1.3-1

By FEA:

At $x = L_T$, $u = 0.1389 \frac{PL_T}{EA} + \frac{P(L_T/3)}{2EA}$

$$= 0.3056 \frac{PL_T}{EA}$$

(b) FEA stresses at element midpoints:

$$\sigma_{3\text{-}4} = \frac{E}{L_T/3}(0.3056 - 0.1389)\frac{PL_T}{EA} = 0.500\frac{P}{A}$$

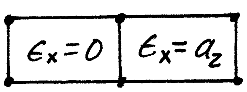
These stresses are exact.

1.3-2

$\boxed{1.3\text{-}2}$ $u = a_1 + a_2 x + a_3 y + a_4 xy$

$$\epsilon_x = \frac{\partial u}{\partial x} = a_2 + a_4 y$$

Continuity of ϵ_x: might have $a_2 = a_4 = 0$ in one element and $a_2 \neq 0$, $a_4 = 0$ in its neighbor. Thus



and ϵ_x is discontinuous across the shared boundary.

1.3-3

$\boxed{1.3\text{-}3}$ In all parts, substitute coordinates of nodes into Eq. 1.3-5.

(a) $\phi_1 = a_1 \qquad \therefore\ a_1 = \phi_1$

$\phi_2 = a_1 + a a_2 \qquad \therefore\ a_2 = (\phi_2 - \phi_1)/a$

$\phi_3 = a_1 + b a_3 \qquad \therefore\ a_3 = (\phi_3 - \phi_1)/b$

$$\phi = \phi_1 + \frac{\phi_2 - \phi_1}{a} x + \frac{\phi_3 - \phi_1}{b} y$$

(d) $\phi = \left(1 - \frac{y}{b}\right)\phi_1 + \left(\frac{x}{2a} + \frac{y}{2b}\right)\phi_2 + \left(-\frac{x}{2a} + \frac{y}{2b}\right)\phi_3$

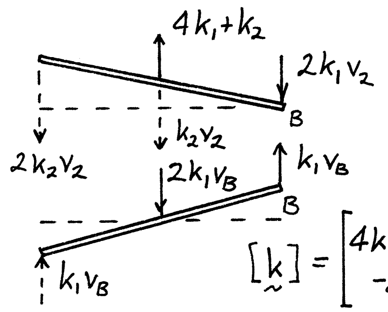
1.3-4

Answer is solution... not being saved electronically. Ask in lab

1.4-1

Ask in lab
1.4-2
Ask in lab
1.4.5
Ask in lab
2.2-3

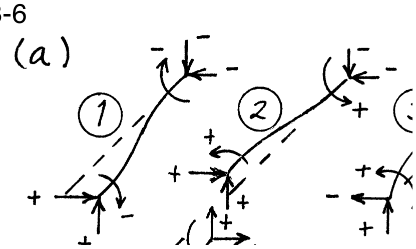
(c)



$$\begin{array}{cc} & \begin{array}{cc} v_2 & v_B \end{array} \\ [\underset{\sim}{k}] = & \begin{bmatrix} 4k_1+k_2 & -2k_1 \\ -2k_1 & k_1 \end{bmatrix} \end{array}$$

2.3-4
See email
We can get all but 22, 24, 42 and 44
2.3-6

(a)



$$\begin{bmatrix} + & + & - & - & - & - \\ + & + & + & - & - & + \\ - & + & + & + & - & + \\ - & - & + & + & + & + \\ - & - & - & + & + & - \\ - & + & + & + & - & + \end{bmatrix}$$

2.5-2

$\boxed{2.5-2}$

$$[\underset{\sim}{K}]: \begin{bmatrix} A,C & C & \\ C & C & \\ A & & \\ C & C & \\ C & C & \ldots \end{bmatrix} \qquad \{\underset{\sim}{R}\}: \begin{Bmatrix} A,C \\ C \\ A,B \\ B,C \\ B,C \end{Bmatrix}$$

2.5-3

$$[K] = EI_z \begin{bmatrix} 12/a^3 + 12/b^3 & -6/a^2 \\ -6/a^2 & 4/a \\ -6/b^2 & 0 \end{bmatrix}$$

2.6-3

$$\text{(c)}\ \{\underset{\sim}{D}\}_3 = c_3 \lfloor 4a \quad 0 \quad 4a \quad -3a \quad 0 \quad -3a \rfloor^T$$

where c_3 is a small constant

d) pick one and do K*D

2.6-4

$$\text{(b)}\ \{\underset{\sim}{d}\} = \lfloor c_1 \quad c_2 \quad c_3 \quad c_1 - Rc_3 \quad c_2 + Rc_3 \quad c_3 \rfloor^T$$

where the c_i are constants and c_3 must be small.

2.8-3

Ask in lab

3.1-1

$$\frac{\partial \sigma_x}{\partial x} + \frac{\partial \tau_{xy}}{\partial y} + \frac{\partial \tau_{zx}}{\partial z} + F_x = 0 \qquad \Phi_x = l\sigma_x + m\tau_{xy}$$
$$\Phi_y = l\tau_{xy} + m\sigma_y$$

3.1-3

Can be proven not possible

3.2-2

If all 4 phi_i=1, phi(x)neq 1, also, Ni don't all have the same units