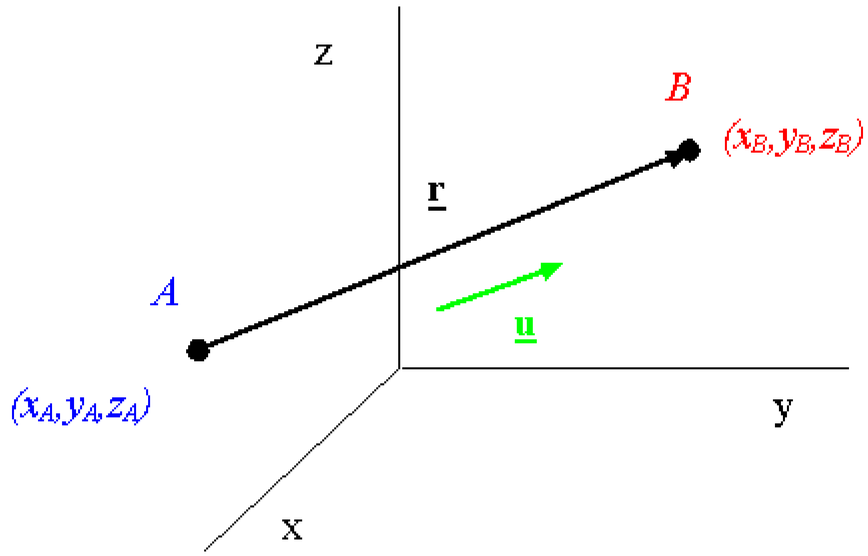
Vectors in 3-D space:

A vector along A-B: A vector ***F*** along the line A-B (and of magnitude F) can be obtained from

$$\boldsymbol{r} = (x_B - x_A)\boldsymbol{i} + (y_B - y_A)\boldsymbol{j} + (z_B - z_A)\boldsymbol{k}$$

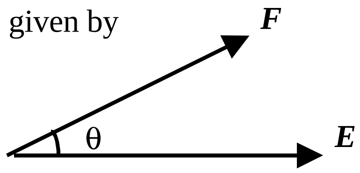
$$\boldsymbol{u} = \frac{\boldsymbol{r}}{r} = \frac{(x_B - x_A)\boldsymbol{i} + (y_B - y_A)\boldsymbol{j} + (z_B - z_A)\boldsymbol{k}}{\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}}$$

$$\boldsymbol{F} = F\frac{\boldsymbol{r}}{r} = F\boldsymbol{u}$$



The dot product: The dot product of vectors ***F*** and ***E*** is given by

$$\boldsymbol{F} \bullet \boldsymbol{E} = FE\cos\theta = F_x E_x + F_y E_y + F_z E_z$$



Projection of a vector by using the dot product: The projection of vector ***F*** along the unit vector ***u*** is given by

$$\boldsymbol{F} \bullet \boldsymbol{u} = F\cos\theta$$