Quiz 7/8

Names: _____

1. When you rise from a chair, you have to lean quite far forward (try it!). Why is this?

2. By experiment you've determined the spring constant for the springs on each wheel of a car. You use Hooke's Law, $F = -kx$, to model these springs. Which factor of Hooke's Law F, k or x would the following physical features fit – or would it not fit the model provided by Hooke?
   a. Load of groceries in the car.
   b. Thickness of metal used to make the springs.
   c. Car sinking down when a very large man (400 lbs) enters the car.
   d. Pressure in the tires of the car.

3. Two bears are hanging out on a tree branch as shown. Let's guess that each bear weighs 40 kg and the tree branch weighs 50 kg and is 5 meters long. Assume one bear is about 1 meter from the trunk and the other is 2.5 meters from the trunk.

   a. Determine the torque on the branch where it meets the trunk of the tree. Model the branch as if it's growing perfectly horizontal to the ground.
   b. Now show how the torque at the trunk would change if the left bear moved to a point 3 meters from the trunk and we said the branch at that point was at an angle of 40 degrees below the horizontal. The right bear is in the same spot and the branch is still horizontal there. Assume the branch is bent right in the middle.

$\theta_f = \theta_i + \omega_i \Delta t + \frac{1}{2}\alpha(\Delta t)^2$ $\quad \omega_f = \omega_i + \alpha \Delta t$ $\quad \omega_f^2 = \omega_i^2 + 2\alpha(\Delta\theta)$

$\tau = F_\perp r$ $\quad v = \omega r$ $\quad a_c = \frac{v^2}{r} = \omega^2 r$

$x_{cg} = \frac{x_1 m_1 + x_2 m_2 + x_3 m_3 + \ldots}{m_1 + m_2 + m_3 + \cdots}$ $\quad F_{sp} = -k\Delta x$ $\quad \frac{F}{A} = Y\frac{\Delta L}{L}$