**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 trianle.

Solution. Let v1, v2 and v3 be given vectors such that  $v1 = \begin{pmatrix} +2 \\ -1 \\ +1 \end{pmatrix}$ ,

$$v2 = \begin{pmatrix} +1 \\ -3 \\ -5 \end{pmatrix} \text{ and } v3 = \begin{pmatrix} +3 \\ -4 \\ -4 \end{pmatrix}.$$

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. To show they form right triangle, we need to show that any two sides from given vertices are perpendicular to each other, that means we need to show two of the three given vectors are perpendicular to each other. For this we need to calculate the dot product of the three vectors. Clearly, we can see that v1.v2=0, that means v1 is perpendicular to v2. Thus, the vectors  $v1,\ v2$  and v3 form vertices of a right angled trianle.