Lets Start Talking :: Vectors and Tensors
Comments on Talk-1 by Pankaj Sharan

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Note:

Pankaj Sharan former professor at Jamia Milia Islamia has sent following comments. Those who understand all comments do not need this series of talks. Reference to these comments will appear in my later talks as and when I elaborate on some point made by Pankaj Sharan.

For physics students it is preferable to name 'zero vector' and not 'null vector' because, later on, in the Minkowski space light-like vectors are going to be called null.

It will be a good idea to show a picture of the 'parallelogram of forces' experiment. I am not sure if all students do that experiment in class 11 these days, or remember it later if they do.

It is natural that students will have a picture of the three dimensional vectors in Cartesian coordinates as some kind of arrow with a tip and a base, almost as a physical object like a rigid arrow. This only works for position vectors. You cannot imagine velocity in that way. And later on, the electric or magnetic fields at points in a region will require even greater sophistication.

Also, it is better to clarify in the beginning that vectors which have a "length" are special, (They belong to those vector spaces which have an "inner-product" or "norm" defined on them.) The students are going to use vector spaces like function spaces, or Hilbert spaces later on.

Since vectors are to be treated in the context of tensors, it is important to emphasize that vectors are to be treated as quantities independent of its components. Components arise when a basis is chosen, and components of a vector or tensor change (or 'transform') when the basis is changed. Unfortunately, most physics books 'define' tensors as a set of components which 'transform' in a certain way, rather than this being a property of a tensor product space and the chosen bases.

I think that this definition (the way the components transform) was thought to be a choice of convenience at one time because the definition of a dual vector space, or tensor product space was considered too abstract. I find this funny, because it requires a much greater degree of abstraction in one's thinking to handle the confusion that results from it!