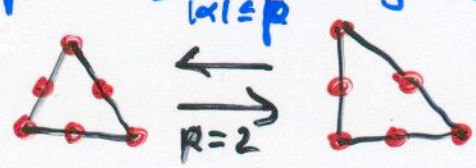
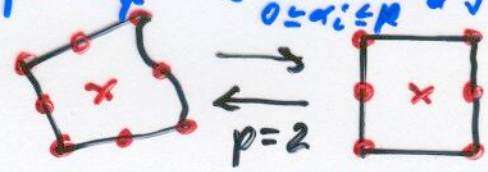
# 1.4.4. FEM for BVP in the case of PDEs

→ Course on NuEPDE by W. Zulehner in the SS 2007

- Subdivisions: Mesh generation is more complicated!
  in 2D: triangles:  Courant triangle, 
  quadrilaterals: 
  in 3D: tetrahedra, hexahedra
- Basis function, shape functions:
  $P_p := \{ \sum_{|\alpha| \le p}^{} c_\alpha \xi^\alpha \}$ resp. $Q_p := \{ \sum_{0 \le \alpha_i \le p}^{} c_\alpha \xi^\alpha \}$
  
  
  
  
- Assembling technology: element-by-element
  here: very important in order to efficiently work with unstructured meshes
- Properties of the stiffness matrix $K_h$:
  → analogous propertres
  BUT: band width grows: $BW = O(h^{-(d-1)})$
- Apriori discretization error estimates: analogously
  $V = H^1$ Rule of thumb: $\|u - u_h\|_V = O(h^p)$ for $P_p$ and $Q_p$.
  higher dimensional elements: acute, obtuse angles, Bramble-Hilbert Lemma } regular, quasi-uniform meshes
- A-posteriori estimates and Adaptivity
  ⇝ analogously, but more technically!
- Variational Crimes