Question 1. *Show that the vectors* $\begin{pmatrix}+2\\-1\\+1\end{pmatrix}$, $\begin{pmatrix}+1\\-3\\-5\end{pmatrix}$ *and* $\begin{pmatrix}+3\\-4\\-4\end{pmatrix}$ *form the vertices of a right angled triangle.*

Solution. Let $v1$, $v2$ and $v3$ be given vectors such that $v1 = \begin{pmatrix}+2\\-1\\+1\end{pmatrix}$, $v2 = \begin{pmatrix}+1\\-3\\-5\end{pmatrix}$ and $v3 = \begin{pmatrix}+3\\-4\\-4\end{pmatrix}$.
To show that $v1$, $v2$ and $v3$ form the vertices of a right anled triangle. First we need to show that $v1$, $v2$ and $v3$ are indeed vertices of a triangle.
For this we need to see if the vertices satisfy trianle inequality. Let a, b and c denote the length of vertices $v1 - v2$, $v2 - v3$ and $v3 - v1$. Now,
$a = \sqrt{41}$, $b = \sqrt{6}$ and $c = \sqrt{35}$. We can see that $a + b > c$, $a + c > b$ and $b + c > a$. Thus, the given vertices $v1$, $v2$ and $v3$ form the vertices of a triangle. Let vertices $v1$, $v2$ and $v3$ be represented as A, B and C respectively.

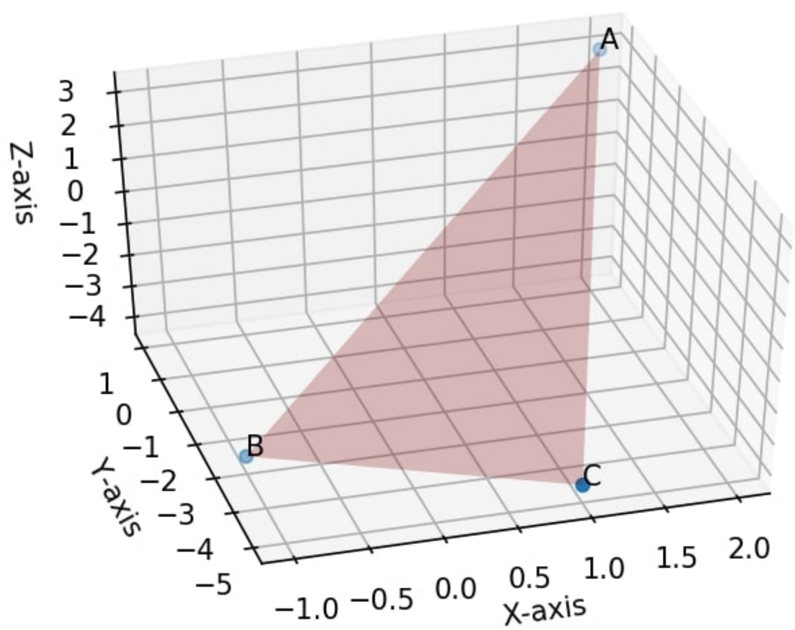

Figure 1

Also triangle formed by A,B and C is ploted in Figure 1, as seen $\triangle ABC$ is right angled at C. This is because $< A - C, B - C >$ which is equal to $(A - C)^T(B - C)$ is indeed $= 0$. This means (A-C)$\perp$(B-C). Thus, proving that $\triangle$ABC is right angled triangle at C.