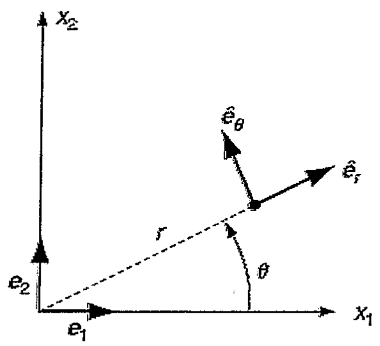
Homework 2 -Tensor Analysis

Handed out: Thurs., 27-09-2007 **Due to: Monday, 08-10-2007**

1. We haven't talked about non cartesian coordinates... Let's do an exercise to see how things change when polar coordinates are applied.(that makes a good opportunity of going to your preferred reference...). Develop the expressions of the gradient operator in polar coordinates.



2. If $\phi(x)$, $\underline{u}(x)$ and $S(x)$ are, respectively, scalar, vector and tensor fields, establish the identities:

(a) $\text{div}(\phi\underline{u}) = \underline{u} \,.\, \nabla\phi + \phi \; \text{div}(\underline{u})$

(b) $\nabla(\phi\underline{u}) = \underline{u} \otimes \nabla \; \phi + \phi\nabla \; \underline{u}$

3. Show that: Let $\mathcal{R}$ with a boundary denoted by $\delta\mathcal{R}$ be a bounded regular then

$$\int_{\delta\mathcal{R}} \underline{v} \otimes \underline{n} \; dA = \int_{\mathcal{R}} \nabla \underline{v} \; dV$$

4. Show that

$$\int_{\delta R} \mathbf{r} \otimes \underline{\mathrm{n}} \; dA = VI$$

where V stands for the volume of the region $\mathcal{R}$ (rember I is the identity) and $\mathbf{r}$ is the position vector of a typical point on $\mathcal{R} + \delta\mathcal{R}$