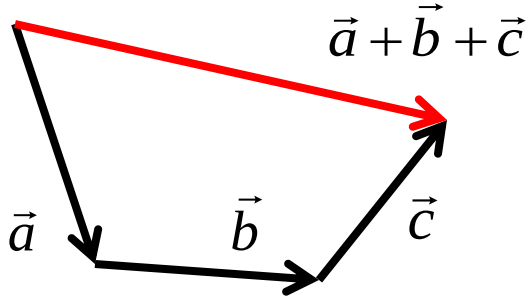
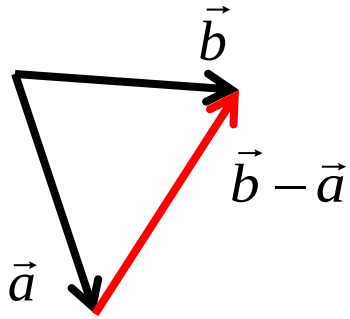
Vectors

Vectors are ***directed line segments***, they have magnitude (length) and direction

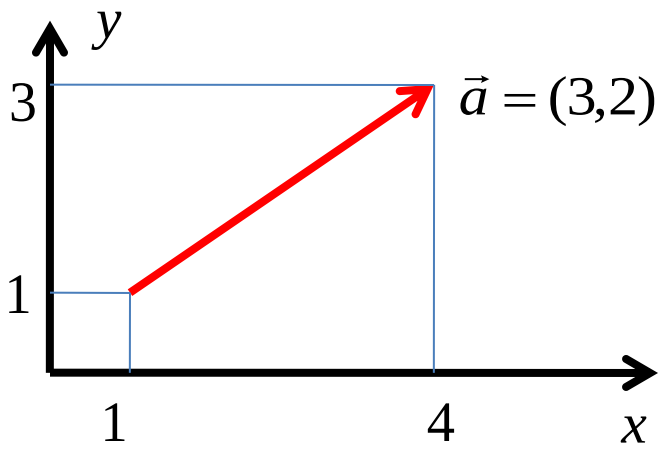
Vectors can be added:



and subtracted:



If there is a coordinate system, a vector can be expressed as a set of ***components*** along X and Y axes in 2D, or along X,Y,Z in 3D:



$+,-$ operations are done for each component:

if $\vec{a}=(a_x,a_y)$ and $\vec{b}=(b_x,b_y)$,

$\vec{a}+\vec{b}=(a_x+b_x,a_y+b_y)$

$\vec{a}-\vec{b}=(a_x-b_x,a_y-b_y)$

To find *magnitude* of a vector, use

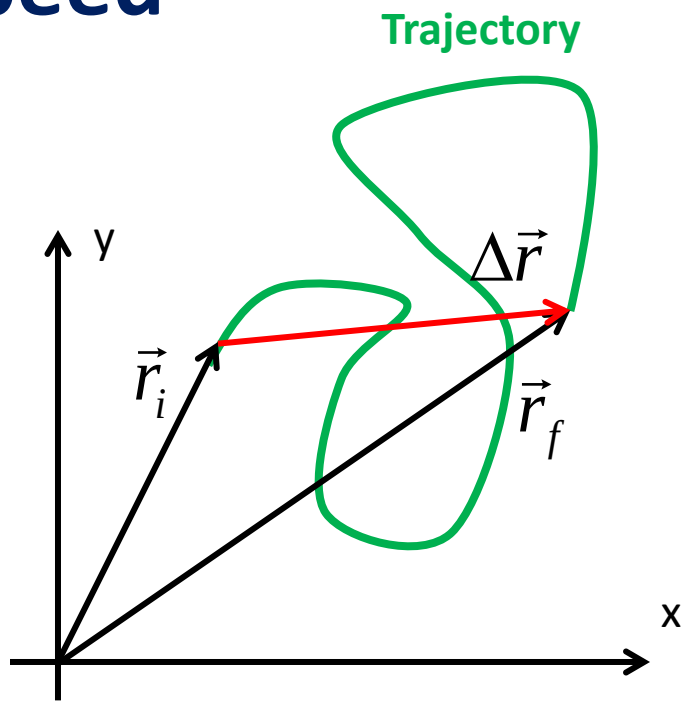
Pythagorean Theorem: $|\vec{a}|=\sqrt{a_x^2+a_y^2}$

Velocity and Speed

$\vec{r_i}$, $\vec{r_f}$ - position vector (initial and final)

displacement: $\Delta\vec{r} = \vec{r_f} - \vec{r_i}$

Travel time: $\Delta t = t_f - t_i$



Average ***velocity:***

$$\vec{v} = \frac{\Delta\vec{r}}{\Delta t}$$

d – distance travelled (length of the trajectory)

Average ***speed:***

$$v = \frac{d}{\Delta t}$$

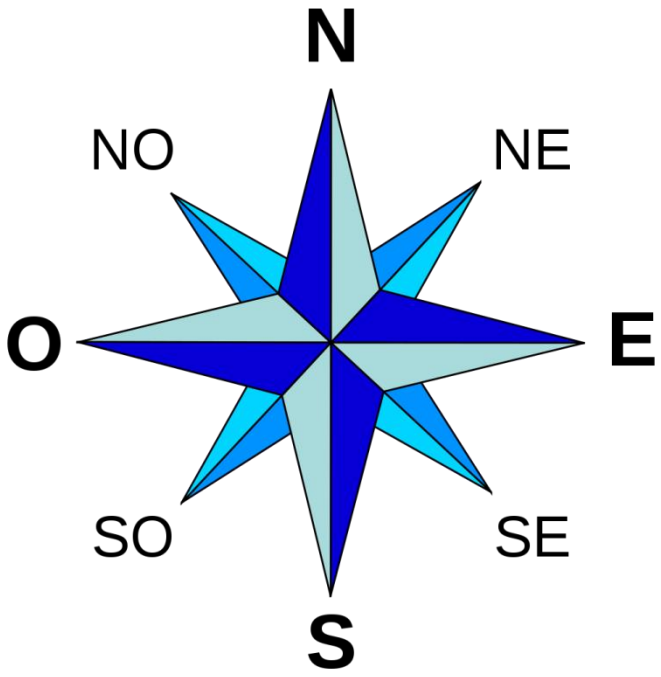
Distance *and* **Speed** *are* *scalars*

Displacement *and* **Velocity** *are* *vectors*

Other examples of *vectors*: **Acceleration** *and* **Force**

Homework

Problem 1. A SchoolNova student was wandering in woods and got lost. Fortunately, he had a tracker that sends out an information about his movements. According to this tracker, the student first walked 1 km to the South-East (SE), then 3 km to SW (South-West) and finally 2 km North. Using this information, determine how far is he from where he started, and in which direction should he go to come back.
Solve the problem graphically (by drawing the displacement vectors on a Quad-ruled paper).



Problem 2. Find the result of operations with vectors. Use graphical method (with pencil and rulers)
Since you will need to redraw vectors while preserving their directions, use the “sliding ruler” trick shown bellow.