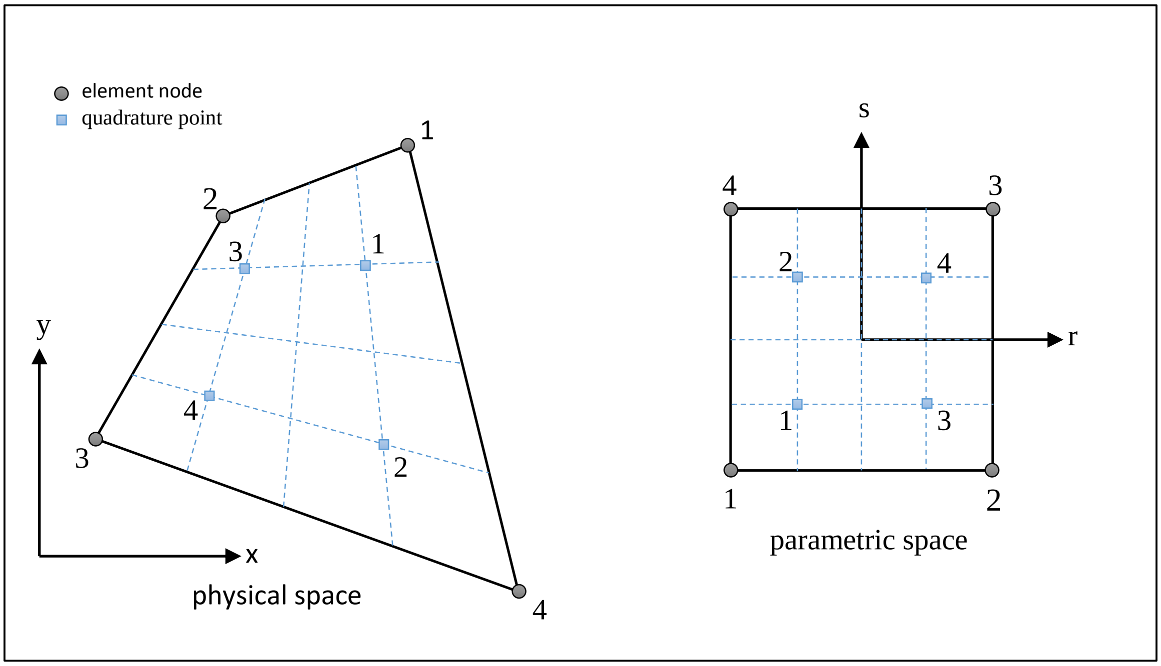
Example of Computing ShapeFunctionWeights for VTK QuadratureSchemeDefinition for a Linear Quadralateral Cell

The following linear quadralateral cell definition was taken from "Concepts and Application of Finite Element Analysis" by R.D. Cook et al, 4^{th} Ed, shape functions are on p206 and Gauss points on p212.



Shape functions and Gauss points for linear quadrilateral cell:

$$N_1 = \tfrac{1}{4}(1-r)(1-s) \qquad q_1 = \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$$

$$N_2 = \tfrac{1}{4}(1+r)(1-s) \qquad q_2 = \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$$

$$N_3 = \tfrac{1}{4}(1+r)(1+s) \qquad q_3 = \frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$$

$$N_4 = \tfrac{1}{4}(1-r)(1+s) \qquad q_4 = \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$$

The shape function weights (ShapeFunctionWeights XML element) for VTK are given by:

$$w_{ij} = N_i(q_j)$$

where *i* is the node id and changes fastest and *j* is the Gauss point id, and Gauss points *q* are given in parametric coordinates. In this example evaluating over shape functions and Gauss points results in the following 16 weights:

0.6220084679281462, 0.16666666666666663, 0.044658198738520435, 0.16666666666666663, 0.16666666666666663, 0.044658198738520435, 0.16666666666666663, 0.6220084679281462, 0.16666666666666663, 0.6220084679281462, 0.16666666666666663, 0.044658198738520435, 0.044658198738520435, 0.16666666666666663, 0.6220084679281462, 0.16666666666666663