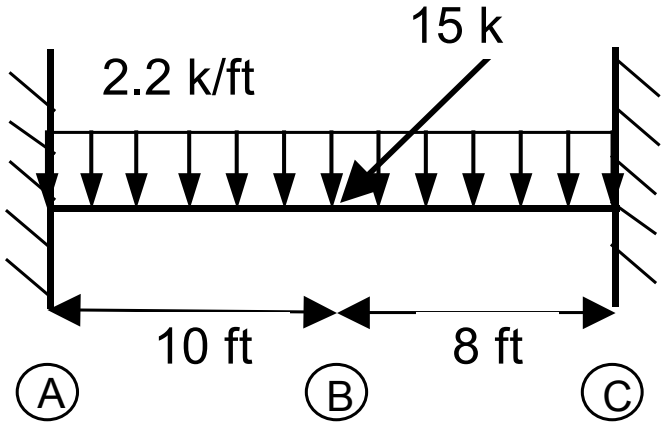
CEE 379 **Sample Final Problems** Name: _____

Problem 1 [25] The frame structure shown below is to be analyzed using the direct stiffness method. The structure is subjected to a uniform load along member AB and a concentrated load at joint B. The load at B is orientated at 45 degrees from the horizontal. Members AB and BC have the following properties: $A = 45$ in.^{2}, $I = 8000$ in^4, and $E = 29{,}000$ ksi.

Determine the rotations and displacements at the free degrees of freedom.



Problem 2 [25] Consider the same structure and loading as considered in Problem 1.

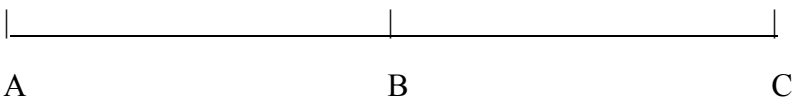
a) (6) On the drawing below, plot the **axial force diagram** for the structure. Indicate the magnitude of the maximum axial force for each member.

b) (6) On the drawing below, plot the **shear force diagram** for the structure. Indicate the magnitude of the maximum shear force for each member.

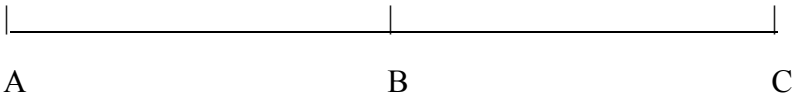
c) (7) On the drawing below, plot the **bending moment diagram** for the structure. Indicate the magnitude of the maximum positive and negative bending moments for each member.

d) (6) On the drawing below, qualitatively and neatly plot the **deflected shape** of the structure.

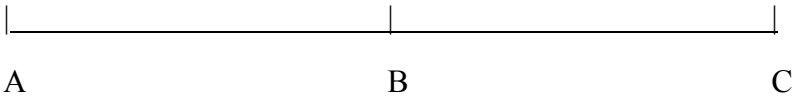
Axial Force Diagram



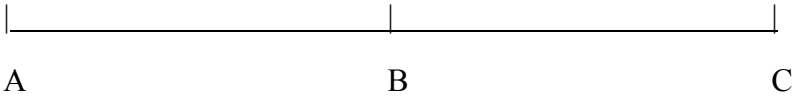
Shear Diagram



Bending Moment Diagram



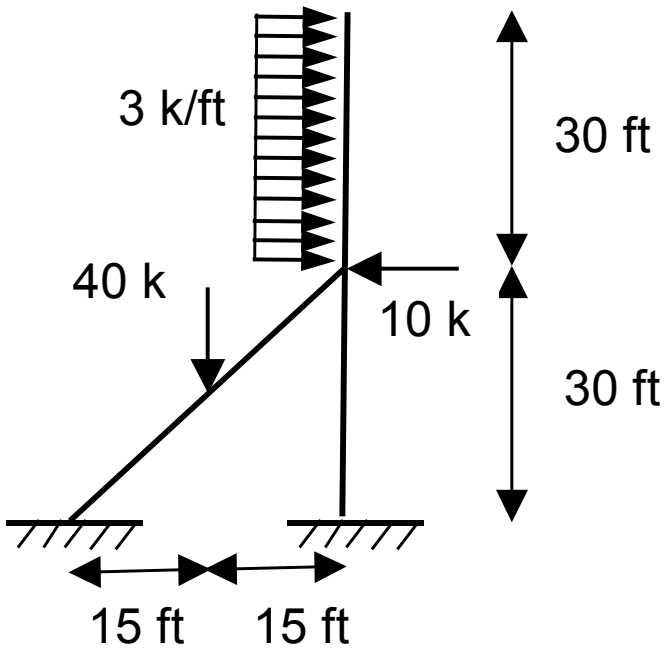
Deflected Shape



Problem 3 [20] Consider the three-member planar frame shown below.

a) (5) On a sketch of the frame, identify the free kinematic DOF.

b) (15) Find the equivalent nodal forces, $\mathbf{P_f}$-$\mathbf{P_{of}}$, at the free degrees of freedom, such that $U_f = K_{ff}^{-1} (P_f - P_{of})$



Problem 4 [30] The structure shown below consists of a horizontal frame member AB and a diagonal truss member BC. The frame member, which is fixed at A, has the same properties as member AB in Problem 1. The diagonal member has the same cross-sectional area. The structure is to be analyzed using the direct stiffness method.

A downward vertical displacement of 0.25 in. is imposed at B. Joint B is free to move horizontally and to rotate. Determine the horizontal displacement and rotation of joint B.