Phy131 Second Homework Assignment
Due Friday, January 15

Figures for the questions can be found on the homework web page

Question 1
A massless plank is 6 feet long. A 200 pound weight is sitting on it a distance of 2 feet from the left end. The plank is held up by two forces: A force of 150 pounds at an angle α at the right end of the plank, and a force of magnitude F at an angle β at the left end. If the plank is in static equilibrium, determine α, β, and F.

Question 2
Doug, who weighs 200 pounds, takes a rest on top of a ladder as shown in the figure on the next page. There is no friction between the ladder and the floor. Each leg of the ladder weighs 40 pounds. Each leg of the ladder is 8 feet long, and a rope holds the two legs together. The legs make an angle of 30° at the top, and the hinge at the top is frictionless.

Find the tension in the rope (which keeps the legs from sliding apart).

Question 3
Baseball pitcher Clayton Kershaw can throw a fastball with a horizontal speed of 160 km/hr (100 mph). How long does it take for the ball to reach home plate, which is 18.4 meters away?

Question 4.
The brakes on your car are capable of creating a deceleration of 17 ft/s^2. If you are going 85 mph and suddenly see a policeman, what is the minimum time that you can slow your car down to 65 mph? (note: 60 mph $\approx$ 88 ft/sec). How far do you travel in slowing down from 85 mph to 65 mph?

Question 5
Michael Jordan can jump vertically into the air a distance of 5 feet. What is the total time that he is in the air? His acceleration is due to gravity, and is downward

with a magnitude of $g = 9.8 \ m/s^2$.

Question 6

A stone is thrown vertically upward. On its way up it passes a point A with speed v. When it passes a point B, which is 3 meters higher than A, its speed is $v/2$. Calculate the speed v. The acceleration is due to gravity, and is downward with a magnitude of $g = 9.8 \ m/s^2$.

Question 7

Neil has a fast race car, and takes it out for a test run. He has an accelerometer in his car, and is able to measure his acceleration. His motion is in the $+x$ direction, and his acceleration is given by the formula:

$$a_x = 4t \tag{1}$$

where t is in seconds and a_x is in m/s^2. At $t = 0$ the car is at rest and at $x = 0$. Determine the following:

a) the velocity of the car at time $t = 3$ seconds.
b) the position of the car at time $t = 3$ seconds.
c) the position of the car when the velocity is $8 \ m/s$.

Question 8

You travel on I5 from L.A. to Sacramento, **half the time** at 60 km/hr and the other **half the time** at 90 km/hr. On the way back, you travel **half the distance** at 60 km/hr and the other **half the distance** at 90 km/hr.
What is your average speed for the following cases:

a) from L.A. to Sacramento?
b) from Sacramento to L.A?
c) for the entire trip?

Question 9

When Ernie Li sprints the 100 meter dash, his speed v down the track is $v(t) = 11(1 - e^{-t})$ m/s, where t is in seconds. At $t = 0$, he starts off at $x(0) = 0$.

a) What is Ernie's acceleration after 10 seconds?

b) Find Ernie's position $x(t)$ down the track as a function of time. Hint: Use v(t) = dx/dt and integrate. $\int e^{-t}dt = -e^{-t}$.

c) Does Ernie run the 100 meter race in under 10 seconds?