

Exercises 4.4

1. For a three-node bar element with coordinates $(x_1, y_1) = (1, 1)$, $(x_2, y_2) = (3, 1)$ and $(x_3, y_3) = (2, 2)$, determine an expression for its orientation as a function of the local coordinate ξ . Find the orientation vector at node 3.

```
clear all
clc
```

```
n = 3;
xi = linspace (-1, 1, n);
```

```
C = [1 1; 3 1; 2 2];
for i = 1:n
    J(:, :, i) = C'* lin_deriv (xi(i));
    Jacobian(:, :, i) = norm (J(:, :, i));
    r(:, :, i) = J(:, :, i)/Jacobian(:, :, i);
end
r = r(:, :, 2)'
```

```
r = 1×2
    1    0
```

```
function dn = lin_deriv (xi)
dn = [xi - 1/2
      xi + 1/2
      -2*xi];
end
```