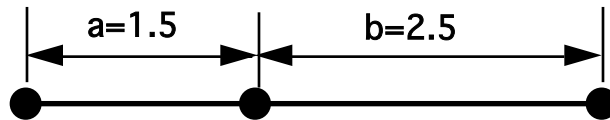
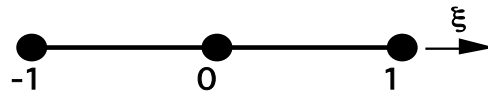


CIVL.666, MANE.666
FUNDAMENTALS OF FINITE ELEMENTS
HOMEWORK 8
Due: November 8, 2017

1. Page 157, Exercise 2 Parts a. through d.
2. Exercise 3 on page 159 of the text. Note - Expect that at least some of the required shape functions to be piecewise expressions (like the shape function given on the top of 160).
3. (to be graded) Derive the stiffness matrix for the 3-noded element shown below to be used in a heat conduction problem. The conductivity, κ is constant along the element. You only need to set-up the integrals for each of the terms, you do not have to carry out the integration.



The element shape functions must be written in the parametric coordinate system shown below. Therefore, you must employ the various relationships between the real and parametric coordinates used in the class.



Would there be any problems if the middle node was moved such that $a=1.0$ and $b=3.0$? Explain your answer.

Hint - remember to properly deal with the interaction between the real and parametric coordinates, which for this 1-D situation reduce to

$$\frac{d}{d\xi} = \frac{dx}{d\xi} \frac{d}{dx} = J(\xi) \frac{d}{dx} \quad , \quad \frac{d}{dx} = \frac{1}{J(\xi)} \frac{d}{d\xi} \quad , \quad dx = J(\xi) d\xi$$