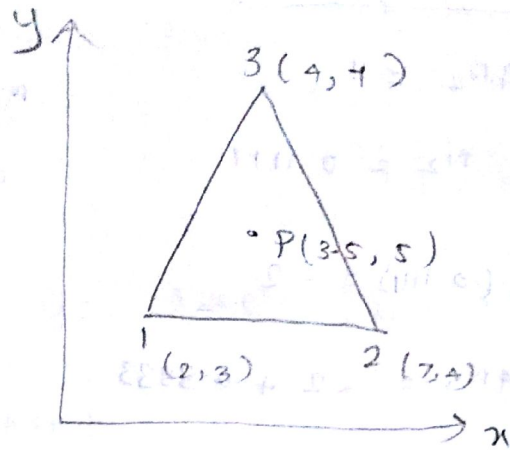


① Determine the shape function N_1 , N_2 and N_3 at the interior point P for the triangular element



co-ordinates

$$x_1 = 2, \quad y_1 = 3$$

$$x_2 = 7, \quad y_2 = 4$$

$$x_3 = 4, \quad y_3 = 7$$

$$x = 3.5, \quad y = 5$$

shape function

$$N_1 + N_2 + N_3 = 1 \text{ (unity)}$$

$$x = (x_1 - x_3) N_1 + (x_2 - x_3) N_2 + x_3$$

$$y = (y_1 - y_3) N_1 + (y_2 - y_3) N_2 + y_3$$

$$3.5 = (2 - 4) N_1 + (7 - 4) N_2 + 4$$

$$3.5 = -2 N_1 + 3 N_2 + 4$$

$$-2 N_1 + 3 N_2 = -0.5 \rightarrow \textcircled{1}$$

$$5 = (3 - 7) N_1 + (4 - 7) N_2 + 7$$

$$-4 N_1 - 3 N_2 = -2 \rightarrow \textcircled{2}$$

solve $\textcircled{1}$ and $\textcircled{2}$

$$\begin{array}{r} \textcircled{1} \times 2 \Rightarrow -4N_1 + 6N_2 = -1 \\ -4N_1 - 3N_2 = -2 \\ \hline \end{array}$$

$$9N_2 = 1$$

$$N_2 = 0.1111$$

$$-4N_1 - 3(0.1111) = -2$$

$$-4N_1 = -2 + 0.3333$$

$$-4N_1 = -1.6666$$

$$N_1 = 0.4166$$

$$N_1 + N_2 + N_3 = 1$$

$$0.1111 + 0.4166 + N_3 = 1$$

$$N_3 = 0.4167$$

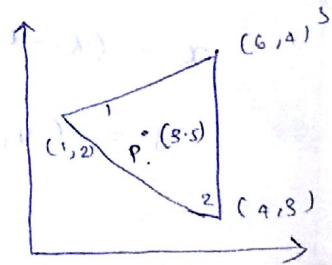
② A nodal co-ordinates of the triangular element are shown at the interior point P the x coordinate is 3.5 and $N_1 = 0.4$. calculate N_2 and N_3 and y coordinate at the point P

$$x_1 = 1, \quad y_1 = 2$$

$$x_2 = 4, \quad y_2 = 3$$

$$x_3 = 6, \quad y_3 = 4$$

$$x = 3.5, \quad y = P$$



$$N_1 + N_2 + N_3 = 1$$

$$x = N_1 x_1 + N_2 x_2 + N_3 x_3$$

$$N_2 + N_3 = 0.6$$

$$3.5 = 0.4(1) + N_2(4) + N_3(6)$$

$$4N_2 + 6N_3 = 3.1 \quad \rightarrow \textcircled{2}$$

$$\textcircled{1} \times 4 \Rightarrow 4N_2 + 4N_3 = 2.4$$

$$4N_2 + 6N_3 = 3.1$$

$$-2N_3 = -0.7$$

$$N_3 = 0.35$$

$$N_2 + 0.35 = 0.6$$

$$N_2 = 0.6 - 0.35$$

$$N_2 = 0.25$$

$$y = y_1 N_1 + N_2 y_2 + N_3 y_3$$

$$= 0.4(2) + 0.25(3) + 0.25(4)$$

$$y = 2.95$$

⑧ GIVEN DATA :

$$x_1 = 1, y_1 = 1$$

$$x_2 = 4, y_2 = 2$$

$$x_3 = 3, y_3 = 6$$

$$N_2 = 0.3, N_1 = 0.2$$

So find :

(i) N_3

(ii) x

(iii) y .

Soln :

$$N_1 + N_2 + N_3 = 1$$

$$N_3 = 1 - 0.3 - 0.2 = 0.5$$

$$N_3 = 0.5$$

$$x = N_1 x_1 + N_2 x_2 + N_3 x_3$$

$$= 0.2(1) + 0.3(4) + 0.5(3)$$

$$x = 2.9$$

$$y = 0.2(1) + 0.3(2) + 0.5(6)$$

$$y = 3.8$$