11/3 In Class – Static Equilibrium and Review for Exam 2

Static Equilibrium

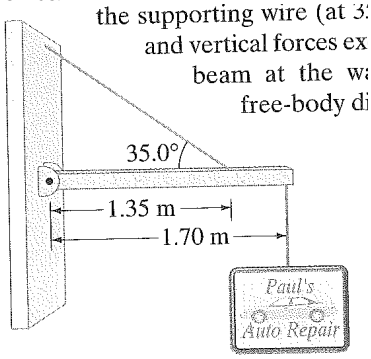
The word static means stationary–that now includes that the cm of the system does not move, and it does not rotate. There are two conditions for static equilibrium:

1. $\Sigma \vec{F} = 0$
2. $\Sigma \vec{\tau} = 0$

These are both special cases of Laws you have worked with in the past: Newton's Second Law and the second law for rotations.

1. A 4m long, 100 kg scaffold is supported by a vertical cable on each end. If a 80 kg painter stands 1 m from one end of the scaffold, determine the tension in each cable.

2. A shop sign of mass 20 kg hangs from the end of a 1.7m long beam of mass 10 kg. A supporting wire makes an angle of 35° wrt the horizontal as shown.



   (a) Draw a free body diagram for the beam. This time, show where the forces act.

   (b) Find the tension in the wire.

   (c) Find the force of the building on the beam.

Some Review Problems–not e complete list at all

3. Assume that mars orbits the sun in a circular orbit. Look up any masses and distances you need to answer:

   (a) What is the gravitational force of the sun on Mars?

   (b) What is the speed of Mars' orbit around the sun?

   (c) What is the period of Mars' orbit?

4. What is $\vec{g}$ on Mars?

5. A crate is pulled 3m across the horizontal, *rough* floor of a warehouse with a force of 80 N at an angle of 30° above the horizontal. The crate has a mass of 15 kg and accelerates from rest. Assume the coefficient of kinetic friction between the crate and the floor is 0.2.

   (a) Draw a free-body diagram for the crate.

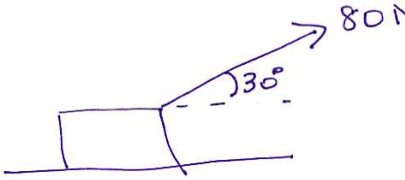
   (b) How much work does gravity do on the crate?

   (c) How much work does the normal force do on the crate?

   (d) How much work does the pull force do on the crate?

   (e) How much work does friction do on the crate?

   (f) If the crate starts from rest, how fast is it moving at the end of the 3m?



6. A solid sphere of mass 1.5kg and radius 12cm rolls without slipping across a horizontal floor. Its translational speed is 2m/s.

$$I_{sphere} = \frac{2}{5}mr^2$$

   (a) What is the sphere's translational (linear) momentum?

   (b) What is the sphere's translational (linear) kinetic energy?

   (c) What is the sphere's angular momentum?

   (d) What is the sphere's angular kinetic energy?

   (e) What is the sphere's kinetic energy?

7. A turntable with a mass of 4 kg and radius 24 cm spins (with negligible friction) at a rate of 12 rad/s. A 2 kg lump of clay is dropped on the turntable at a distance of 12 cm from the center. What is the new angular velocity of the turntable? (The rotational inertia of a disk is $\frac{1}{2}MR^2$.)