HOMEWORK 1

ASSIGNED: 08/28/25

DUE: 09/04/25 (on ELC, PDF and MATLAB)

Create a lookup function for both **N** and **B**.

N = N1D(xi,nn)

B = B1D(xi,nn)

Where *xi* is the location in the parent domain within the element from -1 to 1 and nn is the number of nodes within the element (assume uniformly spaced from -1 to 1). *nn* should support 2 and 3 nodes.

To test these functions you will create plots of the following equations. Create evenly spaced points in the specified domain for your nodal coordinates (you may use `xplot = linspace(-1,1,100);` if you like). Evaluate the function at these nodal coordinates to produce a vector of values, [d] as shown below. Using your shape functions, create plots of the function using both the linear (2 nodes) and quadratic (3 nodes) solutions. Plot both the derivative and the function itself as defined by:

$$u^e(x) = [N]^e [d]^e \quad \frac{du}{dx}^e(x) = [B]^e [d]^e$$

Case 1 (linear shape functions)

$$u(x) = x + 1$$

$$-1 \le x \le 1$$

$$[x]^e = \begin{bmatrix} -1 \\ 1 \end{bmatrix} \quad [d]^e = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$$

Case 2 (quadratic shape functions)

$$u(x) = x^2 + x - 1$$

$$-1 \le x \le 1$$

$$[x]^e = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \quad [d]^e = \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$$