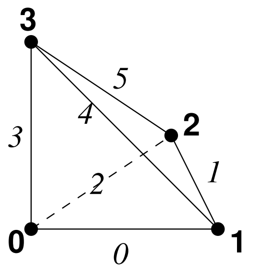
Programming in C^{++}:
Let the vertices and edges of the reference tet be numbered according to the figure below.



25 Write a function

```
void calcCurlCurlElMat (const ElTrans& elTrans,
                        const NedelecTet& fe, Mat<6, 6>& elMat);
```

that computes the element stiffness matrix `elMat`$= K$ associated to a tet T, i.e.

$$\begin{aligned} K_{kl} &= \int_T \mathbf{curl}\, \boldsymbol{\varphi}_k(x) \cdot \mathbf{curl}\, \boldsymbol{\varphi}_l(x)\, dx \\ &= \int_{\hat{T}} (J_T^{-1} F_T\, \mathbf{curl}\, \hat{\boldsymbol{\varphi}}_k(\xi)) \cdot (J_T^{-1} F_T\, \mathbf{curl}\, \hat{\boldsymbol{\varphi}}_l(\xi))\, J_T\, d\xi. \end{aligned}$$

26 Write a function

```
void calcMassElMat (const ElTrans& elTrans,
                    const NedelecTet& fe, Mat<6, 6>& elMat);
```

that computes the element mass matrix `elMat`$= M$ associated to a tet T, i.e.

$$M_{kl} = \int_T \boldsymbol{\varphi}_k(x) \cdot \boldsymbol{\varphi}_l(x)\, dx.$$

Hint: Transform to the reference element as done in the previous exercise.

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27 Show Theorem 3.25 from the lecture (2D): Show that for all $\boldsymbol{v} \in H(\mathrm{curl}, \Omega) \cap \boldsymbol{C}(\Omega)$:

$$\mathrm{curl}\, I_\varepsilon^h\, \boldsymbol{v} = I_\tau^h\, \mathrm{curl}\, \boldsymbol{v},$$

where $I_\varepsilon^h : H(\mathrm{curl}, \Omega) \cap \boldsymbol{C}(\Omega) \longrightarrow V^h(\Omega)$ and $I_\tau^h : L^2(\Omega) \longrightarrow S^h(\Omega)$ are the edge and the element interpolator, respectively.

Hint: Use Stokes' theorem.