ME 441 Example Problem Set3

3.3-3 A uniform bar element of length $L$ has a node at each end and a node at the middle, as shown. Determine the element stiffness matrix that operates on nodal d.o.f. $u_1$, $u_2$, and $u_3$.

**Problem 3.3-3**

3.4-1 The cantilever beam shown is tip-loaded by moment $M$. Use beam theory to compute displacement components of points $D$, $E$, and $F$. Then regard these results as nodal displacements, and use them to compute stresses $\{\sigma\} = [E][B]\{d\}$ in elements defined as follows. Assume that $\nu = 0$. What becomes of the ratio $\tau_{xy}/\sigma_x$ as $L/c$ becomes large?
(a) A CST element whose nodes are $A$, $D$, and $F$.
(b) A CST element whose nodes are $A$, $D$, and $C$.

**Problem 3.4-1**

3.6-5 Let axes $x$ and $y$ originate at node 1 of a Q4 element, as shown. Write shape functions appropriate to this choice of axes.

**Problem 3.6-5**

**Extra Problem:** Consider a plate of length $L$ and width $W$ subjected to distributed compression loads at both ends, each equal to $p(W^2-y^2)$ where $y$ denotes vertical position. You decided that you will use 4 Q4 elements in your finite element approach. Find consistent nodal forces required for solving the problem. (Using geometrical symmetry will help a lot!)