



Sadiq Public School

Do the right, fear no man

Subject: Mathematics

Class: H2

Saturday, 16th Nov, 2024

Lesson: Vectors

A) Inquiry:

How we can define a vector? What is meant by Unit vector? How parallelogram Law apply through vectors? How we can understand the concept of addition and subtraction of vectors?

B) Information:

Vector

A vector quantity has both magnitude and direction. Acceleration, velocity, force and displacement are all examples of vector quantities. A scalar quantity is has only magnitude (so the direction is not important). Examples include speed, time and distance.

Unit Vectors

A unit vector is a vector which has a magnitude of 1. There are three important unit vectors which are commonly used and these are the vectors in the direction of the x, y and z-axes. The unit vector in the direction of the x-axis is $\mathbf{i}$, the unit vector in the direction of the y-axis is $\mathbf{j}$ and the unit vector in the direction of the z-axis is $\mathbf{k}$.

Writing vectors in this form can make working with vectors easier.

The Magnitude of a Vector

The magnitude of a vector can be found using **Pythagoras's theorem**.

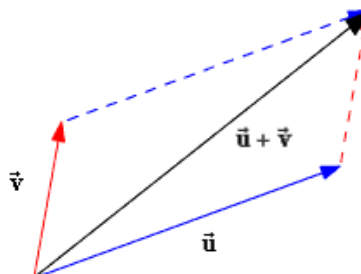
- The magnitude of $a\mathbf{i} + b\mathbf{j} = \sqrt{a^2 + b^2}$

We denote the magnitude of the vector $\mathbf{a}$ by $|\mathbf{a}|$

The sum of two or more vectors is called the resultant. The resultant of two vectors can be found using either the *parallelogram method* or the *triangle method*.

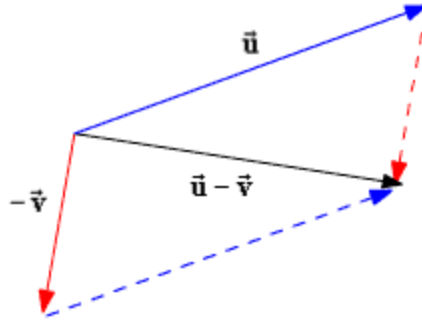
Parallelogram Method:

Draw the vectors so that their initial points coincide. Then draw lines to form a complete parallelogram. The diagonal from the initial point to the opposite vertex of the parallelogram is the resultant.



Vector Addition:

- Place both vectors $\mathbf{u}$ and $\mathbf{v}$ at the same initial point.
- Complete the parallelogram. The resultant vector $\mathbf{u} + \mathbf{v}$ is the diagonal of the parallelogram.



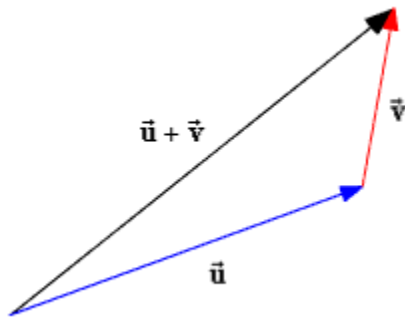
Vector Subtraction:

1. Complete the parallelogram.
2. Draw the diagonals of the parallelogram from the initial point.

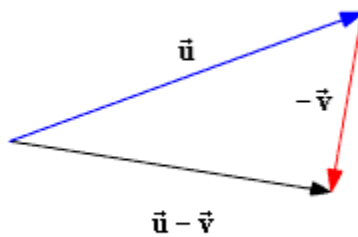
Triangle Method:

Draw the vectors one after another, placing the initial point of each successive vector at the terminal point of the previous vector. Then draw the resultant from the initial point of the first vector to the terminal point of the last vector. This method is also called the *head-to-tail method*.

Vector Addition:



Vector Subtraction:



Example:

Find

(a) $\vec{u} + \vec{v}$ and

(b) $\vec{u} - \vec{v}$ if $\vec{u} = \langle 3, 4 \rangle$ and $\vec{v} = \langle 5, -1 \rangle$.

Substitute the given values of u_1, u_2, v_1 and v_2 into the definition of vector addition.

$$\vec{u} + \vec{v} = \langle u_1 + u_2, v_1 + v_2 \rangle = \langle 3+5, 4+(-1) \rangle = \langle 8, 3 \rangle$$

Rewrite the difference $\vec{u} - \vec{v}$ as a sum $\vec{u} + (-\vec{v})$.

We will need to determine the components of $-\vec{v}$.

Recall that $-\vec{v}$ is a scalar multiple of -1 times $\vec{v}$. From the definition of scalar multiplication, we have:

$$-\vec{v} = -1\langle v_1, v_2 \rangle = -1\langle 5, -1 \rangle = \langle -5, 1 \rangle$$

Now add the components of $\vec{u}$ and $-\vec{v}$.

$$\mathbf{u}^{\rightarrow} + (-\mathbf{v}^{\rightarrow}) = \langle 3+(-5), 4+1 \rangle = \langle -2, 5 \rangle$$

C) Synthesizing:

- ❖ You can review this topic from your textbook.
- ❖ Create notes in your Notebook after referring to the given text and the formulas in your textbook.
- ❖ Solve the following exam style questions to assess the extent of your learning.

D) Practising:

- ❖ Now apply the above concepts to solve the questions from classified from year 2019 to 2022 on your notebook.