HW#2
EE699 – Fall 2007
Due 9/25/07

1. You are given a linear triangular patch with the coordinates:

$$\vec{r}_0 = (0,0,0),\ \vec{r}_1 = (0.1,0,0.1),\ \vec{r}_3 = (0.1,0.1,0.2)$$

   a) Determine the unitary vectors of the local curvilinear coordinate system of the triangle.
   b) Determine the reciprocal unitary vectors of the triangle.
   c) Determine the area of the triangle.
   d) Determine the unit normal to the triangle.
   e) You are given the scalar field in local coordinates: $L_0 L_1 L_2^2$. Determine the *gradient* of the scalar field in local coordinates.
   f) You are given the vector field: $\vec{F} = (2L_1 - 3L_1^2)L_2^3\vec{a}^1 + 3L_1^2 L_2^3(1-L_1)\vec{a}^2$. Determine the *curl* of the field.
   g) You are given the vector field: $\vec{G} = \frac{L_1 L_0}{\sqrt{g}}\vec{a}_1 + \frac{L_2 L_0}{\sqrt{g}}\vec{a}_2$, determine the *divergence* of the vector field.
   h) Given the vector field $\vec{G}$ in part g), compute the surface integral: $\int_{\Delta} \vec{G}\cdot d\vec{s}$, where Δ is the surface of the triangle. Validate your result using the surface divergence theorem.
   i) Given the vector field $\vec{F}$ in part f), compute the line integral: $\oint_C \vec{F}\cdot d\vec{\ell}$, where *C* is the contour bounding the triangle. Validate your result using Stoke's theorem.