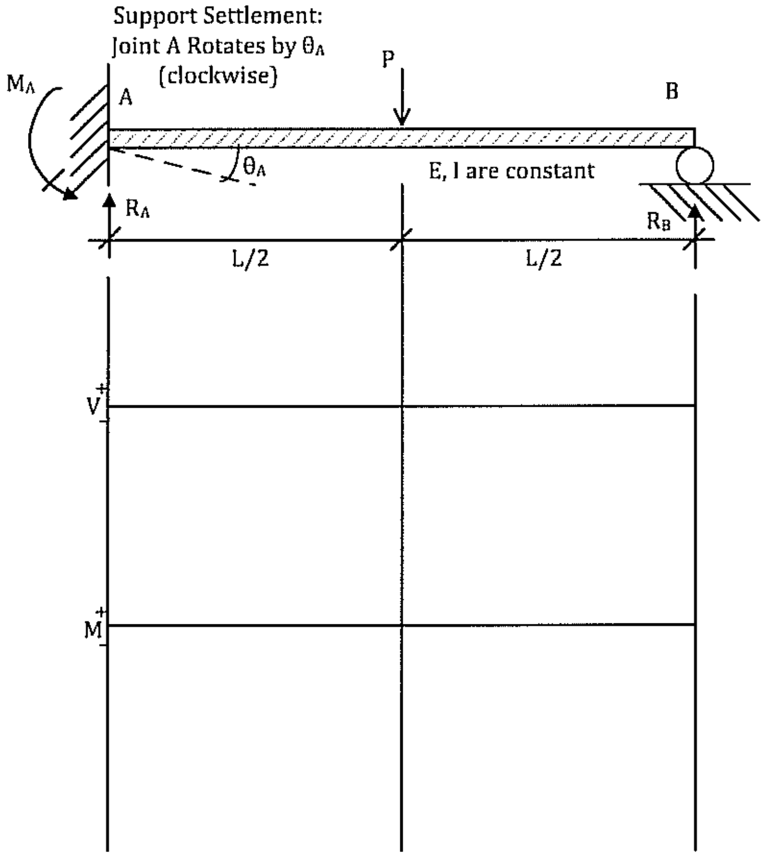
CE 3202 Fall 2010 Quiz 1 Name ____________________

Closed Book; Closed Notes
(3) 3"x5" Note Cards Allowed; Calculator Allowed
80 points are possible

Answer all questions to the best of your ability. State any assumptions you feel are necessary. Attach extra sheets, if used. **Show your work!**

Problem 1. Flexibility Method – Single Redundant.

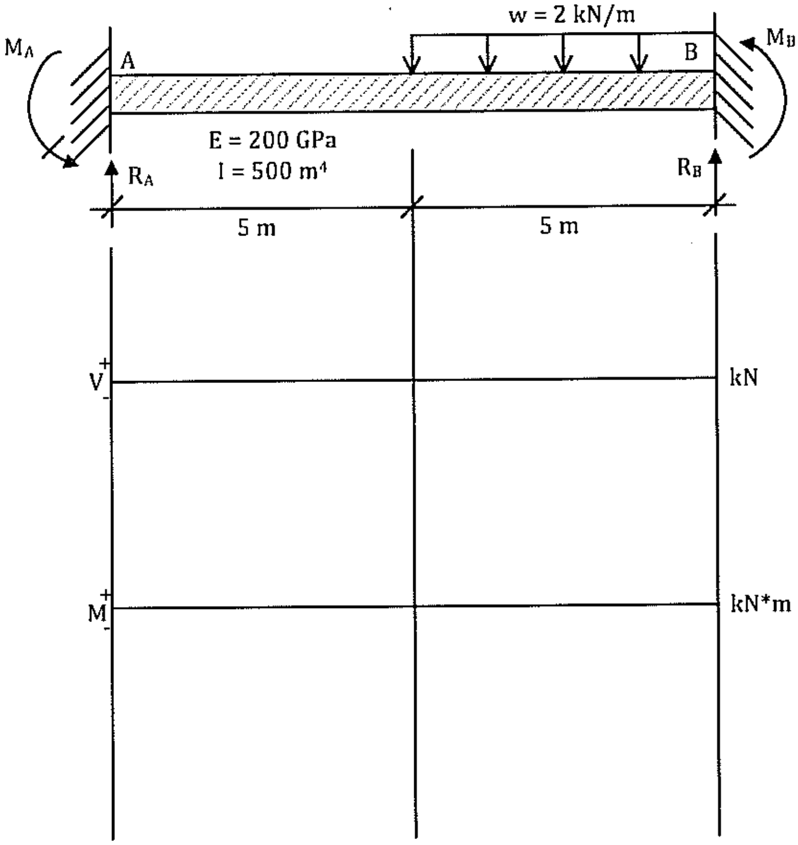
For the beam shown below, find the vertical and moment reactions then draw the shear and moment diagrams. You will ignore any axial loads or effects. Use the flexibility method. Clearly draw your released structure. Identify your equation(s) of compatibility. The beam is loaded at mid-span and is subjected to a support settlement at A (the settlement is in the form of a counter-clockwise rotation of the support). Use the attached load table, if possible. **(40 Points)**.



Additional space for Problem 1.

Problem 2. Flexibility Method – 2 Redundants.

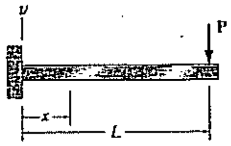
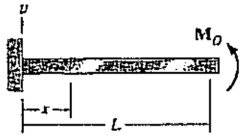
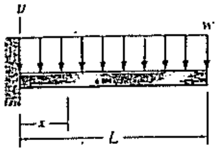
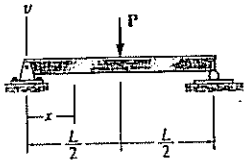
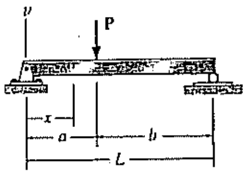
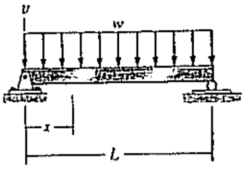
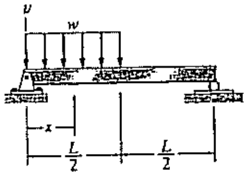
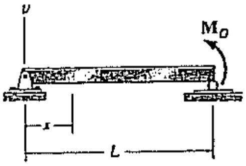
For the beam shown below, find the vertical and moment reactions then draw the shear and moment diagrams. You will ignore any axial loads or effects. Use the flexibility method. Clearly draw your released structure. Identify your equation(s) of compatibility. The beam is loaded by a uniform distributed load on one half of its span. Correct units are necessary for full credit. Use the attached deflection table, if possible. **(40 Points).**



Additional space for Problem 2.

Copied from:
Hibbeler, R. C. (1999), Structural Analysis, 4th Ed., Prentice Hall, Upper Saddle River, NJ, USA.

Beam Deflections and Slopes

	Loading	v + ↑	θ + ↶	Equation + ↑ + ↶
①		$v_{max} = -\frac{PL^3}{3EI}$ at $x = L$	$\theta_{max} = -\frac{PL^2}{2EI}$ at $x = L$	$v = \frac{P}{6EI}(x^3 - 3Lx^2)$
②		$v_{max} = \frac{M_O L^2}{2EI}$ at $x = L$	$\theta_{max} = \frac{M_O L}{EI}$ at $x = L$	$v = \frac{M_O}{2EI}x^2$
③		$v_{max} = -\frac{wL^4}{8EI}$ at $x = L$	$\theta_{max} = -\frac{wL^3}{6EI}$ at $x = L$	$v = -\frac{w}{24EI}(x^4 - 4Lx^3 + 6L^2x^2)$
④		$v_{max} = -\frac{PL^3}{48EI}$ at $x = L/2$	$\theta_{max} = \pm\frac{PL^2}{16EI}$ at $x = 0$ or $x = L$	$v = \frac{P}{48EI}(4x^3 - 3L^2x), 0 \leq x \leq L/2$
⑤			$\theta_L = -\frac{Pab(L+b)}{6LEI}$ $\theta_R = \frac{Pab(L+a)}{6LEI}$	$v = -\frac{Pbx}{6LEI}(L^2 - b^2 - x^2)$ $0 \leq x \leq a$
⑥		$v_{max} = -\frac{5wL^4}{384EI}$ at $x = \frac{L}{2}$	$\theta_{max} = \pm\frac{wL^3}{24EI}$	$v = -\frac{wx}{24EI}(x^3 - 2Lx^2 + L^3)$
⑦			$\theta_L = -\frac{3wL^3}{128EI}$ $\theta_R = \frac{7wL^3}{384EI}$	$v = -\frac{wx}{384EI}(9L^3 - 24Lx^2 + 16x^3)$ $0 \leq x \leq L/2$ $v = -\frac{wL}{384EI}(8x^3 - 24Lx^2 + 17L^2x - L^3)$ $L/2 \leq x \leq L$
⑧		$v_{max} = -\frac{M_O L^2}{9\sqrt{3}EI}$	$\theta_L = -\frac{M_O L}{6EI}$ $\theta_R = \frac{M_O L}{3EI}$	$v = -\frac{M_O x}{6EIL}(x^2 - 3Lx + 2L^2)$

CE 3202 Fall 2010 Quiz 2

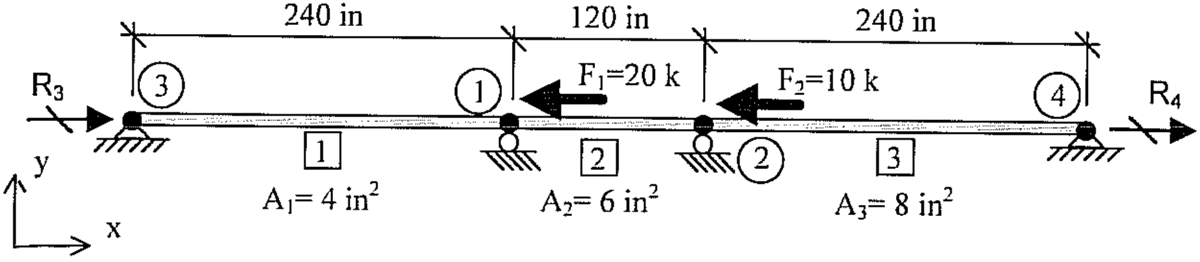
Name ______________________________

Closed Book; Closed Notes
(4) 3"x5" Note Cards Allowed; Calculator Allowed
20 points are possible

Answer all questions to the best of your ability. State any assumptions you feel are necessary. Attach extra sheets, if used. Show your work!

Problem 1. Direct Stiffness Method – 1D Truss.

The truss below is loaded only in the x-direction. For all members E = 30,000 kips/in².



(a) For the 1-dimensional truss shown above, derive the 2x2 member stiffness matrices for members 1, 2, and 3. Show your work. (5 Points).

$$\overline{K_1} = \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix}, \quad \overline{K_2} = \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix}, \quad \overline{K_3} = \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix}$$

(b) From your answer in part (a), derive the global stiffness matrix for the structure. Draw lines that separate the terms associated with the free and fixed degrees of freedom. (5 Points).

$$\overline{K_{Global}} = \begin{array}{c c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} & \\ \begin{bmatrix} \quad & \quad & \quad & \quad \\ \quad & \quad & \quad & \quad \\ \quad & \quad & \quad & \quad \\ \quad & \quad & \quad & \quad \end{bmatrix} & \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} \end{array}$$

(c) From your answer in part (b), set up and solve the matrix stiffness equation to find the horizontal reactions at joints 3 and 4. Show your work **(10 Points)**.