

## Magnitude and Direction

Each vector holds the magnitude as well as the direction of the movement.

Lets calculate both for vector  $\vec{x} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$

The symbol we use for the **magnitude** is  $\| \cdot \|$ .

To calculate the **magnitude** of a 2D vector we will use the [Pythagorean Theorem](#).

In our example the magnitude will be calculated the following way:

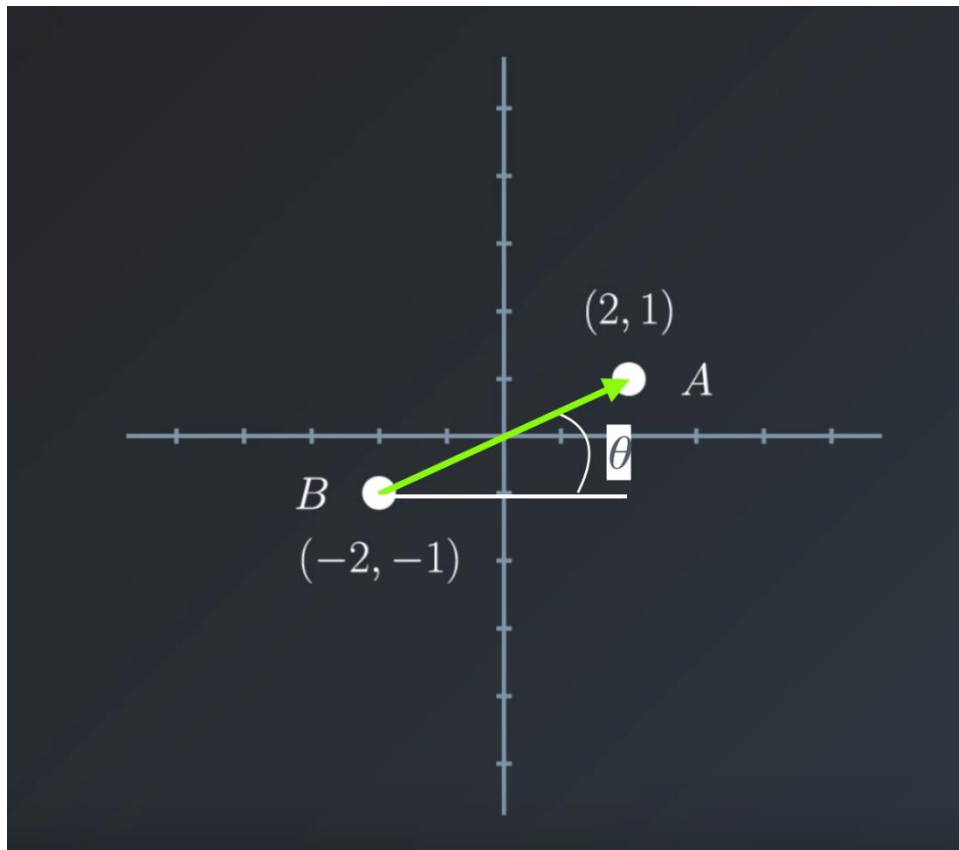
$$\|\vec{x}\| = \sqrt{4^2 + 2^2}$$

Where 4 is the horizontal component of the vector and 2 is the vertical.

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](#)).

lets look at the vector  $\vec{x}$  again. It has an angle  $\theta$  with respect to the horizontal axis.

Please take a look at the picture below for an illustration:

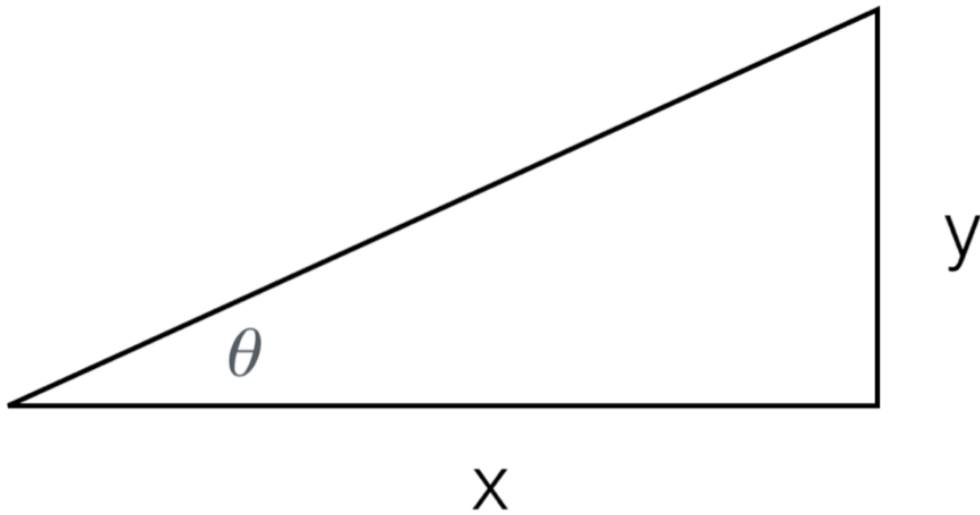


To calculate  $\theta$  we will use what we remember from Trigonometry!

In the specific angle illustrated below  $\theta$  is calculated the following way:

$$\theta = \tan^{-1} \frac{y}{x}$$

*Equation 3*



Therefore, in our case

$$\theta = \tan^{-1} \frac{y}{x} = 26.56505^\circ$$

For further information on magnitude and direction of a 2D vector, please use the following [link](#)