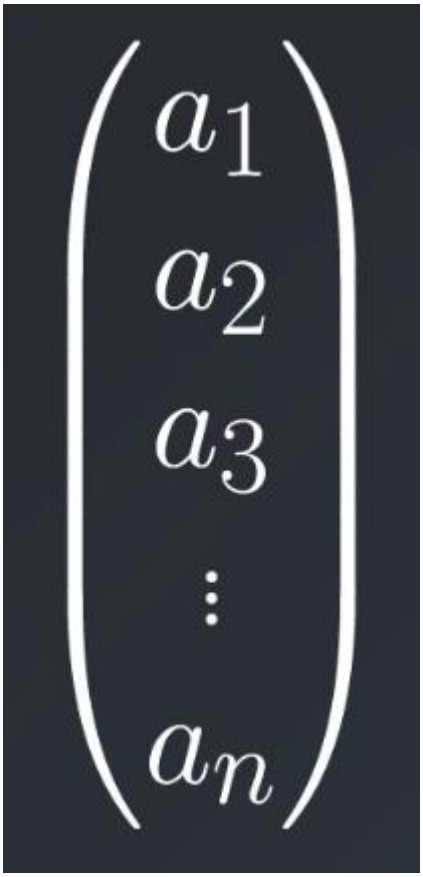
## Vectors- Mathematical Definition

What is a Vector? The plain explanation would be that a vector is an ordered list of numbers.




*n Dimensional Vector*

Each **element** in the vector, also called **component** or **coordinate**, is a number, denoted here by aia_iai.

This specific vector (in the picture above ) has nnn elements and can be in the field of Real Numbers R\mathbb{R}R.

A vector of nnn real elements defines an nnn dimensional vector and belongs to Rn\mathbb{R}^nRn.

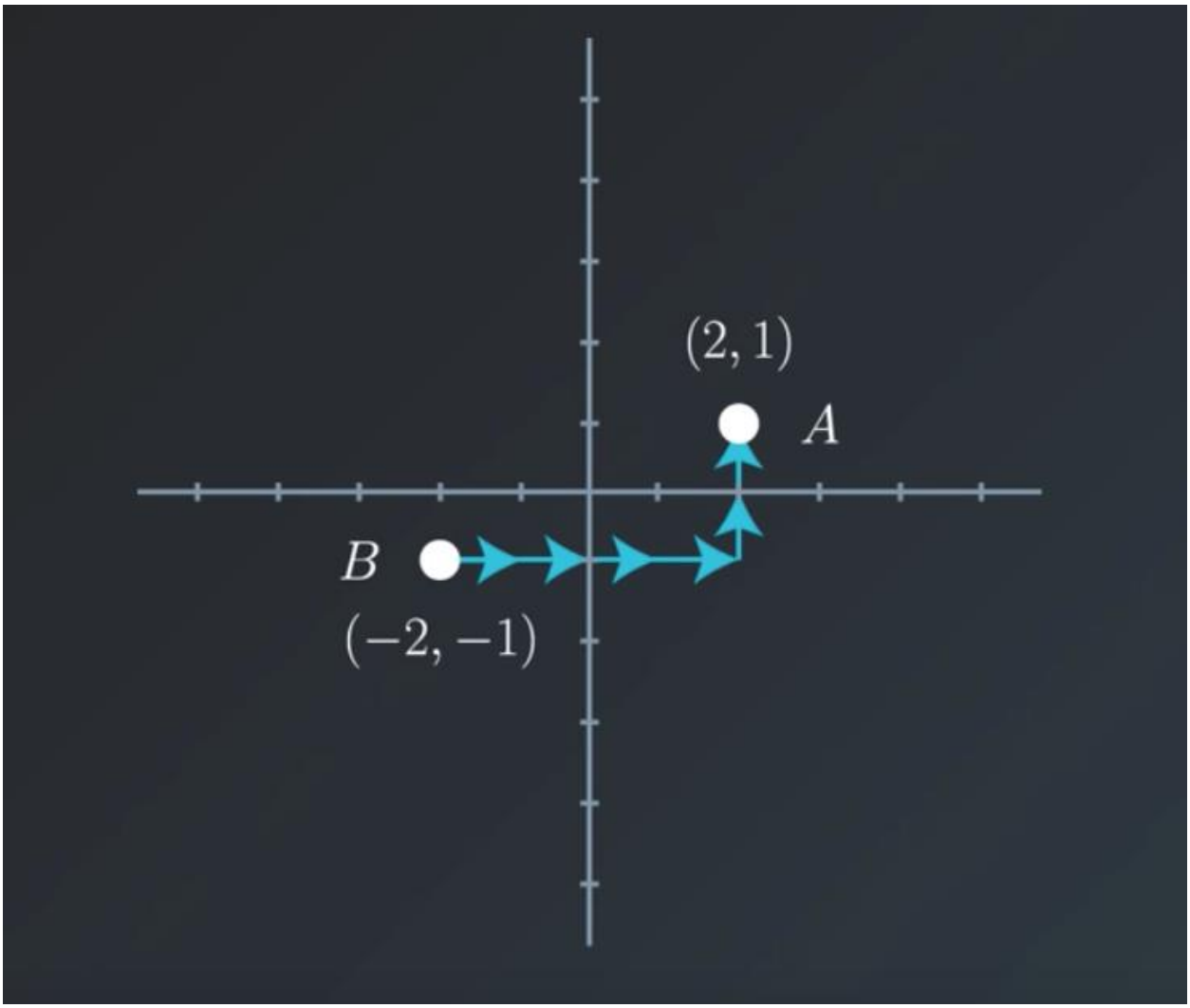
We use the following mathematical notation to define a vector: x⃗\vec{x}x⃗

In the example above:

- $\vec{x} \in \mathbb{R}^n$
- $\vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}$

As in the video let's put this into a more visual context and focus on a $2D$ vector of the field of real numbers. In other words, we will focus on a vector in $R^2$, which defines all points on the plane.

Lets look at the following picture:

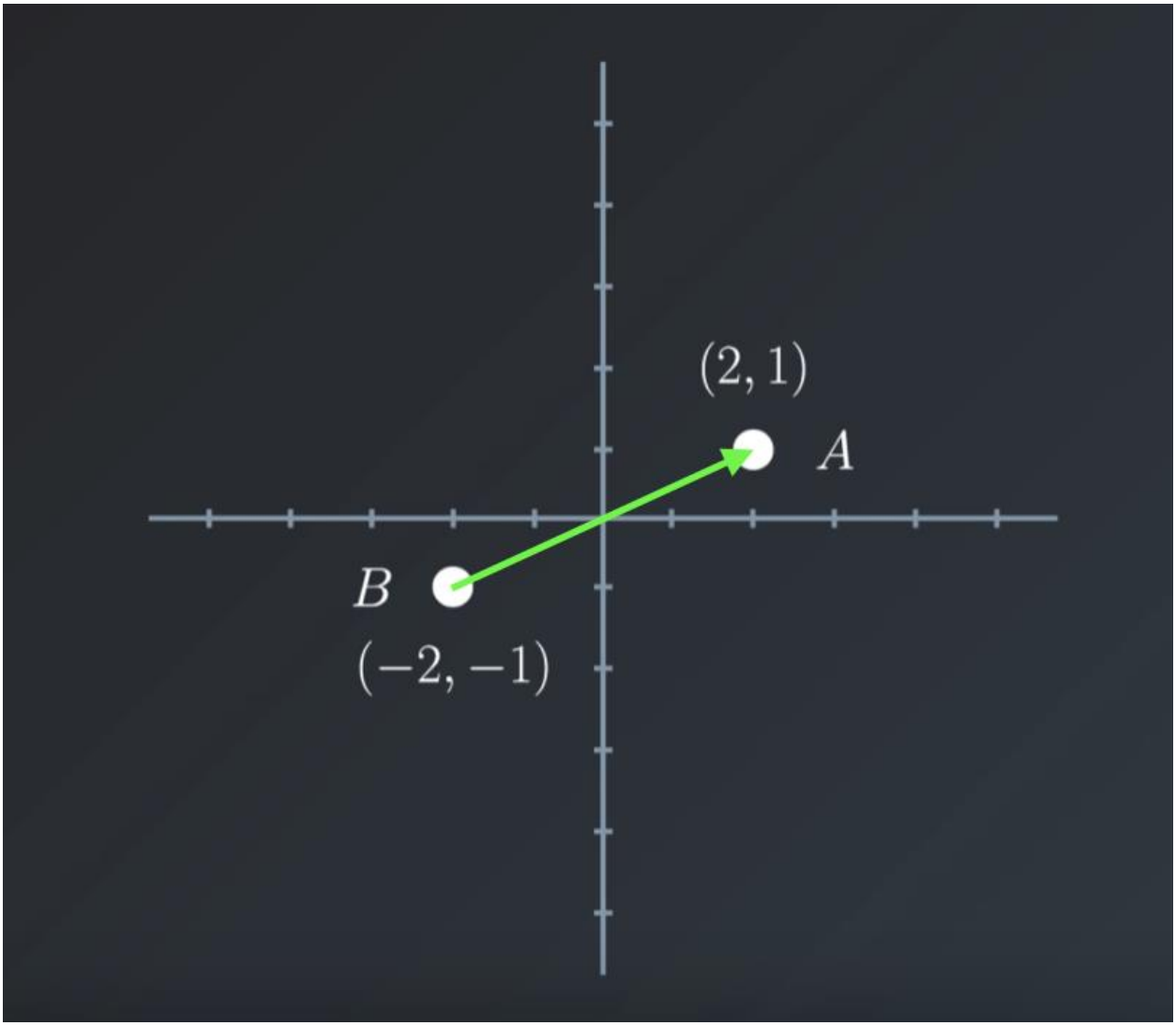



To go from point B to point A we will need to take 4 steps to the right and 2 steps up. This defines the vector

$$\vec{x} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}.$$

The green arrow below defines vector $\vec{X}$.

Graphically we use an arrow to illustrate a vector, as depicted in the following picture.




To calculate the **direction of the movement** we will use an angle. We can use Degrees or Radians. In this example we will focus on Degree. (It is always possible to move Degrees to Radians and vice versa).