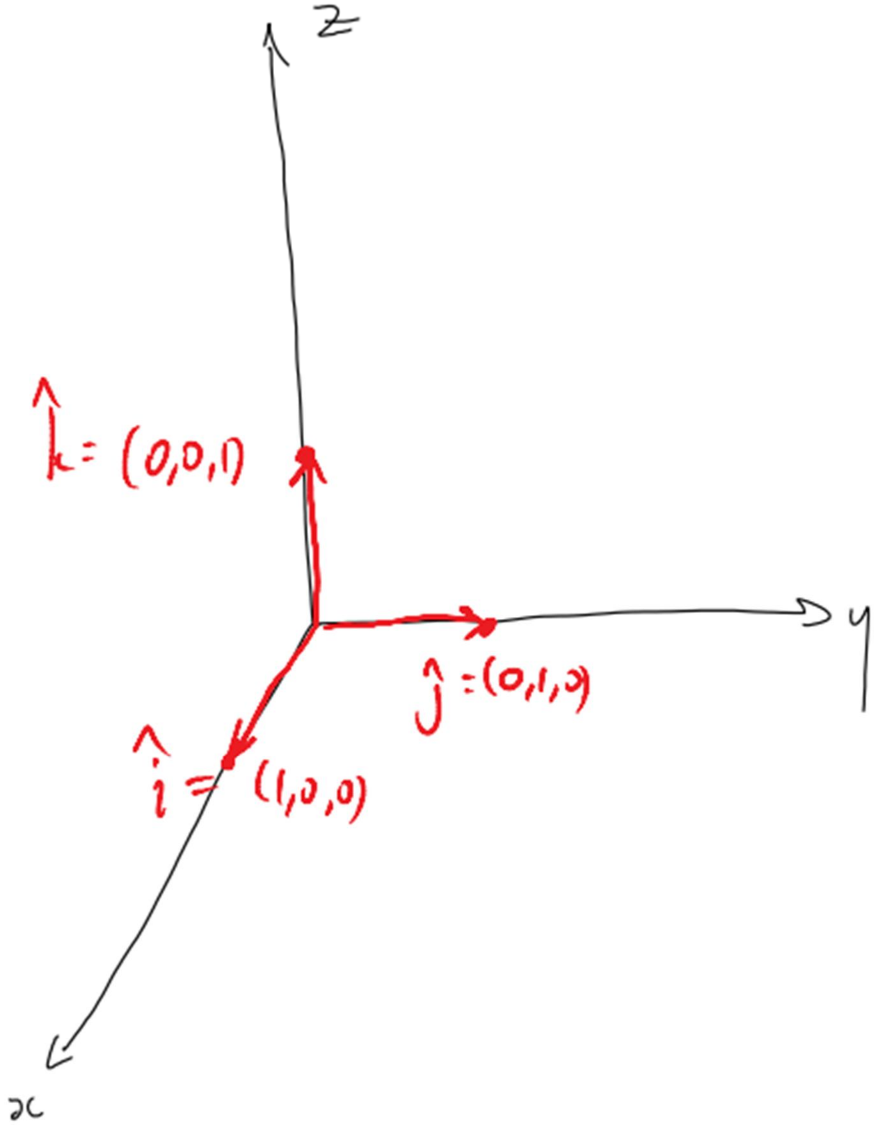
6.7 Algebraic Operations with Vectors in $\mathbb{R}^3$

Today's lesson is an extension (into the third dimension…***ominous music plays***) of what we saw in section 6.6.

Consider the sketch:



We call the vectors $\hat{i}$, $\hat{j}$, and $\hat{k}$

As in $\mathbb{R}^2$ we have a **unique** association between points and position vectors in $\mathbb{R}^3$. That is, given a point $P(a,b,c)$ we can uniquely define the position vector $\overrightarrow{OP}=(a,b,c)$. Furthermore, we can write $\overrightarrow{OP}$ as a **linear combination** of the standard unit vectors in $\mathbb{R}^3$:

$$\overrightarrow{OP}=$$

Consider the ***general*** vector $\overrightarrow{AB}$ in $\mathbb{R}^3$ where the points $A(x_1,y_1,z_1)$, and $B(x_2,y_2,z_2)$ are the tail and tip of $\overrightarrow{AB}$ respectively. We can write

Further, by Pythagorus,

$$\left|\overrightarrow{AB}\right|=$$

Finally, for a general position vector $\vec{v}=(a,b,c)$

$$\left|\vec{v}\right|=$$

Class/Homework for Section 6.7

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