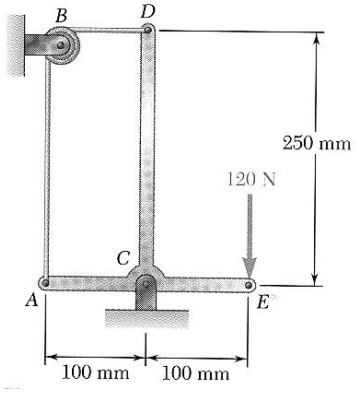
EM203 Mechanics of Materials
First Homework

1. For the system shown, draw the correct free body diagram for member ADE.



2. Consider a load hanging from a vertical rod.

   2i. We double the load (still in the elastic region). Compared to the original deflection, the new deflection will:

   a) stay the same
   b) be double original deflection
   c) be quadruple original deflection
   d) decrease to one half original deflection
   e) decrease to one fourth original deflection
   f) depend upon the area of the rod
   g) depend upon the length of the rod
   h) depend upon Young's Modulus, E
   i) other _____

   2ii. We reduce the length of the rod to one half the original value but keep the original load. Compared to the original deflection, the new deflection will:

   a) stay the same
   b) be double original deflection
   c) be quadruple original deflection
   d) decrease to one half original deflection
   e) decrease to one fourth original deflection
   f) depend upon the area of the rod
   g) depend upon the length of the rod
   h) depend upon Young's Modulus, E
   i) other _____

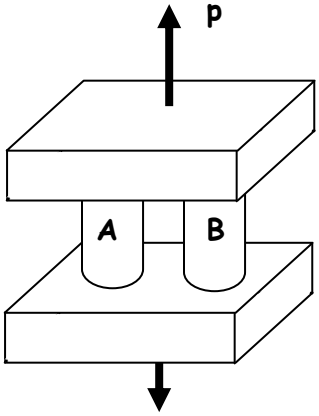
   2iii We double the diameter of the rod but keep the original length and load. Compared to the original deflection, the new deflection will:

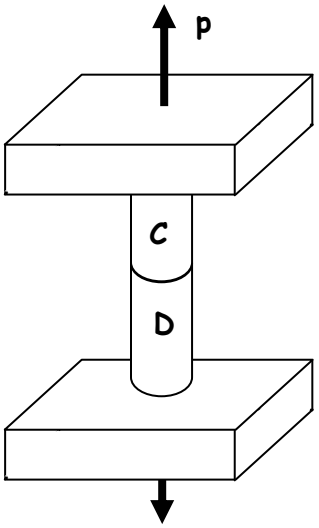
   a) stay the same
   b) be double original deflection
   c) be quadruple original deflection
   d) decrease to one half original deflection
   e) decrease to one fourth original deflection
   f) depend upon the area of the rod
   g) depend upon the length of the rod
   h) depend upon Young's Modulus, E
   i) other _____

3. If we cut a spring in half, the stiffness of each half spring will be
   a) the same as the stiffness of the full spring
   b) half the stiffness of the full spring
   c) twice the stiffness of the full spring
   d) other _____

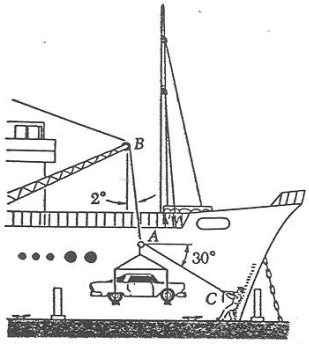
4. In the systems shown, all bars (A, B, C, D) are the same length and the same cross-sectional area. The plates are rigid, remain parallel, and have the same load, P, applied. Bars A and C are steel. Bars B and D are aluminum.

3i. Name the rod(s) in which internal force is equal to applied load P _____
3ii. Name the rod(s) in which force is less than P _____
3iii Name the rod(s) in which the force is the lowest _____
3iv. Name the rod(s) in which force is greater than P _____
3v. Name the rod(s) with the largest deflection _____
3vi. Name the system with the largest deflection _____

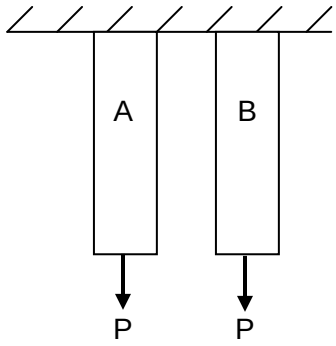




5. In a ship unloading operation, a 3500-lb automobile is supported by a cable. A rope is tied to the cable at A and pulled in order to center the automobile over the intended position. The angle between the cable and the vertical is 2 degrees, while the angle between the rope and the horizontal is 30 degrees. If the tension in the cable is 3574 pounds, what tension is needed in the rope for equilibrium? Show your work.



a) 125 lb b) 144 lb c) 249 lb d) 2490 lb e) none of these



6. Two metal bars are made of different materials but have identical geometry (dimensions) and identical tensile loading.

   6i) At the applied load, Bar A deflects more than bar B. When load is removed, both bars return to their original dimensions. Therefore, the metal in bar A is (circle all that apply)

a) stronger	b) weaker
c) stiffer	d) less stiff
e) more ductle	f) less ductile
g) can't tell from given	

   6ii) In a second test, the bars are identically loaded until one bar fails. The bar that fails first is

a) stronger	b) weaker
c) stiffer	d) less stiff
e) more ductle	f) less ductile
g) can't tell from given	

   6iii) Name a design circumstance in which you would want

   a) a strong material

   b) a stiff material

   c) a ductile material

7. Suppose we have performed tensile tests using steel specimens (Group 1) with nominal 0.505 inch diameter and 2 inch gage length.

   7i. If we test identical steel specimens (Group 2) with a 0.400 inch diameter and 2.00 inch gage length, we expect the Group 2 specimen's average Youngs Modulus to

   a) be lower than the Modulus from Group 1
   b) be higher than the Modulus from Group 1
   c) be the same as the Modulus from Group 1

   7ii. If we test identical steel specimens (Group 3) with a 0.505 inch diameter and 4.00 inch gage length, we expect the Group 3 specimen's average Youngs Modulus to

   a) be lower than the Modulus from Group 1
   b) be higher than the Modulus from Group 1
   c) be the same as the Modulus from Group 1