

Design Using FEM (5537)  
 HW- Due by 11/29/2004  
 (For Graduate Credit Only)

1. Using gaussian quadrature with two and three points evaluate the following integrals

(a)  $\int_{-1}^1 \xi^4 d\xi$ ,    (b)  $\int_{-1}^1 \frac{\cos \xi}{1-\xi^2} d\xi$

(c)  $\int_{-1}^1 \int_{-1}^1 (\xi^2 \eta^3 + \xi \eta^4) d\xi d\eta$

2. The Cartesian coordinates of the nodes of a quadratic quadrilateral isoparametric element is as shown in the figure 5a. It is being mapped on 4 node parent element as shown in figure 5b. Determine the coordinate transformation relation between the local and global coordinates. Find the area of the element Evaluate the partial derivatives  $\frac{\partial N_1}{\partial x}$  and  $\frac{\partial N_1}{\partial y}$  of the element at the point  $(\xi, \eta) = (0.5, 0.5)$ .

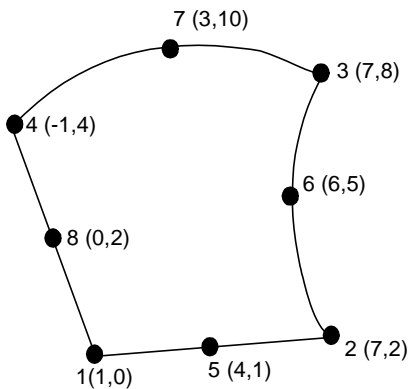


Figure 5a

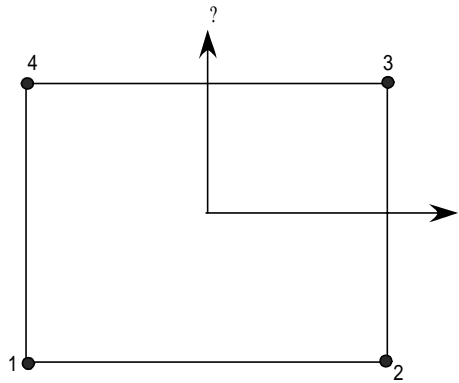


Figure 5b

3. Derive the shape function for corner node of a cubic serendipity element

4. Consider the five node element shown below. Using basic linear and quadratic interpolations along the local axis derive the shape function for this element. Note that this element can be used to connect four node elements to eight node or nine node elements.

