Exercises 5.2

2. Mount the matrix B for a three-node bar element given the nodal coordinates x1, x2 and x3.

```
clear all
clc
```

```
syms x1 x2 x3 xi
```

```
C = [x1; x2; x3];
```

```
B = compute_B(C, xi)
```

B =

$$\left(\frac{\xi - \frac{1}{2}}{\sigma_1} \quad \frac{\xi + \frac{1}{2}}{\sigma_1} \quad -\frac{2\,\xi}{\sigma_1} \right)$$

where

$$\sigma_1 = \overline{x_1}\left(\xi - \frac{1}{2}\right) + \overline{x_2}\left(\xi + \frac{1}{2}\right) - 2\,\xi\,\overline{x_3}$$

```
function B = compute_B(C, xi)
nnodes = size(C, 1);
ndof = 1;
dN    = lin3_derivs(xi);
J     = C'*dN;
dNdX = dN*inv(J);
    for i = 1: nnodes
    c = (i-1) * ndof;
    B(1, c+1) = dNdX(i,1);
    end
end

function dN = lin3_derivs (xi)
n = [ xi*xi/2 - xi/2
      xi*xi/2 + xi/2
            1 - xi*xi];
dN = [diff(n, xi)];
end
```