The graduate with a Science degree asks, "Why does it work?"
The graduate with an Engineering degree asks, "How does it work?"
The graduate with an Accounting degree asks, "How much will it cost?"
The graduate with a Liberal Arts degree asks, "Do you want fries with that?"
Tutoring for Statics

- Tutoring is available for statics here in engineering
- Check the web site at http://www.memphis.edu/eece/stem/stem_tutoring.php

I don’t have the details but they should be available on that site.
Objectives

- Understand the use of the equilibrium constraint conditions
- Understand the development of the FBD in the solution of equilibrium problems
Tools

- Basic Trigonometry
- Pythagorean Theorem
- Algebra
- Visualization
- Position Vectors
- Unit Vectors
For a system to be in equilibrium, the three following constraint conditions must be satisfied:

\[
\sum F_x \vec{i} = 0
\]

\[
\sum F_y \vec{j} = 0
\]

\[
\sum F_z \vec{k} = 0
\]
Review

- If we take the sign of the direction vector times the magnitude for each of the components we can then write

\[
\sum F_x = 0 \\
\sum F_y = 0 \\
\sum F_z = 0
\]
Review

- The free-body diagram is an isolation of an element and the identification of all forces which are acting on that element.
- By an element, we mean a part of a mechanical system.
- Forces can act on a system as either an applied force from some external source or
- Forces can act due to the connection of the system to some other system in response to the applied forces – these forces are known as reactions.
Review

Important points about springs

- The force that they exert will have a line of action along their axis
- The force that they exert will be proportional to the amount they are compressed or extended
- A compressed spring will push on the object(s) it is attached to
- An extended spring will pull on the object(s) it is attached to
Review

- A rope always pulls on whatever it is connected to.
- The force generated by a rope always has a line of action along the rope.
- Whenever the same rope passes over, but not tied to, multiple connections, the force magnitude is the same through the length of the rope.
Review

- Weight always acts toward the center of the earth
- In typical problems, that will be towards the bottom of the page
- If the weight or mass of an element is not given, you may assume that it is negligible in the analysis that is being done
Problems

- In order to illustrate how the process works, we will work a couple of example problems.
- The first will be a two-dimensional problem and the second will be a three-dimensional problem.
Determine the unstretched length of spring AC if a force $P = 80$ lb causes the angle $\theta = 60^\circ$ for equilibrium. Cord AB is 2 ft long. Take $k = 50$ lb/ft.
Determine the maximum weight of the bucket that the wire system can support so that no single wire develops a tension exceeding 100 lb.
Determine the maximum weight of the crate so that the tension developed in any cable does not exceed 450 lb.
Determine the force in each of the three cables needed to lift the tractor which has a mass of 8 Mg.