

ARCH 331. Assignment #6

Date: 2/22/18, due 3/1/18

Pass-fail work

Problems: supplemental problems (6A, etc.) **and** from Onouye & Kane, Chapters 4 & 10

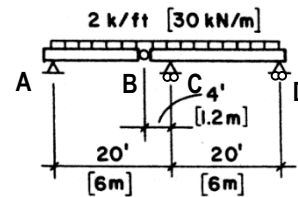
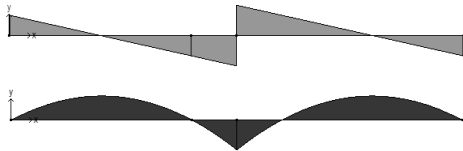
*Notes: Problems marked with a * have been altered with respect to the problem stated in the text.*

- (25%) 6A) Using **metric units** investigate the beam shown in Figure 3.48c. Find the reactions and draw the shear and moment diagrams, indicating all critical values. (*compound beams*)

Partial answers to check with:

$$V_{max} = 108 \text{ kN},$$

$$M_{max} = -108 \text{ kN-m}.$$



(c)

Figure 3.48 (c)
Reference for Problem 6A)

- (25%) 3.30 Determine all support and pin forces for the multiforce member diagram listed below.

(pinned frames)

Partial answers to check with:

$$A_x = +171.8 \text{ kN},$$

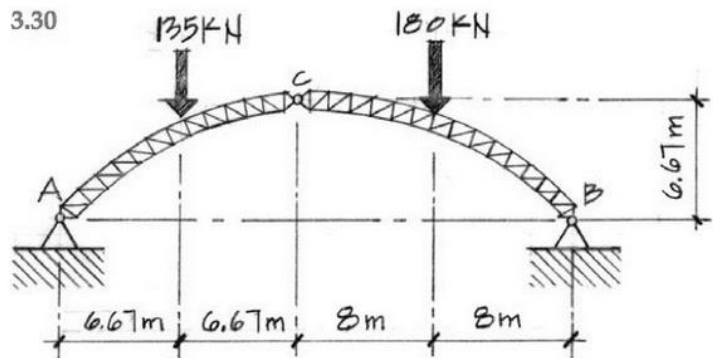
$$A_y = +153.4 \text{ kN},$$

$$B_x = -171.8 \text{ kN},$$

$$B_y = +161.6 \text{ kN},$$

$$C_x = -171.8 \text{ kN (wrt AC)},$$

$$C_y = -18.4 \text{ kN (wrt AC)}.$$

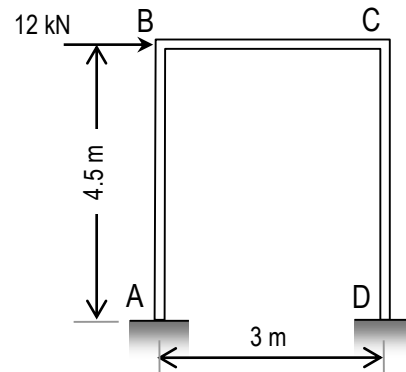


- (6%) 6B) A 22-ft span beam is fixed at both ends and carries a single concentrated load of 16 kips at midspan (no image). Find the reactions and construct the complete shear and moment diagrams *using beam diagram formulas*.

Partial answers to check with: $V_{max} = 8 \text{ kips}$, $M_{max} = 44 \text{ k-ft}$

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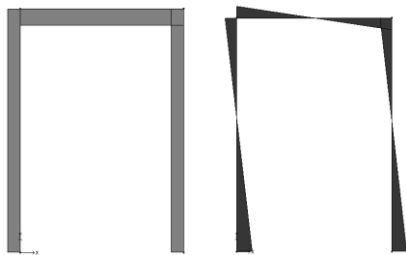
(22%) 6C) For the rigid frame shown, the reactions *using an approximate analysis method* at A are: $A_x = -6.0$ kN, $A_y = -8.10$ kN, $M_A = 14.85$ kN·m, and at D are: $D_x = -6.0$ kN, $D_y = 8.10$ kN, $M_D = 14.85$ kN·m. Plot the shear and bending moment diagrams and identify V_{max} and M_{max} . Also sketch the deflected shape. (equilibrium & semigraphical method)



Partial answers to check with:

$$M_{BA} = 12.15 \text{ kN}\cdot\text{m}, M_{CB} = -12.15 \text{ kN}\cdot\text{m},$$

$$V_{max} = -8.10 \text{ kN}, M_{max} = -14.85 \text{ kN}\cdot\text{m}$$



(8%) 6D) For the frame of problem 6C, use Multiframe software to find the shear and bending moment values to verify your work from the semigraphical method. Use the standard steel section you have been assigned which is posted in My Grades on eCampus. Submit the data file (.mdf) on eCampus (under Assignments: Assignment 6) and provide a print of the shear diagram (V), bending moment diagram (M), and deflected shape (δ). **Note: The values from Multiframe will not be identical to the approximate analysis values, but will be close.**
 Note: The "Find, Given, Solution" format is not required.

(14%) 9.6 Determine the critical buckling load and stress for the column shown. Assume A36 structural steel.
 (Euler buckling formula)

Partial answers to check with:

$$L_e/r_x = 91.2 \text{ and } L_e/r_y = 119.25,$$

$$P_{cr-x} = 244 \text{ k}, P_{cr-y} = 142 \text{ k}, \therefore f_{cr} = 20.1 \text{ ksi}$$

Note: there is only ONE critical buckling load

