

## Definitions/Notation:

- 1) **, iff**: These both stand for the phrase 'if and only if'. Logically speaking, this means that either condition implies the other.
  
- 2) The difference between perpendicular, orthogonal, and orthonormal...
 

**Perpendicular** — intuitively, this means that the two objects in question are at right angles to each other. This only makes sense in two or three dimensions, which is why we define..

**Orthogonal** — this has a slightly deeper meaning in that not only is it sort of like the n-dimensional counterpart of perpendicular, but it also means that the inner product of any pair of orthogonal things is equal to zero.

**Orthonormal** — Guess what. we add normalization. This means that not only are the inner products of pairs of orthonormal things zero, but that the inner product of one with itself is one.
  
- 3)  $\bar{r}, \underline{r}, \tilde{r}, \mathbf{r}$ : Any of these may be used to indicate that  $r$  is a vector quantity. However, **this is not necessarily so**, since there is overlap with other notations.  $\bar{r}$  is also an average value, and  $\tilde{r}$  can represent a one-form (see G.R. section).
  
- $\hat{r}$ : unit vector - has length 1 in a given direction.  
 $\hat{i}, \hat{j}$ , and  $\hat{k}$  are commonly used for the x-, y-, and z-axis unit vectors, as are  $\hat{x}, \hat{y}$ , and  $\hat{z}$ .
  
- 4)  $A, \mathbf{A}$ : matrix.  
 $A^T, \tilde{A}, A', A^t$ : The transpose of matrix  $A$ .  
 $A_{ij}$ : the  $i$   $j^{\text{th}}$  element of matrix  $A$ , that is, the entry in the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column.  
 A boldface capital letter is frequently used for both vectors and matrices.
  
- 5)  $\frac{dx}{dt}$ ,  $x'$ ,  $\dot{x}$ : the complete derivative of  $x$  with respect to  $t$ .  
 $x'$  is usually a spatial derivative, and  $\dot{x}$  is a time derivative.

- 6)  $\Delta x$ , change in  $x$   
 $dx$ , the differential of  $x$ , the limit of small  $\Delta x$ )

References: Shenk, Calculus and Analytic Geometry  
Boas, Mathematical Methods in the Physical Sciences  
Serway, Physics for Scientists and Engineers