

Tutorial N°1 : Vector Calculus 2023/2024

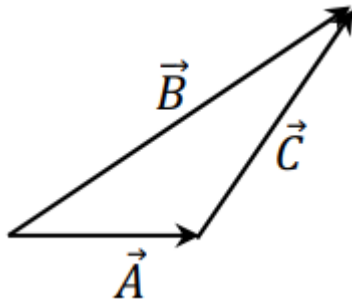
Exercise 1.1

Determine the dimensions of constants v_0 and k in the following equation.

$$v = kt + v_0$$

Exercise 1.2

\vec{A} , \vec{B} and \vec{C} are vectors as shown in the figure. Find the expression of the vector \vec{C} ?



Exercise 1.3

Write the given vector by using the standard basis vectors for \mathbb{R}^2 and \mathbb{R}^3 .

$$\begin{matrix} (2, 4) & (9, -6) & (3, 2, -4) \\ (-1, 2, 5) & (2, 4, 0) & \end{matrix}$$

Exercise 1.4

1/ Write the given vector without using the standard basis notation.

$$\begin{aligned} \vec{V}_1 &= \vec{i} + \vec{j} - 3\vec{k} \\ \vec{V}_2 &= \vec{i} - 2\vec{j} + 2\vec{k} \\ \vec{V}_3 &= -\vec{i} + \vec{j} + 3\vec{k} \end{aligned}$$

2/ Find :

$$\vec{A} = -3\vec{V}_1 \quad \vec{A} = \vec{V}_1 + \vec{V}_2$$

$$\vec{B} = \vec{V}_1 - \vec{V}_2 \quad \vec{D} = \frac{\vec{V}_1 - \vec{V}_3}{|\vec{V}_2|}$$

2/ Determine the unit vector of \vec{V}_1 , \vec{V}_2 and \vec{V}_3 .

Exercise 1.5

Calculate the scale product of the following two vectors, and then find the angle between them.

$$\vec{V}_1 = 2\vec{i} - 3\vec{j} + 4\vec{k} \quad \text{and} \quad \vec{V}_2 = -2\vec{i} + 3\vec{j} + 2\vec{k}$$

Exercise 1.6

\vec{A} and \vec{B} are non zero vectors. If $\vec{A} \cdot \vec{B} = 0$ Explain that?

Exercise 1.7

We have the following vectors:

$$\begin{aligned} \vec{V}_1 &= 3\vec{i} - 2\vec{j} - 4\vec{k} & \vec{V}_2 &= -2\vec{i} + 2\vec{j} + \vec{k} \\ \vec{V}_3 &= 2\vec{i} + 3\vec{j} - 4\vec{k} & & \end{aligned}$$

- 1/ Calculate the vector product. $\vec{V}_1 \wedge \vec{V}_2$, $|\vec{V}_1 \wedge \vec{V}_2|$, What do you represent?
- 2/ Calculate the mixed product. $(\vec{V}_1 \wedge \vec{V}_2) \cdot \vec{V}_3$, What do you represent?

Exercise 1.8

We have the following two functions

$$f(x, y, z) = 2xy^2z \quad \text{is a scalar function.}$$

$$\vec{V}(x, y, z) = 2xy\vec{i} - yz\vec{j} + 3xy\vec{k} \quad \text{is a vector function.}$$

- 1/ Find the gradient of the scalar function $f(x, y, z)$.
- 2/ Find the divergence of the vector function $\vec{V}(x, y, z)$.
- 3/ Find the rotation of the vector function $\vec{V}(x, y, z)$.