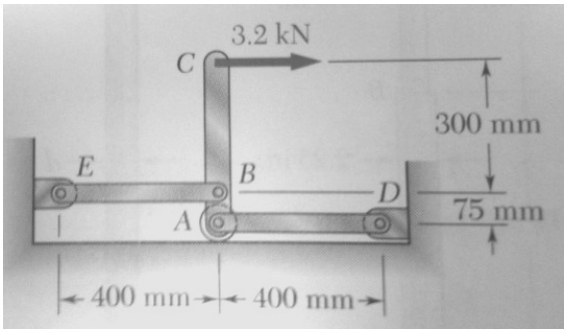
Exam 1
November 12, 2010
90 minutes

Problem 1 (25 Points)

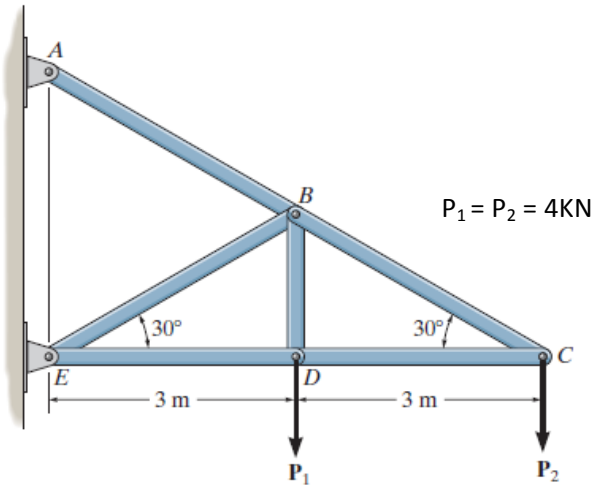
The steel members BE and AD each has a 6mm x 18mm cross-sectional area. Knowing that E=200GPa, determine the deflections of points A, B, and C of rigid member ABC.



Problem 2 (25 Points)

(a) Given that all members are made of steel with an ultimate stress of 400MPa. Using a factor of safety of 2.0, calculate the required cross-sectional areas for square members AB and ED.

(b) The pins on the frame at A and E each have a diameter of 8mm. If these are subjected to double shear, determine the average shear stress in each pin.

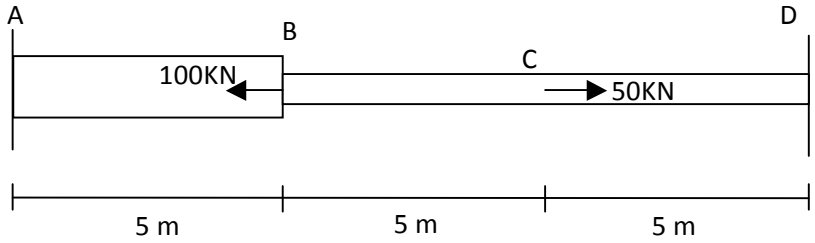


Problem 3 (25 Points)

The bar shown below is made of aluminum (E = 70GPa). It is fixed at A and D, and loaded with two axial loads of 100KN and 50 KN at B and C respectively. Determine the maximum normal stress in the bar.

Area of AB = 6.0 mm^2

Area of BD = 2.0 mm^2



Problem 4 (25 Points)

A horizontal rigid beam is supported by three bar elements. Bars AB and CD are made of steel (E = 200GPa, $\alpha = 12 \times 10^{-6}$ / ˚C). Bar EF is made of a Titanium Alloy (E = 120GPa, $\alpha = 21 \times 10^{-6}$ / ˚C). All Bars have the same Length, L = 500mm, the same cross-sectional Area, A = 25mm^2, and are equally spaced at a distance d = 250mm. If the temperature in the assembly increases by 60 ˚C, determine (a) the normal stresses in the bars, and (b) the angle of tilt of the rigid beam.