Homework #3

Problem 7:

Show that in the oblique coordinate system K' defined in class the position vector $\mathbf{r}'$ can be written as

$$\mathbf{r}' = x'_1 \hat{\mathbf{e}'}^1 + x'_2 \hat{\mathbf{e}'}^2 = x'_i \hat{\mathbf{e}'}^i,$$

where x'_i are the covariant (perpendicular) components of $\mathbf{r}'$ and $\hat{\mathbf{e}'}^i$ are the contravariant basis vectors, i.e., the basis of the dual (or reciprocal) system of coordinates. Follow the steps below:

i) Find expressions for $\hat{\mathbf{e}'}^i$ in terms of $\hat{\mathbf{e}}_i$, i.e., the versors of the orthogonal system K using that

$$\hat{\mathbf{e}'}^i . \hat{\mathbf{e}'}_j = \delta^i{}_j.$$

ii) Find the components of **r'** in the dual basis given by $\hat{\mathbf{e}'}^i$ and show that they are identical to the perpendicular components x'_i obtained in class.