of 9.8 m/s,
iv: in free fall,
v: at rest

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Problem 2

A block of mass m is situated upon the surface of a ramp, which is inclined at an angle of θ with respect to the horizontal. For the block on the ramp $\mu_s = 0.350$ and $\mu_k = 0.200$.

(a) Draw the free-body diagram for the forces acting on the block when it is in static equilibrium, *i.e.* it is not yet sliding.
(b) At what angle θ will the block start sliding? Why?
(c) Assuming the angle is big enough so that the block will start sliding, draw the free-body diagram for the forces acting on the block as it slides down the incline.
(d) Is the block in dynamic equilibrium when it slides down the incline? Why or why not?
(e) Setting $\theta = 30.0^\circ$ and assuming that the block starts from rest, what is the speed of the block after it has traveled 1.00 m?
(f) How long does it take for this block to travel a distance of 1.00 meter?
(g) For the block's journey traveling down the ramp sketch: a_x vs t v_x vs t x vs t. Take x to be parallel to the surface of the ramp.
(h) Once the block is down off the ramp, it encounters a surface that is perfectly smooth, flat, and frictionless. Once this block is beyond the ramp and is traveling on this frictionless surface, sketch: a_x vs t v_x vs t x vs t, where x is parallel to this frictionless surface. You may assume that the block leaves the ramp at the speed calculated in part (e).

Useful Expressions

$$\vec{r} = \vec{r}_\circ + \vec{v}_\circ t + \tfrac{1}{2}\vec{a}t^2$$
$$\vec{v} = \vec{v}_\circ + \vec{a}t$$
$$v_y^2 = v_{\circ y}^2 + 2a_y\Delta y$$
$$v_x^2 = v_{\circ x}^2 + 2a_x\Delta x$$