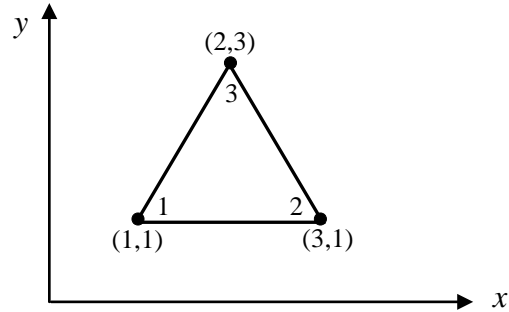


**MCE 561 Computational Methods in Solid Mechanics**  
**Homework Assignment 5**  
**Due March 9, 2011**

1. For the differential equation  $\nabla^2 u = f$ , using the following linear triangular element with the node numbering as shown, determine:

- a.) the three interpolation functions
- b.) the element matrices  $[K]$  and  $\{f\}$

*Partial Ans.*  $K_{11} = 5/8$ ,  $K_{12} = -3/8$ , ...



2. Consider the rectangular element shown in Figure 8.2.12 (in text), for the differential equation  $\nabla^2 u = f$ . Explicitly verify the first row of the stiffness matrix given by equation (8.2.54). Use the interpolation functions given in terms of local coordinates, equations (8.2.32a), to do the integrations.

3. Problem 8.9, page 506 in text.

*Partial Ans.* (b)  $K_{ij} = \frac{1}{2ab} \begin{bmatrix} a^2 + b^2 & -b^2 & 0 & -a^2 \\ \bullet & a^2 + b^2 & -a^2 & 0 \\ \bullet & \bullet & a^2 + b^2 & -b^2 \\ \bullet & \bullet & \bullet & a^2 + b^2 \end{bmatrix}$

4. Problem 8.11, page 507 in text. Only do part (a) and include only the first two rows; i.e.  $K_{1j}$  and  $K_{2j}$ .

*Partial Ans.* (a)  $K_{11} = K_{11}^1$ ,  $K_{12} = K_{14}^1$ ,  $K_{13} = 0$ , ...