

Answer on Question #45096 – Math - Analytic Geometry

Problem.

Using projection show that the line passing through $(-1, 8, 8)$ and $(6, 2, 0)$ is perpendicular to the line passing through $(4, 2, 3)$ and $(2, 1, 2)$.

Solution.

The direction vector of the first line is $\vec{a}(7, -6, -8)$ and the direction vector of the second line is $\vec{b}(-2, -1, -1)$. The projection of the vector \vec{a} on the vector \vec{b} is equal to

$$\vec{a}_0 = \frac{(\vec{a}, \vec{b})}{|\vec{b}|^2} \vec{b},$$

where (\vec{a}, \vec{b}) is inner product of (\vec{a}, \vec{b}) .

$$\vec{a}_0 = \frac{7 \cdot (-2) + (-6) \cdot (-1) + (-8) \cdot (-1)}{(-2)^2 + (-1)^2 + (-1)^2} \vec{b} = \vec{0},$$

so the projection of the vector \vec{a} on the vector \vec{b} is equal to $\vec{0}$. Hence the vector \vec{a} is perpendicular to the vector \vec{b} or the line passing through $(-1, 8, 8)$ and $(6, 2, 0)$ is perpendicular to the line passing through $(4, 2, 3)$ and $(2, 1, 2)$ (\vec{a} and \vec{b} are direction vectors of this lines).