

3.9

 $D = EI = 2(10)^6$  for all elements  ~~$Q(x) = m(x)$~~ 

$$Q(x) = m(x)$$

Node	$m(x)$	$Q(x)$
1	0	0
2	$2.7(10^6)$	$-2.7(10^6)$
3	$1.8(10^6)$	$-1.8(10^6)$
4	$0.9(10^6)$	$-0.9(10^6)$
5	0	0

$$L = 300\text{cm} \quad \text{---} \quad \text{---} \quad \text{---}$$

$$\frac{D}{L} = \frac{2(10)^6}{300} = \frac{2}{3} 10^6$$

$$\frac{L}{6} = \frac{300}{6} = \frac{1}{2} (10^2)$$

$$y_1 = y_5 = 0$$

$$R_5 = \frac{D}{L} (-y_{s-1} + 2y_s - y_{s+1}) - \frac{L}{6} (Q_{s-1} + 4Q_s + Q_{s+1}) = 0$$

$$R_2 = \frac{2}{3} (10^8) (-y_1 + 2y_2 - y_3) + \frac{1}{2} (10^8) (0 + 4(2.7) + 1.8) = 0$$

$$R_3 = \frac{2}{3} (10^8) (-y_2 + 2y_3 - y_4) + \frac{10^8}{2} (2.7 + 4(1.8) + 0.9) = 0$$

$$R_4 = \frac{2(10^8)}{3} (-y_3 + 2y_4 - y_5) + \frac{10^8}{2} (1.8 + 4(0.9) + 0) = 0$$

$$2y_2 - y_3 + \frac{3}{4} (12.6) = 0$$

$$-y_2 + 2y_3 - y_4 + \frac{3}{4} (10.8) = 0$$

$$-y_3 + 2y_4 + \frac{3}{4} (5.4) = 0$$

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix} \begin{Bmatrix} y_2 \\ y_3 \\ y_4 \end{Bmatrix} = \begin{Bmatrix} -9.45 \\ -8.10 \\ -4.05 \end{Bmatrix}$$

$$y_2 = -12.5$$

$$y_3 = -14.86$$

$$y_4 = -9.11$$