

EXAM #1

February 19, 2008

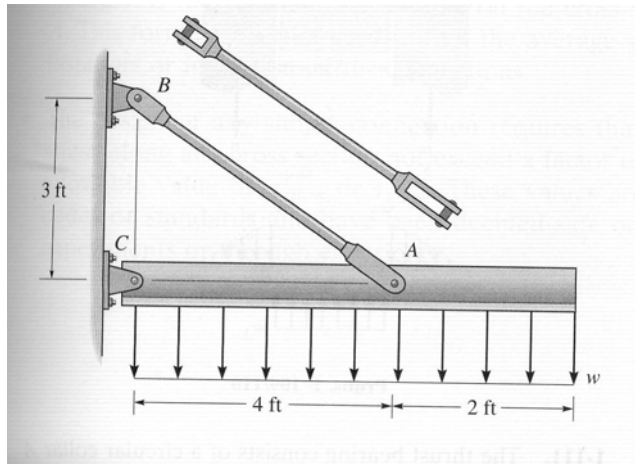
Name: _____

Question	Points	Score
1	25	
2	20	
3	30	
4	25	
total	100	

1. (25 pts.) The hanger assembly below is used to support a distributed loading of $w = 0.8$ kip/ft.

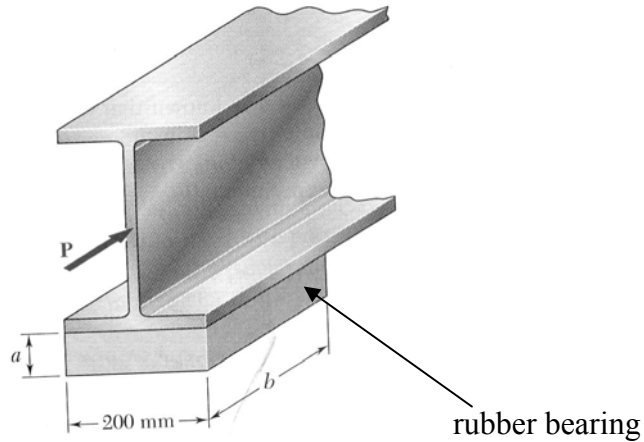
a) Determine the average shear stress in the 0.4 in. diameter bolt at A and the average tensile stress in rod AB, which has a diameter of 0.5 in.

b) If the yield shear stress for the bolt is $\tau_y = 25$ ksi, and the yield tensile stress for the rod is $\sigma_y = 38$ ksi, determine the factor of safety with respect to yielding in each case.



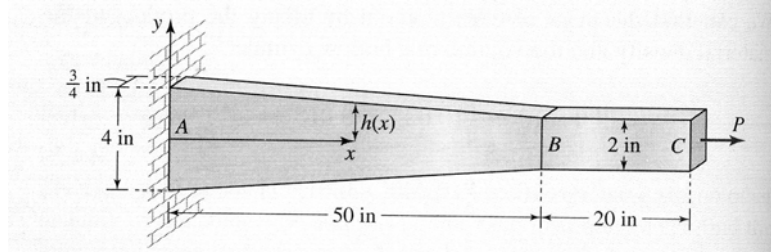
2. (20 pts.) A rubber bearing ($G = 0.9 \text{ MPa}$) is used to support a bridge girder as shown to provide flexibility during earthquakes. The beam must not displace more than 10 mm when a 22 kN load is applied as shown, and the maximum allowable shear stress is 410 kPa. Determine:

- The smallest allowable dimension b , to the nearest mm.
- The largest required thickness a , also to the nearest mm.



3. (30 pts.) A rectangular aluminum bar ($E_{al} = 10,000$ ksi, $\nu = 0.25$) of a $\frac{3}{4}$ in. thickness consists of uniform and tapered cross sections, as shown. The depth of the tapered section varies as $h(x) = 2 - 0.02x$. Determine:

- The elongation of the bar under a load $P = 10$ kips.
- The change in dimension in the y direction in section BC.



4. (25 pts.) A rigid horizontal bar ABC is supported by a hinge at A by two steel cables BD and CD, which are of equal length, $L = 0.8 \text{ m}$, and cross-sectional area $A = 140 \text{ mm}^2$. Find the stress in each cable due to a vertical force of $P = 40 \text{ kN}$, assuming small displacements.

