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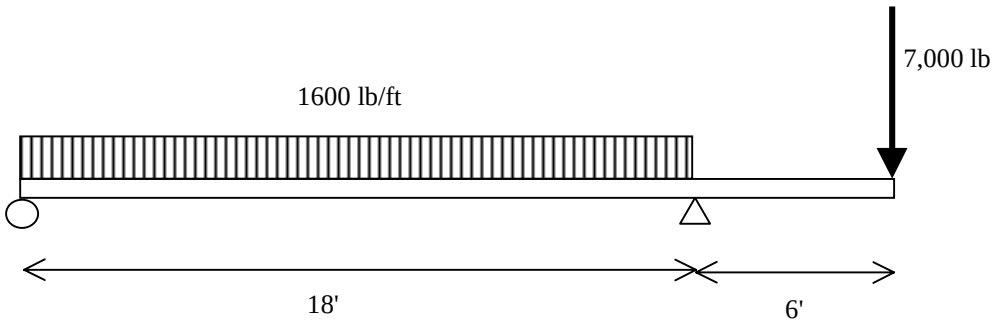
Beam Deflection

Problem No. 1

The figure below illustrates a beam subject to a set of loads.

a. Determine the reactions at the supports (neglect the weight of the beam).
b. Draw the shearing forces diagram.
c. Draw the bending moments diagram.
d. Design the beam for bending using a W-shape steel (A36) cross-section.
e. Using the section that you have selected before, determine the deflections of the beam at midspan and the maximum deflection. Provide the ratio of the calculated deflections over the corresponding clear span length. Redesign if any of these ratios exceeds 1/360.
f. Determine the maximum shearing stresses in the beam.
g. The shearing stresses in an I-beam can be approximated by dividing the shearing force at a section by the area of the web. How good is such an approximation for this beam?



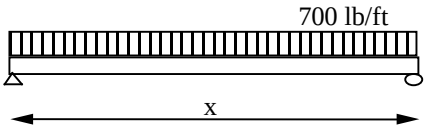
Problem No. 2

Please determine the maximum length of the simply supported 6x10 (made of 3 2x10 dimensional lumber: actual dimensions 4.5x9.25) wood floor beam (Δ_{allow} = L/360, f_b=1,200 psi, f_v=180 psi, E=1,500,000 psi) shown below. Please consider the maximum length of the beam governed by:

a. shearing stresses

b. bending stresses

c. deflection



Problem No. 3

a. Please determine the maximum shearing stress in the prismatic beam shown below, with a rectangular cross-section of b=4" and d=10".

b. What is the shearing stress at a distance of 4" from the top edge of the same beam?

c. What is the shearing stress at the top edge of the same beam?