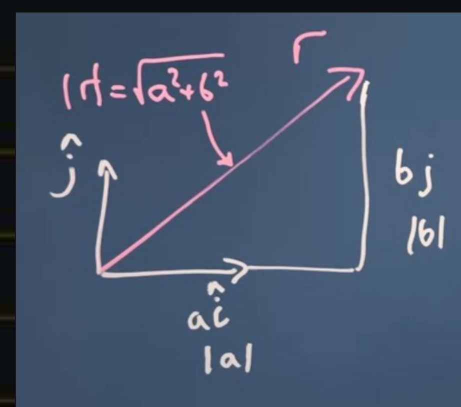
(*) The size/length/magnitude of a vector

When $\hat{i}$ and $\hat{j}$ are unit vectors along the x and y axes, respectively, then the magnitude of $\vec{r}$ is given as follows :-

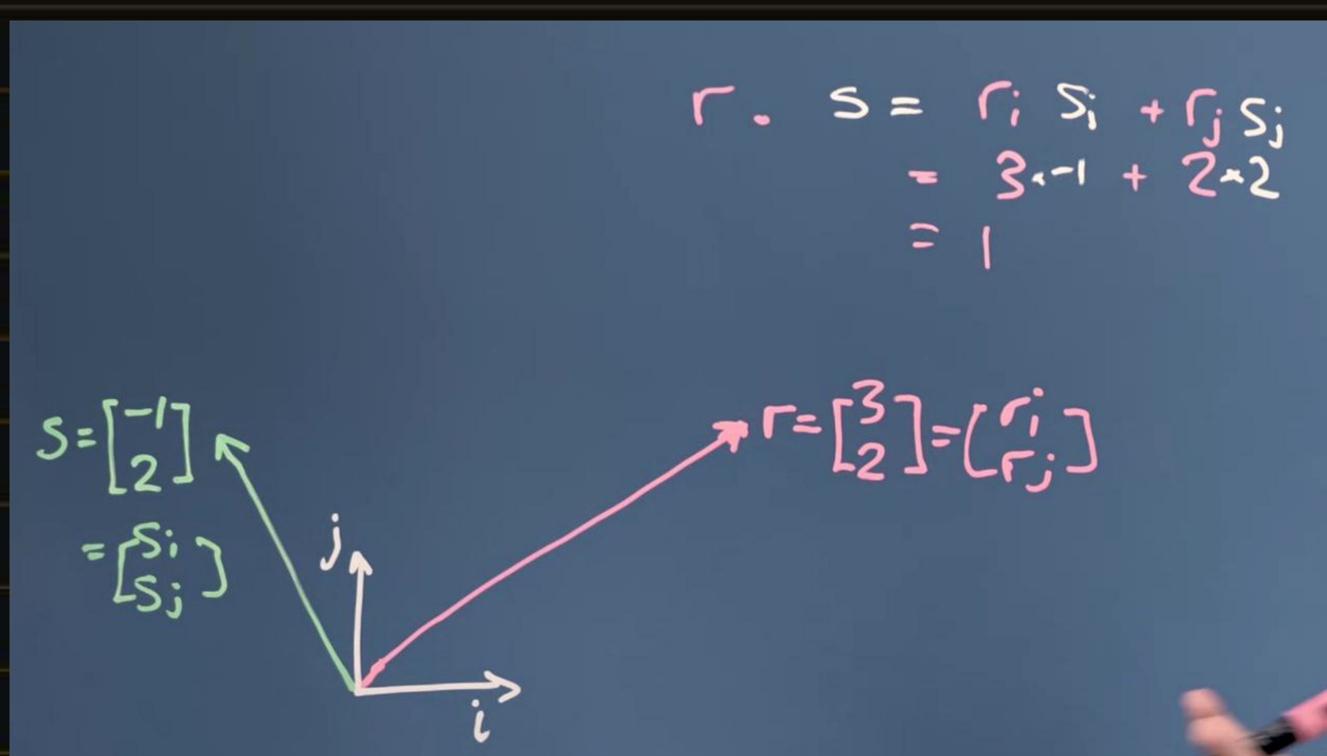
$$\vec{r} = a\hat{i} + b\hat{j} \implies |\vec{r}| = \sqrt{a^2 + b^2}$$

$$= \begin{bmatrix} a \\ b \end{bmatrix}$$



Again, as stated earlier, the axes don't necessarily have to represent the dimensions of a physical space, and can instead represent any data.

(*) The dot product of two vectors



The dot product is commutative, i.e. $\vec{r} \cdot \vec{s} = \vec{s} \cdot \vec{r}$

The dot product is distributive over addition, i.e. $\vec{r} \cdot (\vec{s} + \vec{t}) = (\vec{r} \cdot \vec{s}) + (\vec{r} \cdot \vec{t})$

Proof :-