University Of Oran - 2 **Academic Year 2023-2024**
Faculty of Earth and Universe Sciences
Department of Earth Sciences - Level L1

DW SHEET N°2
VECTOR CALCULATION

Exercise1

In repere $(O, \vec{\imath}, \vec{\jmath}, \vec{k})$, we give the two vectors
$\vec{V}_1 = \vec{i} + 2\vec{j} + 3\vec{k}$ et $\vec{V}_2 = 2\vec{i} - 2\vec{j} + 3\vec{k}$.

- graphically represent these two vectors and calculate their modules.
- Calculate $\vec{S} = \vec{V}_1 + \vec{V}_2$ et $\vec{D} = \vec{V}_1 - \vec{V}_2$.
- Find the directing cosines of the direction of $\vec{S}$.
- Calculate the Scalar product $\vec{V}_1 . \vec{V_2}$ and the angle between $\vec{V}_1$ et $\vec{V}_2$.
- Calculate the vector product $\vec{V_1} \wedge \vec{V_2}$.
- Determine the unit vector perpendicular to the plane $(\vec{V_1}, \vec{V_2})$.

Exercise 2

Let $(\vec{\imath}, \vec{\jmath}, \vec{k})$, be the unit vectors of the rectangular axes Oxyz , we consider the vectors :
$\vec{r_1}(2,3,-1)$, $\vec{r_2}(3,-2,2)$, $\vec{r_3}(4,0,3)$

1) Calculate their modules

2) Calculate the components and modules of the vectors
$\vec{A} = \vec{r_1} + \vec{r_2} - \vec{r_3}$ *and* $\vec{B} = \vec{r_1} - 2\vec{r_2}$

3) Determine the unit vector $\vec{u}$ carried by the vector $\vec{A}$, what are called the components of the unit vector of A

4) Calculate $\vec{r_1} \wedge \vec{r_2}$ *and* $\vec{r_2} \cdot \vec{r_3}$, deduce the area of the triangle formed by the three vectors $\vec{r_1}$, $\vec{r_2}$ and $\vec{r_3}$.

5) Calculate the products $\vec{A}.(\vec{B} \wedge \vec{C})$ et $\vec{A} \wedge (\vec{B} \wedge \vec{C})$

Exercise 3

We give the three vectors:
$$\begin{cases} \vec{A} = 3\vec{\imath} - 4\vec{\jmath} \\ \vec{B} = 2\vec{\imath} + 3\vec{k} \\ \vec{C} = \vec{\imath} + 2\vec{\jmath} - 2\vec{k} \end{cases}$$

We ask :

1) What is the angle between $\vec{A}$ *and* $\vec{B}$
2) Calculate the directing cosines of the vector $\vec{C}$and indicate the angles that makes $\vec{C}$ with the three axes
3) The length of the projection of $\vec{B}$ on $\vec{C}$.

Exercise 4

1- Determine the value of the number a for which the vectors
$\vec{V_1} = 2\vec{\imath} + a\vec{\jmath} + \vec{k}$ et $\vec{V_2} = -4\vec{\imath} - 2\vec{\jmath} - 2\vec{k}$ be:

a- perpendicular.
b- Parallels
c- $(\vec{V_1} \wedge \vec{V_2}) \cdot \vec{k} = 1$

2- let C (α ,1/3, 1/2) be a point in space, where α is a real number. Under what condition is the $(\overrightarrow{OC})$ a unitary vector.

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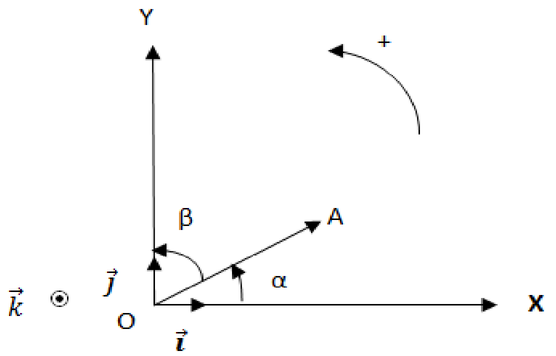
Exercise 5

In a landmark $(O, \vec{\imath}, \vec{\jmath}, \vec{k})$, direct orthonormal, we consider a vector $\vec{U} = \overrightarrow{OA}$ which makes an angle α with the axis $(O, \vec{\imath})$ and an angle β with the axis $(O, \vec{\jmath})$ (Figure opposite).



1- the vector $\vec{U}$ as a function of α, the module U and the unit vectors $\vec{\imath}$ *and* $\vec{\jmath}$

2- as a function of β , the module U and the unit vectors $\vec{\imath}$ *and* $\vec{\jmath}$

3- Same questions of 1 and 2 if by making a rotation in the positive direction along the axis $(O, \vec{K})$ of $\frac{\pi}{2}$.

Exercise 6

In an orthonormal reference (Oxyz) of unit vector$(\vec{\imath}, \vec{\jmath}, \vec{k})$, we consider the vector: $\vec{V} = -2\vec{\imath} + 3\vec{\jmath} + \vec{K}$ whose support passes through the point$A(3, -2, 2)$.

1- Calculate its moment relatively to an axis (Δ) of unit vector$\overrightarrow{U_\Delta}(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})$ and which passes through the point O.

2- Calculate its moment with respect to the point $B(2,1,0)$.

3- Calculate its moment with respect to an axis (Δ') which passes through the point B and parallel to (Δ).

Exercise 7 (Home work)

Let be the following vectors $\overrightarrow{U_1} = A_1\vec{\imath} + A_2\vec{\jmath} + A_3\vec{k}$ and $\overrightarrow{U_2} = B_1\vec{\imath} + B_2\vec{\jmath} + B_3\vec{k}$

1- Calculate scalars products $\overrightarrow{U_1}.\overrightarrow{U_1}$, $\overrightarrow{U_1}.\overrightarrow{U_2}$ and $\overrightarrow{U_2}.\overrightarrow{U_2}$

2- We give$\overrightarrow{V_1} = 2\vec{\imath} - \vec{\jmath} + 5\vec{k}$, $\overrightarrow{V_2} = -3\vec{\imath} + 1.5\vec{\jmath} - 7.5\vec{k}$ and $\overrightarrow{V_3} = -5\vec{\imath} + 4\vec{\jmath} + \vec{k}$

3- Calculate $\overrightarrow{V_1}.\overrightarrow{V_2}$ and $\overrightarrow{V_1}\Lambda\overrightarrow{V_2}$

4- Without making the graphic representation, what can we say about the meaning and direction of the vecteur $\overrightarrow{V_2}$ with respect to $\overrightarrow{V_1}$

5- Calculate the following products $\overrightarrow{V_1}.(\overrightarrow{V_2}\Lambda\overrightarrow{V_3})$ et $\overrightarrow{V_1}\Lambda(\overrightarrow{V_2}\Lambda\overrightarrow{V_3})$

6- Determine the surface of the triangle formed by the vectors $\overrightarrow{V_2}$ and $\overrightarrow{V_3}$.

Exercise 8

The following vectors are considered:

$\overrightarrow{V_1} = sint\,\vec{\imath} - cost\,\vec{\jmath} + 3t\,\vec{K}$, $\overrightarrow{V_2} = cost\,\vec{\imath} - sint\,\vec{\jmath}$

Calculate $\frac{d(\overrightarrow{V_1}.\overrightarrow{V_2})}{dt}$, $\frac{d(\overrightarrow{V_1}\Lambda\overrightarrow{V_2})}{dt}$

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