Answer on Question #51024 – Math – Analytic Geometry

$\boldsymbol{a}$ and $\boldsymbol{b}$ are vectors defined by $\boldsymbol{a} = 8\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{3k}$ and $\boldsymbol{b} = 3\boldsymbol{i} - 6\boldsymbol{j} + 4\boldsymbol{k}$, where $\boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}$ are mutually perpendicular unit vectors. Show that $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular to each other.

Solution

To show that $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular vectors, we must find scalar (dot) product of these vectors.

$(\boldsymbol{a}, \boldsymbol{b}) = |\boldsymbol{a}||\boldsymbol{b}|cos\alpha$, where α is angle between $\boldsymbol{a}$ and $\boldsymbol{b}$. If $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular, than α is equal to $\frac{\pi}{2}$. Then $(\boldsymbol{a}, \boldsymbol{b}) = 0$. So, in our case we have

$$(\boldsymbol{a}, \boldsymbol{b}) = (8\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{3k}, 3\boldsymbol{i} - 6\boldsymbol{j} + 4\boldsymbol{k}) = 8 \cdot 3 + 2 \cdot (-6) + (-3) \cdot 4 =$$

$$= 24 - 12 - 12 = 0$$

Answer: $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular vectors.