SCALARS

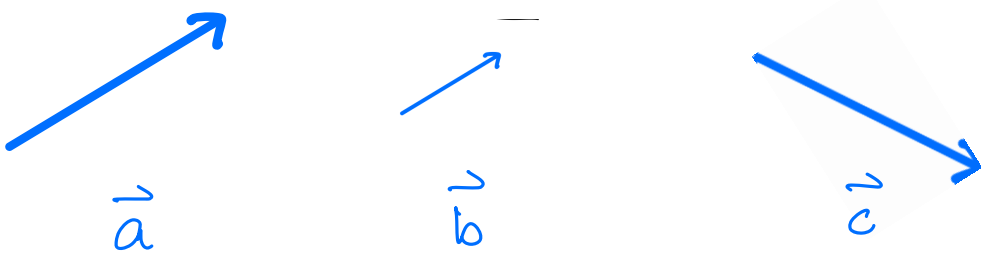
* magnitude only

e.g. speed
mass, time, energy

VECTORS

* magnitude AND direction

e.g. velocity
acceleration, Force, momentum

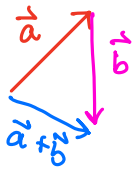


vectors $\vec{a}$ & $\vec{b}$ are the same direction but different magnitudes.

vectors $\vec{a}$ & $\vec{c}$ are same magnitude but different directions

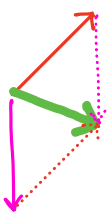
"Two" ways to add vectors: "Head to Tail" or "Parallelogram"

$\vec{a}$ $\vec{b}$ Let's do $\vec{a}+\vec{b}$

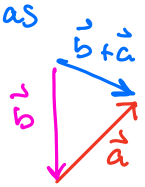


- Draw 1st vector.
- Draw 2nd vector, starting where 1st one ended.
- Resultant is original start to final end.

$\vec{a}+\vec{b}$



Notice its the same as $\vec{b}+\vec{a}$

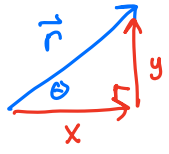


The "Parallelogram" method is basically doing both of those:

- Draw 2 vectors starting from same point
- Make a parallelogram by copying the 2 vectors over

- Resultant is the diagonal of the parallelogram

COMPONENTS OF VECTORS a.k.a. UNIT VECTOR NOTATION

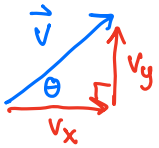


$r^2 = x^2 + y^2$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$

$x = r\cos\theta$

$y = r\sin\theta$



$\vec{r} = r \angle \theta$ or $\vec{r} = x\hat{\imath} + y\hat{\jmath}$

mag & direction — components

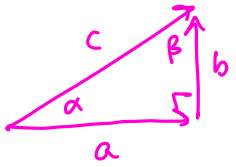
2 ways to give a vector

$\vec{v} = v \angle \theta$ or $\vec{v} = v_x\hat{\imath} + v_y\hat{\jmath}$

- To add or subtract vectors, just add or subtract the components!

$$\vec{a} + \vec{b} = (a_x + b_x)\hat{\imath} + (a_y + b_y)\hat{\jmath}$$

Some little things to remember/notice:



α & β are complementary b/c its a right triangle.

If we limit ourselves to the 1st quadrant for directions, then

$b\hat{\imath} + a\hat{\jmath}$ is in a complentary direction to $a\hat{\imath} + b\hat{\jmath}$

Recall from math that if yw have a line with a slope of "m", then a line with a slope of "$-\frac{1}{m}$" will be $\perp$ to the first line.

$\therefore$ $-b\hat{\imath} + a\hat{\jmath}$ and $b\hat{\imath} - a\hat{\jmath}$ are both $\perp$ to $a\hat{\imath} + b\hat{\jmath}$