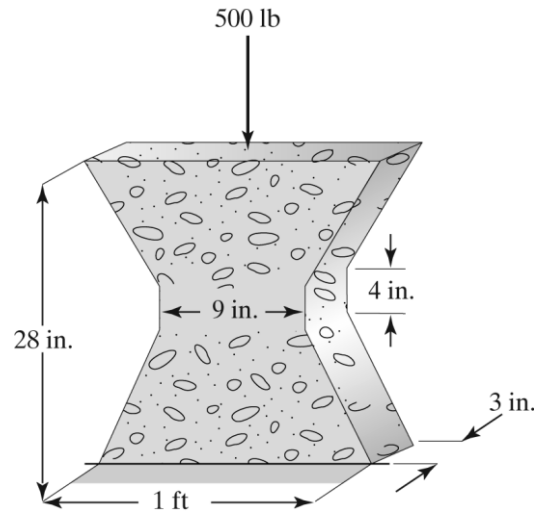


Please show your work and draw a box around your answer to receive full credit.

- 1) A concrete support shown in Figure 1 carries a load of 500 lb. Use the direct formulation method for finite elements and divide the column into five elements. Determine the deflection and average normal stress in each element ( $E = 3.27 \times 10^3$  ksi). Use Matlab to solve and submit your DIARY file along with your hand-written work for the problem. Draw a box around your answers in the DIARY file.



**Figure 1.**

- 2) Identify the size and type of the given matrices. Denote whether the matrix is square, column, diagonal, row, unit (identity), triangular, banded, or symmetric:

a.  $\begin{bmatrix} 3 & 2 & 0 \\ 2 & 4 & 5 \\ 0 & 5 & 6 \end{bmatrix}$     b.  $\begin{Bmatrix} x \\ x^2 \\ x^3 \\ x^4 \end{Bmatrix}$     c.  $\begin{bmatrix} 4 & 0 \\ 0 & 8 \end{bmatrix}$     d.  $\begin{bmatrix} 1 & y & y^2 & y^3 \end{bmatrix}$     e.  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

f.  $\begin{bmatrix} 3 & -1 & 0 & 0 & 0 \\ 2 & 0 & 6 & 0 & 0 \\ 0 & 4 & 1 & 4 & 0 \\ 0 & 0 & 5 & 4 & 2 \\ 0 & 0 & 0 & 7 & 8 \end{bmatrix}$     g.  $\begin{bmatrix} 1 & 2 & 2 & 2 \\ 0 & 1 & 3 & 3 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$     h.  $\begin{bmatrix} c_1 & 0 & 0 & 0 \\ 0 & c_2 & 0 & 0 \\ 0 & 0 & c_3 & 0 \\ 0 & 0 & 0 & c_4 \end{bmatrix}$

3) Given the matrices:

$$[A] = \begin{bmatrix} 1 & 4 & 2 \\ 8 & 3 & 6 \\ 7 & 1 & -2 \end{bmatrix}$$

$$[B] = \begin{bmatrix} 0 & 5 & -1 \\ -3 & 1 & 7 \\ 2 & 4 & -4 \end{bmatrix}$$

Perform the following operations:

- $[A]^T = ?$  and  $[B]^T = ?$ .
- Verify that  $([A]+[B])^T = [A]^T + [B]^T$
- Verify that  $([A][B])^T = [B]^T[A]^T$

4) Given the following matrix

$$[A] = \begin{bmatrix} 0 & 5 & 0 \\ 8 & 3 & 7 \\ 9 & -2 & 9 \end{bmatrix}$$

Calculate the determinate of  $[A]$  and the determinant of  $[A]^T$ .

5) Solve the following set of equations (a) using the Gaussian method, (b) using the LU decomposition method, and (c) by finding the inverse of the coefficient matrix.

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 5 & 1 \\ -3 & 1 & 5 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 6 \\ 15 \\ 14 \end{Bmatrix}$$