Tutorial n°1 Physics 1	Vector calculus

EXERCISE 1

In a direct orthonormal coordinate system $(O; \vec{i}, \vec{j}, \vec{k})$, consider the vectors:

$$\vec{a} = -2\vec{i} + 3\vec{j} + \alpha\vec{k}\ ;\ \vec{b} = 6\vec{i} - \beta\vec{j} + 3\vec{k}\ ;\ \vec{c} = \vec{i} + 2\vec{j} - 3\vec{k}$$

Where α and β are constants to be determined.

1- For which values of α and β are the vectors $\vec{a}$ and $\vec{b}$ collinear?
2- Calculate the magnitudes of vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$, as well as those of the combinations?

$\left(\vec{a} + \vec{b}\right)$, $\left(\vec{a} - \vec{b}\right)$, $\left(\vec{a} + \vec{c}\right)$ And $\left(\vec{a} - \vec{c}\right)$

3- Determine the components of the vector $\vec{d}$ satisfying the vector relation: $2\vec{a} + \vec{b}/3 - \vec{c} + \vec{d} = \vec{0}$ Deduce the unit vector $\vec{u}$ carried by the vector $\vec{d}$

EXERCISE 2

In a Cartesian orthonormal coordinate system $(O; \vec{i}, \vec{j}, \vec{k})$, We give the three points: $A(1,7)\ ;\ B(8,3)$ and $C\left(\frac{9}{2}, 1\right)$ forming the triangle ABC.

1- Determine the components and magnitudes of the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$, and $\overrightarrow{BC}$.
2- Express the value of the angle $\hat{B}$ using the definition of the dot product

EXERCISE 3

Let there be three points $A(1, 1, 1)$, $B(-1, 3, 1)$, and $C(1, 6, -4)$ in an orthonormal Cartesian coordinate system, $\left(O\ ; \vec{i}, \vec{j}, \vec{k}\right)$.

1- Determine the components and magnitudes of vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$.
2- Calculate the vector product of $\overrightarrow{AB} \wedge \overrightarrow{AC}$. Deduce the area of the triangle ABC and the interior angle $\hat{A}$ of this triangle.

EXERCISE 4

In an orthonormal coordinate system $(O; \vec{i}, \vec{j}, \vec{k})$ we consider the vectors: $\vec{u} = \vec{i} - \vec{j} + 2\vec{k}$ and $\vec{v} = -\vec{i} - 2\vec{j} + \vec{k}$.

1- Give their norms, their scalar product, and the angle they form between them.
2- Calculate the projection of $\vec{u}$ on $\vec{v}$.
3- Determine, in two different ways, a vector orthogonal to $\vec{u}$ and $\vec{v}$.