BADJI MOKHTAR UNIVERSITY -ANNABA
FACULTY OF TECHNOLOGY
SCIENCE AND TECHNOLOGY DEPARTMENT (ST)
1st year LMD 2024/2025

Physics 1: Series 2
Vector calculus

Exercise 1

Let the vectors in space be represented in an orthonormal coordinate system $R\ (OXYZ)$,

$\overrightarrow{V_1} = 2\vec{\imath} - 3\vec{\jmath} + \vec{K}$ and $\overrightarrow{V_2} = -\vec{\imath} + 2\vec{\jmath} + \vec{K}$

1. Represent these vectors in the reference $R(OXYZ)$.

2. Calculate $\vec{S} = \overrightarrow{V_1} + \overrightarrow{V_2}$ and the modules: $\|\overrightarrow{V_1}\|$, $\|\overrightarrow{V_2}\|$ and $\|\vec{S}\|$.

3. Calculate the scalar product of $\overrightarrow{V_1}$ and $\overrightarrow{V_2}$ and deduce the angle between them.

4. Determine the unit vector carried by the vector $\overrightarrow{V_2}$. Deduce the direction cosines of $\overrightarrow{V_2}$.

5. Determine the unit vector perpendicular to the plane $\left(\overrightarrow{V_1},\ \overrightarrow{V_2}\right)$

Exercise 2

Consider the points A(1,0,-1), B(-1,2,1), C(2,1,3) and D(0,1,0) in the frame (OXYZ).

1- Determine the components and magnutides of the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$.

2- Determine the projection and the vector projection of $\overrightarrow{AB}$ on $\overrightarrow{AC}$.

3- Calculate the surface area of triangle ABC and the volume constituted by $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$.

Exercise 3

a. Given the two vectors $\vec{A} = \begin{pmatrix} 1 \\ \alpha \\ \beta \end{pmatrix}$, $\vec{B} = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}$.

Find the values of α and β such that $\vec{B}$ is parallel to $\vec{A}$.

b. Determine the value of the number a for which the vectors $\overrightarrow{V_1} = 2\vec{\imath} + a\vec{\jmath} + \vec{k}$ and $\overrightarrow{V_2} = 4\vec{\imath} - 2\vec{\jmath} - 2\vec{k}$ are perpendicular.

Exercise 4

In the frame $R\left(O, \vec{\imath}, \vec{\jmath}, \vec{k}\right)$ we give the sliding vector $\vec{V} = \vec{\imath} + 2\,\vec{\jmath} + 3\vec{k}$ and which passes through the point A(3, 4, 2).

1. Calculate the moment of the vector $\vec{V}$ relative to the origin *O*, then relative to the axes OX and OY.

2. Calculate the moment of vector $\vec{V}$ relative to point B (3, 6, 0)

3. Consider the (Δ) axis of unit vector $\vec{u}$ (-1/√2, 1/2, 1/2) and passing through *B*, calculate the moment of $\vec{V}$ relative to (Δ).