Quiz 7/8 Solution

1. To stay balanced, your center of mass must be over a support point. If you are sitting, you are supported by your butt. If you stand, your center of mass needs to be over your feet.

2. Hooke's Law $F = -kx$

   F is force so mass · gravity or the <u>load</u> on the springs

   k is the spring constant which tells you how flexible the springs are.

   x is displacement or how far the springs compress or stretch.

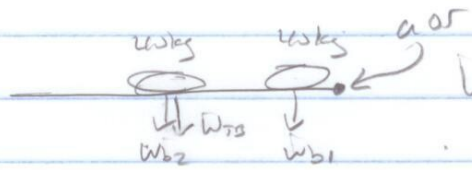
a. Load of groceries will change F - force on springs.

b. The stress of metal will change k - spring constant

c. Sinking is x - displacement

d. Pressure in the tires has nothing to do with the load (F), the strength of the springs (k) or how much the springs compress / stretch.

3. a.



W_b = Weight of a bear cub

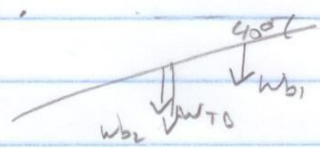
$= 40\,kg \; 9.8\,m/s^2 = 392\,N$

W_{TB} = weight of the tree brace

$= 50\,kg \; 9.8\,m/s^2 = 490\,N$

$$\tau_{Trunk} = \tau_{b_1} + \tau_{b_2} + \tau_{TB}$$
$$= W_{b_1} d_1 + W_{b_2} d_2 + W_{TB} d_{TB}$$
$$= -392N \cdot 1.0m + -392N \cdot 2.5m + -490N \cdot 2.5m$$
$$= 392\,Nm + 980\,Nm + 1225\,Nm$$
$$= 2,597\,Nm$$
$$= \boxed{2,600\,Nm}$$

b.



$$\tau_{Trunk} = \tau_{b_1} + \tau_{b_2} + \tau_{TB}$$
$$= W_{b_1} \sin 50° d_1 + W_{b_2} \sin 50° d_2 + W_{TB} \sin 50$$
$$= -392N \sin 50° \cdot 1.0m + -392N \sin 50° \cdot 2.5m +$$
$$-490N \sin 50° \cdot 2.$$

$$= 300\,Nm + 751\,Nm + 938\,Nm$$
$$= 1989\,Nm$$
$$= \boxed{2,000\,Nm}$$

c. There is less torque on the branch that is hanging down than the branch that is completely horizontal.