Homework #2

Problem 5:

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

$$\mathbf{r}' = a\hat{\mathbf{e}'}_1 + b\hat{\mathbf{e}'}_2.$$

Are a and b the covariant (perpendicular) or contravariant (parallel) components of $\mathbf{r}'$? Why? Give an explanation based on vectors' properties and another based on tensors' properties.

b)

Show that

$$a = \frac{(\mathbf{r}' \times \hat{\mathbf{e}'}_2).(\hat{\mathbf{e}'}_1 \times \hat{\mathbf{e}'}_2)}{|\hat{\mathbf{e}'}_1 \times \hat{\mathbf{e}'}_2|^2},$$

and

$$b = \frac{(\mathbf{r}' \times \hat{\mathbf{e}'}_1).(\hat{\mathbf{e}'}_2 \times \hat{\mathbf{e}'}_1)}{|\hat{\mathbf{e}'}_2 \times \hat{\mathbf{e}'}_1|^2}.$$