

Ch-04

Vectors

Lect-02

Today's Goal



Graphical Method of Vector Addition

Triangle Law of Addition

Parallelogram Law of Addition

Polygon Law of Addition

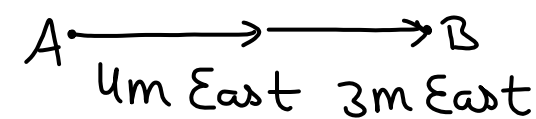
We have Studied:

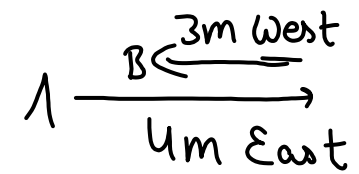
Scalar Addition

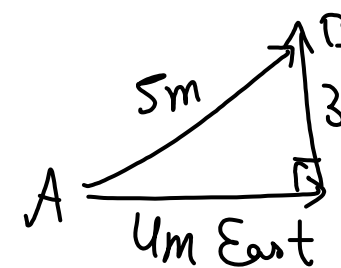
$$3\text{kg Mango} + 4\text{kg Mango}$$

$$= 7\text{kg Mango}$$

Vector Addition

$$\text{disp} = \vec{4\text{m}} + \vec{3\text{m}} = \vec{7\text{m}}$$


$$\text{disp} = \vec{4\text{m}} + \vec{3\text{m}} = \vec{1\text{m}}$$


$$\text{disp} = \vec{4\text{m}} + \vec{3\text{m}} = \vec{5\text{m}}$$


Methods of Vector Addition

1. Graphical Method or Geometrical Method

↘ diagram | draw

2. Analytical Method

↓
Formula

Graphical Methods

1. Triangle Law 

2. Parallelogram Law 

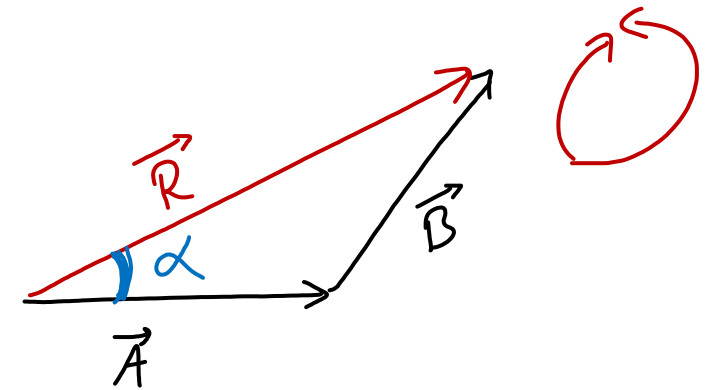
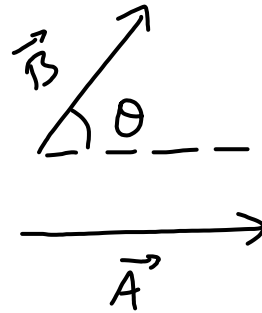
3. Polygon Law 

Triangle Law of Vector Addition

$$\vec{A} + \vec{B} = \vec{R}$$

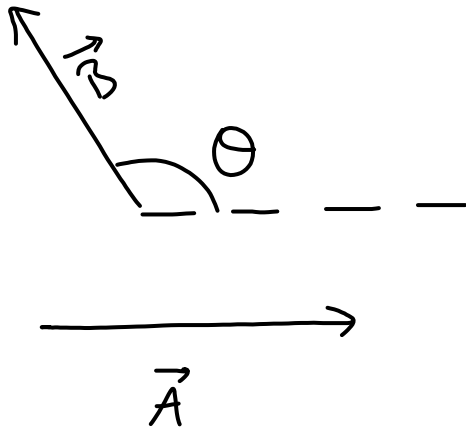
Magnitude
direction

Resultant
Magnitude
direction

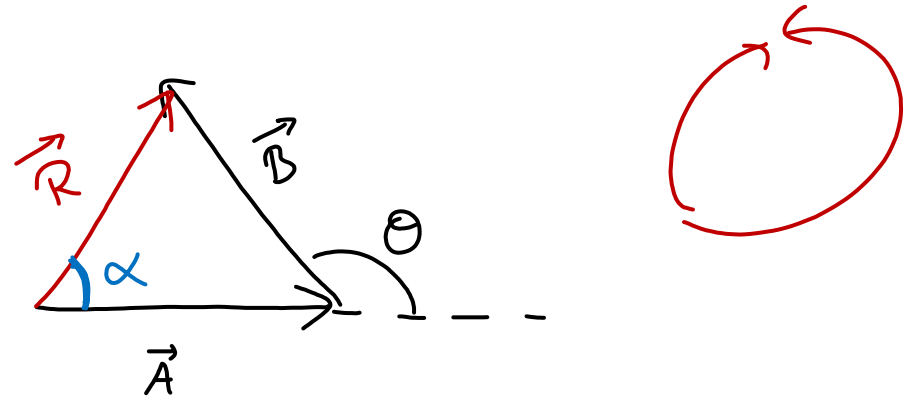


Magnitude of \vec{R} = length of third side
Direction of \vec{R} = ' α ' wrt \vec{A}

“If two vectors are represented by two sides of a triangle in magnitude and direction taken in same order, then the resultant is given by the third side of the triangle in magnitude and direction taken in opposite order”



\Rightarrow



$$\vec{A} + \vec{B} = \vec{R}$$

Magnitude \rightarrow length of third side
direction \rightarrow ' α ' wrt A

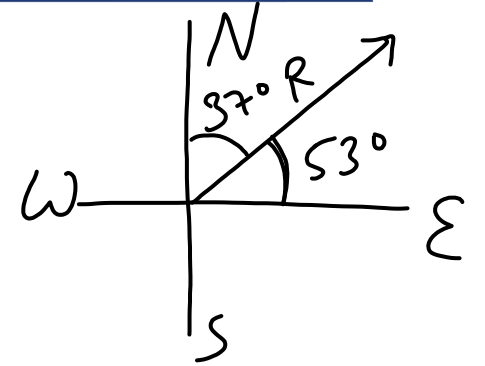
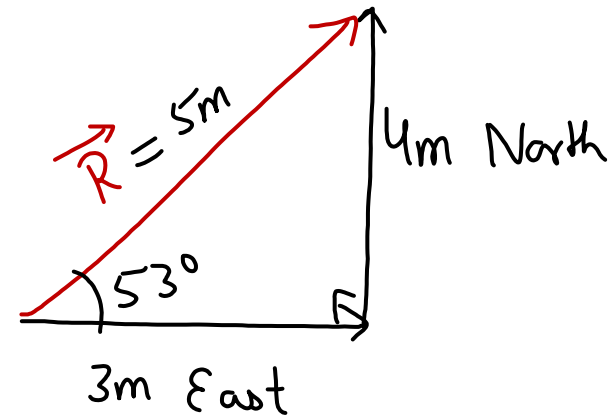
Q1) A girl moves 3 m towards east, then she takes 90° left turn & moves 4 m North . Find displacement of girl

- a) 5 m 53° East of North
- ~~b) 5m 37° East of North~~
- c) 5 m 37° West of South
- d) 5m 53° West of South

$$|R|^2 = 3^2 + 4^2$$

$$|R|^2 = 25$$

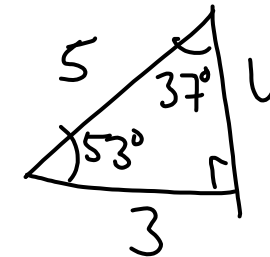
$$|R| = 5$$



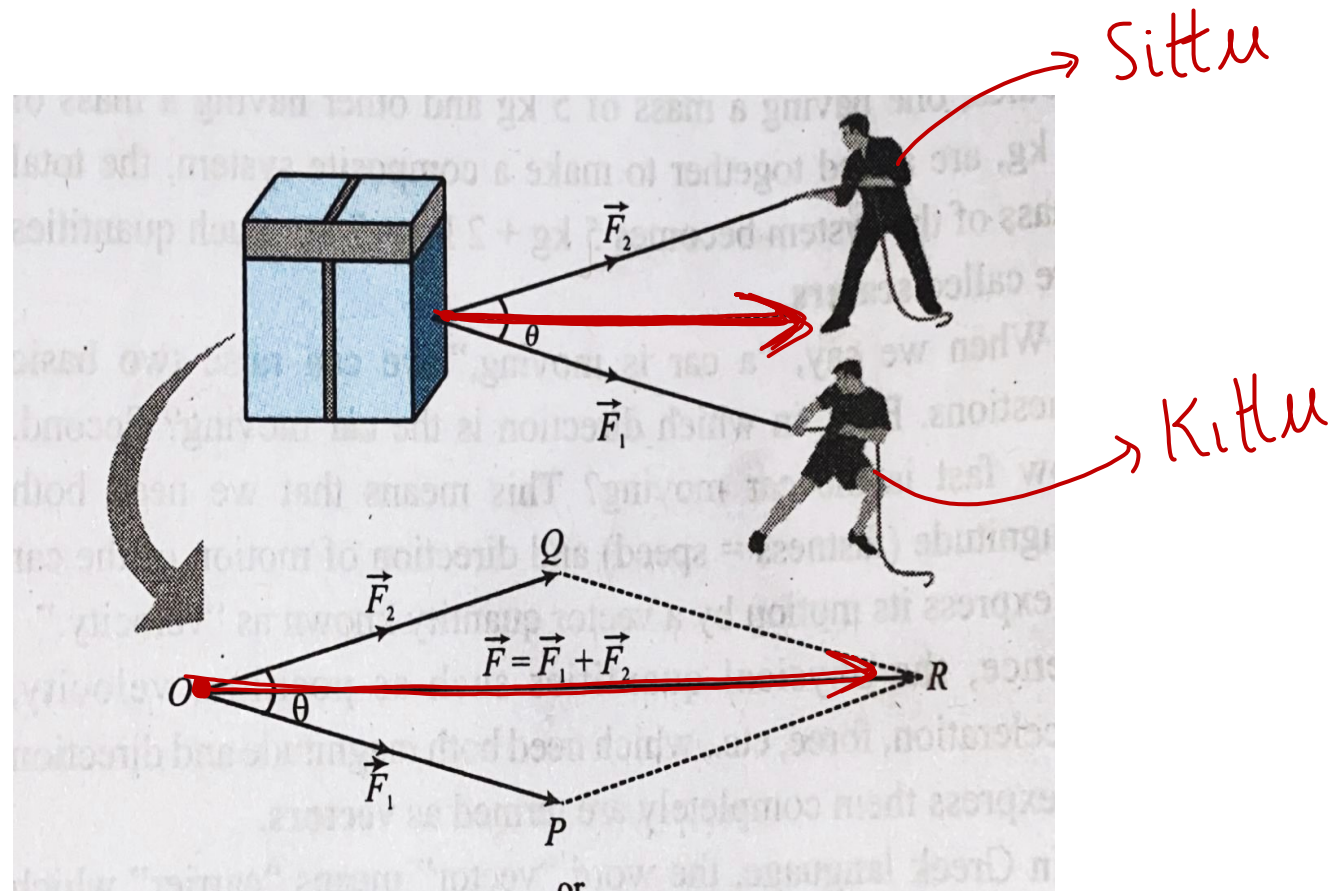
$$1\text{cm} \rightarrow 1\text{m}$$

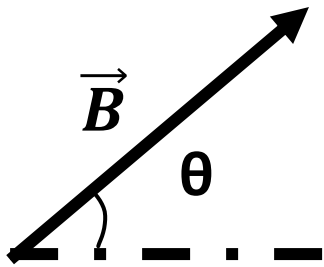
$$3\text{cm} \rightarrow 3\text{m}$$

$$4\text{cm} \rightarrow 4\text{m}$$

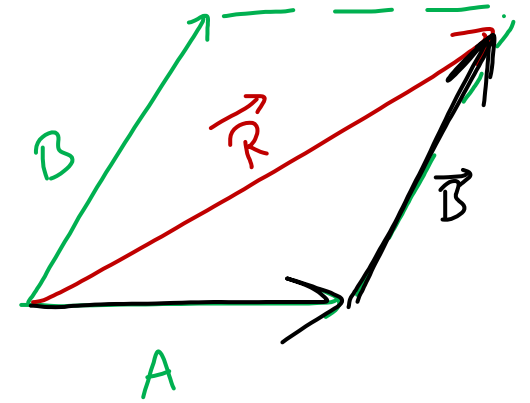
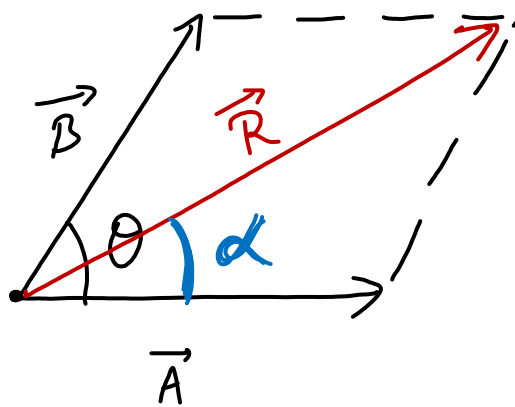


Parallelogram Law of Vector Addition





Two Vectors
joined
Tail to
Tail



\vec{A}

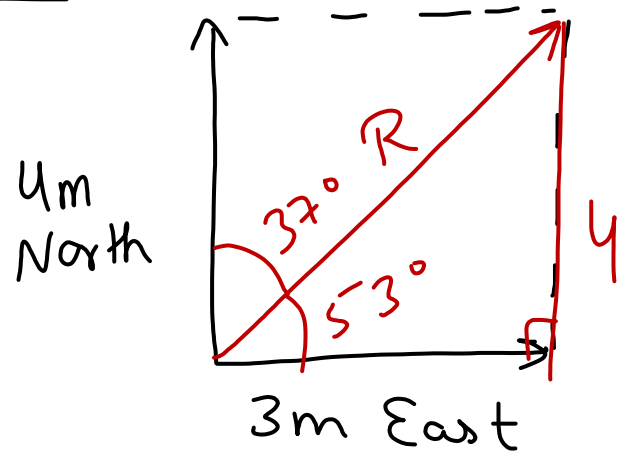
$$\vec{A} + \vec{B} = \vec{R}$$

Magnitude \rightarrow length of common Tail diagonal

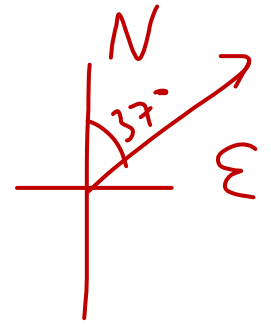
direction \rightarrow ' α ' wrt A

“If two vectors are represented by two adjacent sides of a parallelogram in magnitude and direction (Joined tail to tail) then the Resultant is given by the diagonal of parallelogram in magnitude and direction starting from common intersection of two vectors”

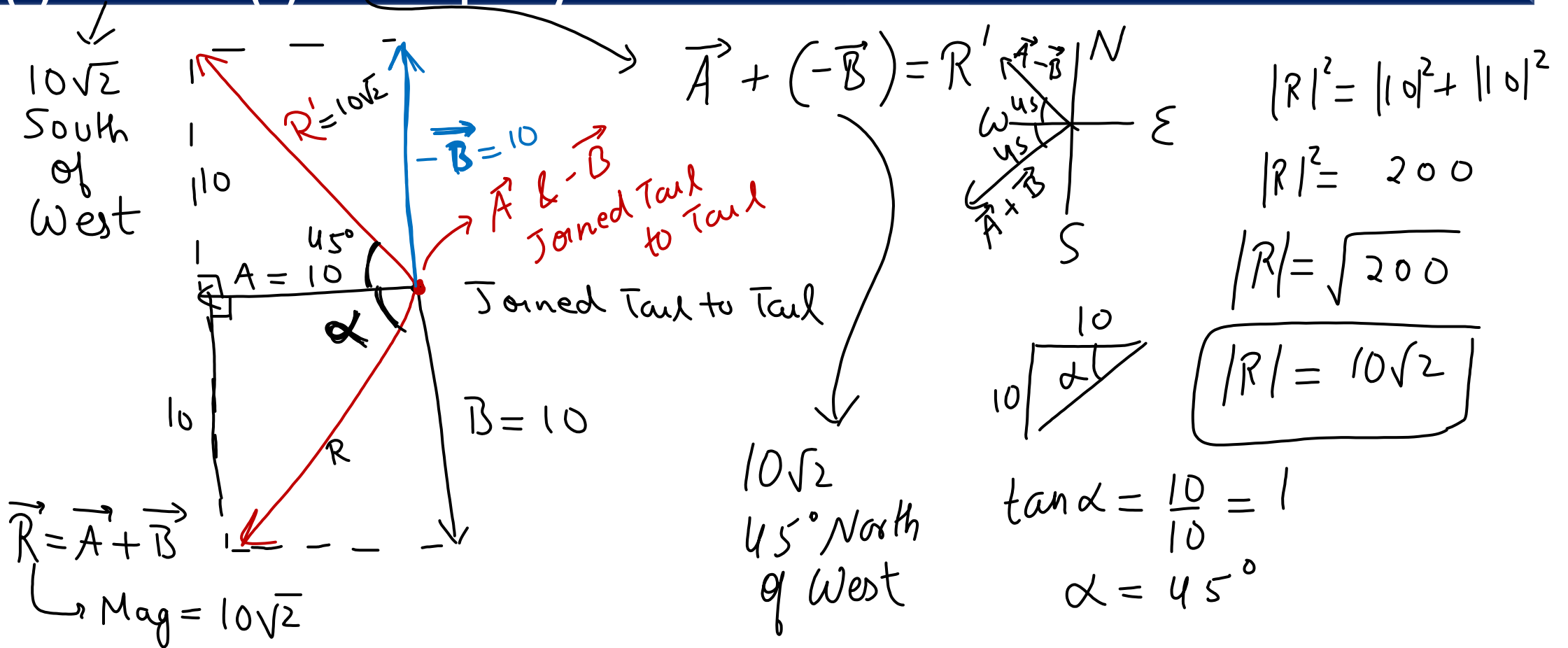
1/gm Law



$R = 5m \ 37^\circ \text{ East of North}$



Q2) Vector A has a magnitude of 10 units and points due west, while vector B has the same magnitude and points due south. Find the magnitude and direction of (a) $\vec{A} + \vec{B}$ and (b) $\vec{A} - \vec{B}$. Specify the directions relative to due west.

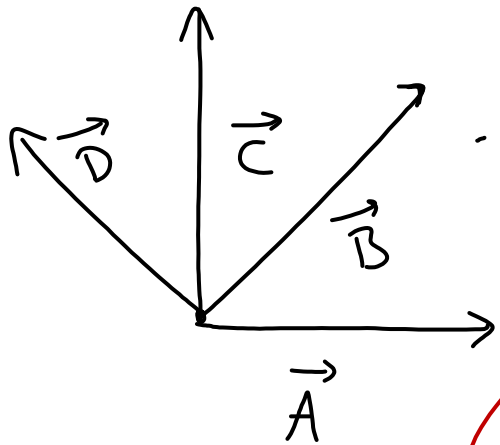


$$|\vec{R}| = |R'|$$
$$|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}| \longrightarrow \vec{A} \perp \vec{B}$$

$$\vec{A} + \vec{B} \neq \vec{A} - \vec{B}$$
$$\vec{R} \neq \vec{R}'$$

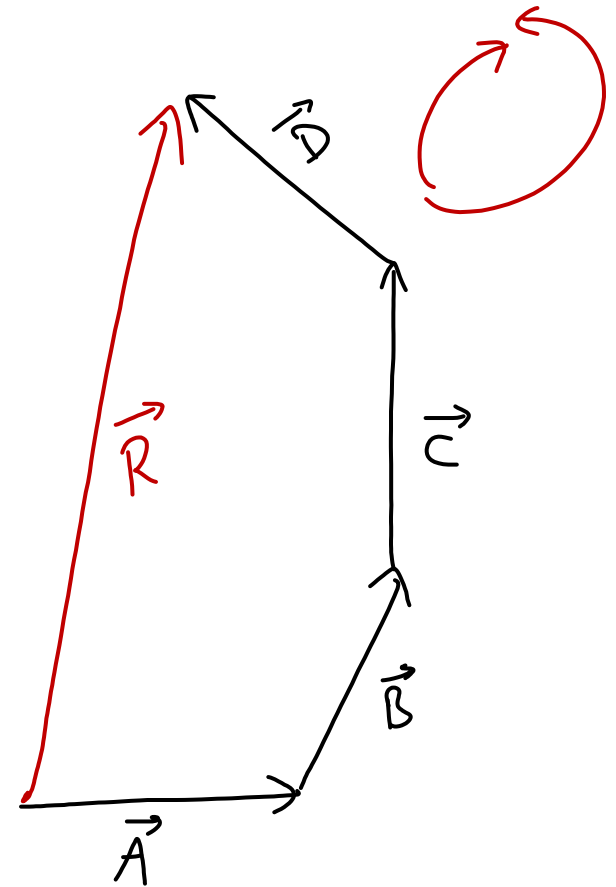
Polygon Law of Vector Addition OR Head-Tail Method (To add more than two vectors)

(extension of Δ law)



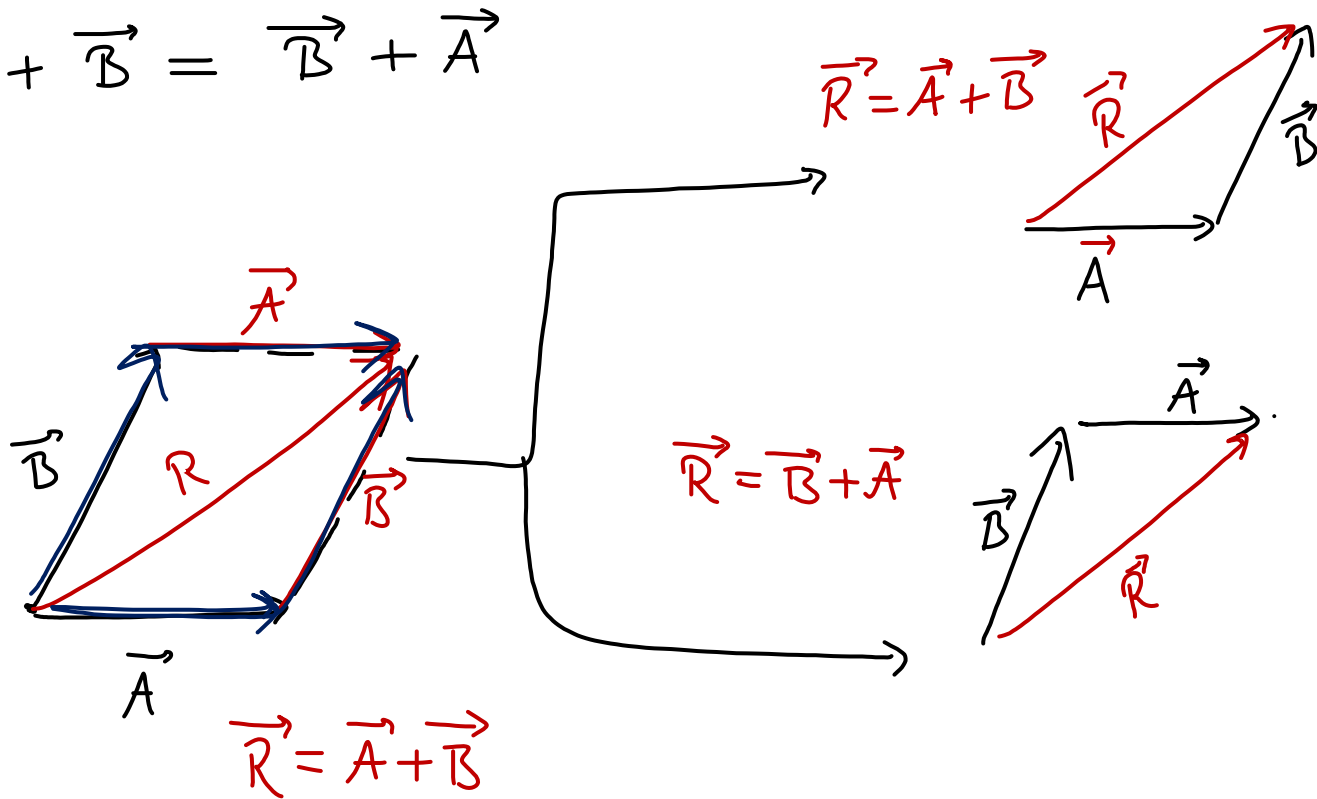
पहले की Tail को
Jod दो आखिरी के Head से

$$\vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$$



Vector Addition obeys Commutative Law

$$\vec{A} + \vec{B} = \vec{B} + \vec{A}$$



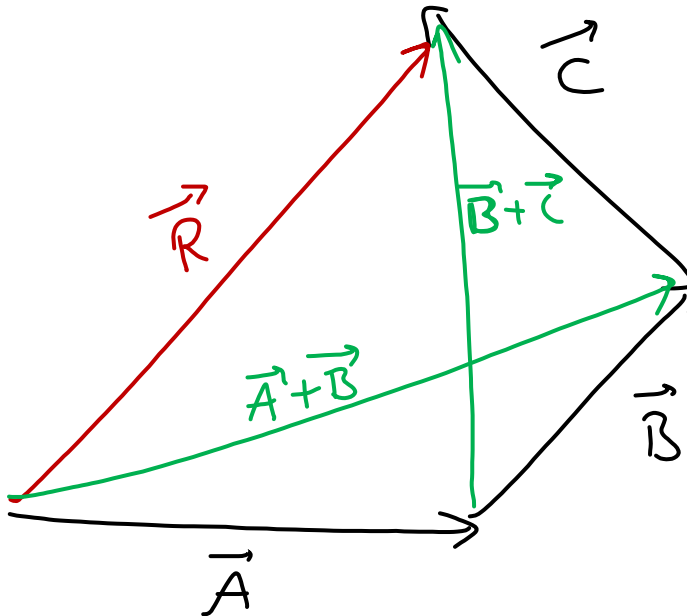
Vector Addition is Associative

$$\vec{A} + (\vec{B} + \vec{C}) = (\vec{A} + \vec{B}) + \vec{C}$$

$$\vec{R} = \vec{A} + (\vec{B} + \vec{C})$$

$$\vec{R} = (\vec{A} + \vec{B}) + \vec{C}$$

$$\vec{R} = \vec{A} + \vec{B} + \vec{C}$$



Thank You

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