

**ASEN 5007 - Introduction to Finite Element Methods - Fall 2009**  
**Homework Assignment #7 — Chapters 17–18**

Due Thursday October 29, 2009 (Nov 5 for CAETE students)

*Do not forget to attach this cover sheet to your returned homework and write your name(s) on it*

Four Exercises:

17.1 and 17.2 (easy)

18.1 or 18.4 (pick one)

18.8 or 18.9 (pick one)

Grading weights posted at the start of the Exercises.

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Notes:

Exercises 17.1 and 17.2 are just verifications of a two-dimensional element. They can be done by hand or by CAS. Doing it by hand will take much longer but will give you that 1960s feeling.

When you verify that the sum of shape functions of an element is identically one, do it algebraically (*not* numerically at specific points). Two examples are provided in §16.6.2. For the shape functions of the cubic triangle, one quick way using *Mathematica* is to write down the 10 shape functions symbolically in the triangular coordinates, say  $z_1$ ,  $z_2$  and  $z_3$ . Add them up and call their sum  $S$ . Then write  $S = \text{Simplify}[S /. \{z_3 \rightarrow 1 - z_1 - z_2\}]$  and print  $S$ . The answer should be exactly 1. If not, check for errors.

As preparation for Midterm Exam 2 (announced below) you may want to do more Exercises than the minimum. Solutions for all of the Exercises listed above will be given.

Grading weights posted at the start of the Exercises.

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**Tentative Date for Second Midterm Exam**

Th November 12, 2009, with a Part II review on Nov 10.