Step-1

Consider the vectors $(1,4,5),(x,y,z)$ as the matrix multiplication Ax

The objective is to write the inner product and complete the blanks in the statement â€œThe solutions to $Ax=0$ lie on a _____ perpendicular to the vector _______. The columns of A are only in ___ space.â€

Step-2

Assume the matrix $A=\begin{bmatrix}1 & 4 & 5\end{bmatrix}$

The inner product of matrix A and the vector $\begin{bmatrix}x\\y\\z\end{bmatrix}$ is given as the dot product of $A\cdot x$ where each element is multiplied element wise.

$$Ax=\begin{bmatrix}1 & 4 & 5\end{bmatrix}\cdot\begin{bmatrix}x\\y\\z\end{bmatrix}$$
$$Ax=x+4y+5z$$

Hence, $\boxed{Ax=x+4y+5z}$

Now, $Ax=0$ implies that $x+4y+5z=0$

Step-3

Recall that an equation $ax+by+cz+d=0$ where a,b,c,d are constants represents the equation of plane.

Thus, the equation $x+4y+5z=0$ represents the equation of plane.

Also, for an equation of the form $ax+by+cz+d=0$, the normal or perpendicular to the plane is (a,b,c)

Here, the solutions to equation $Ax=0$ lie on the plane $x+4y+5z=0$ and the vector perpendicular to the plane is $\begin{bmatrix}1 & 4 & 5\end{bmatrix}$

Each column of matrix A is a non-zero singleton set which is one-dimensional.

Thus, the columns of A are in one-dimensional space.

Hence, the blanks are filled with $\boxed{\text{plane}}$, $\boxed{\begin{bmatrix}1 & 4 & 5\end{bmatrix}}$ and $\boxed{\text{one-dimensional}}$