

3D7 Answers

$$1. \quad (a) \quad \frac{AE}{2\sqrt{2}L} \begin{bmatrix} 1+\sqrt{2} & -1 & -\sqrt{2} & 0 \\ -1 & 1 & 0 & 0 \\ -\sqrt{2} & 0 & 1+\sqrt{2} & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

(b) -

$$(c) \quad \frac{L}{EA} \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix} x \quad \text{or} \quad \frac{L}{EA} \begin{bmatrix} 2 \\ 2 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix} x$$

2. (a) -

(b) -

(c) Element 1: $u_1 = (2-x)(x+y) \times 10^{-4}$, $v_1 = 0$,

Element 2: $u_2 = (2-y)y \times 10^{-4}$, $v_2 = (1/2)x(y-2) \times 10^{-4}$

(d) Element 1: $\epsilon_x = 0.5 \times 10^{-4}$, $\epsilon_y = 0$, $\gamma_{xy} = -1 \times 10^{-4}$

Element 2: $\epsilon_x = 0$, $\epsilon_y = 0$, $\gamma_{xy} = -1.25 \times 10^{-4}$

(e) Element 1: $\sigma_x = 10.99 \text{ N/mm}^2$

Element 2: $\sigma_x = 0$

3. (a)&(b) -

$$(c) \quad \left(\int_b^a \mathbf{B}^T k_x \mathbf{B} dx \right) \mathbf{a} = (\mathbf{N}^T)_{x=b} q_b - (\mathbf{N}^T)_{x=a} q_a + \int_b^a \mathbf{N}^T Q dx$$

(d) & (f) -

4. (a) $p_{x1} = -(1/6)tpL$, $p_{x2} = -(4/6)tpL$, $p_{x3} = -(1/6)tpL$, $p_{y1} = p_{y2} = p_{y3} = 0$

(b) Node A, $0.0833tpR$, 90° from x axis

Node B, $0.345tpR$, 75° from x axis

Node C, $0.167tpR$, 60° from x axis

Node D, $0.345tpR$, 45° from x axis

Node E, $0.167tpR$, 30° from x axis

Node F, $0.345tpR$, 15° from x axis

Node G, $0.0833tpR$, 0° from x axis