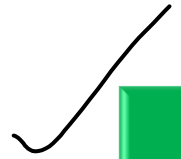


Ch-03

Vectors

Lect-01

Today's Goal



Introduction to Vectors

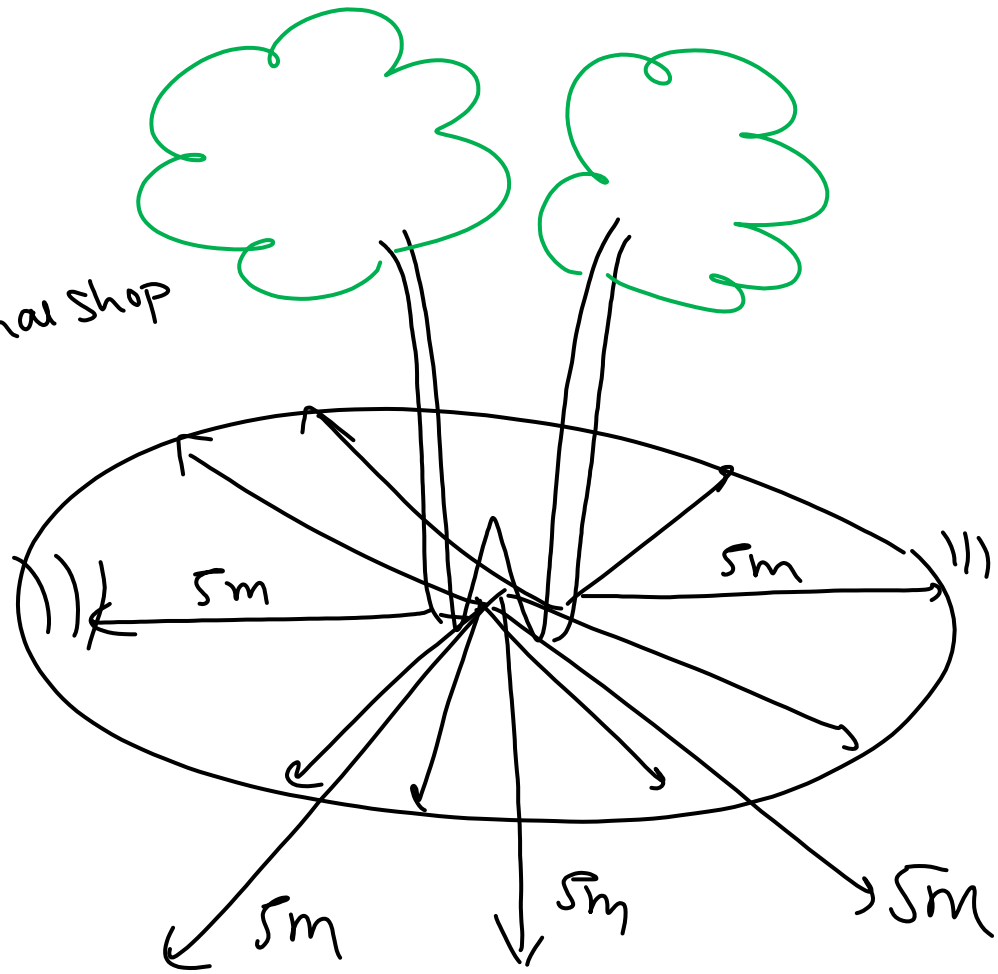
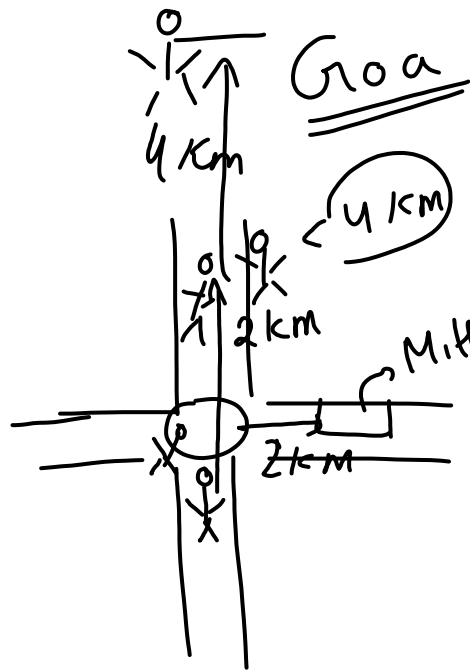
Why do we need Vectors?

$$\text{Physical Quantity (PQ)} = n \mu$$

Mango \rightarrow 2 Kg
(Mass)
Fever \rightarrow 101 F
(Temperature)

**Numerical
value
(magnitude)**

Unit



displacement
 ↓
 5 m X
 direction

Difference between Scalar Quantities & Vector Quantities

Scalar Quantities

1)) *Numerical Value Only*

2) *Added according to ordinary rules of algebra.*

Examples: Mass, distance, speed, Temperature , Energy

Vector Quantities

a) *Numerical Value*

b) *Direction*

c) *Obeys Vector Law of addition*

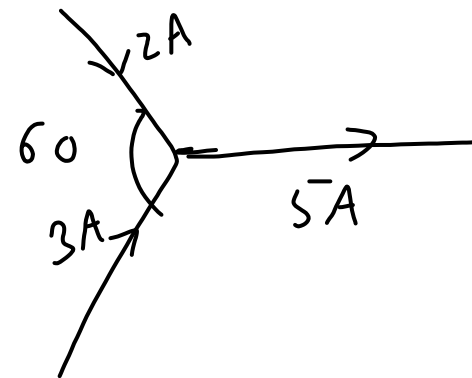
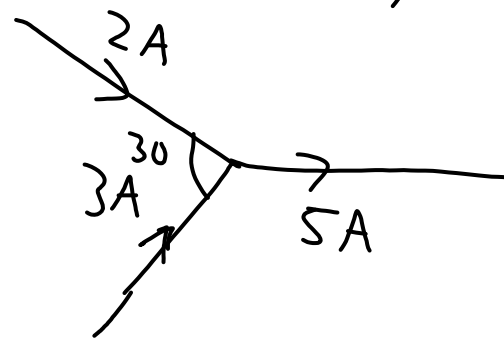
2) *Added according to Vector Law of Addition (necessary condition to be a Vector)*

Example: Displacement, velocity, Force, Acceleration

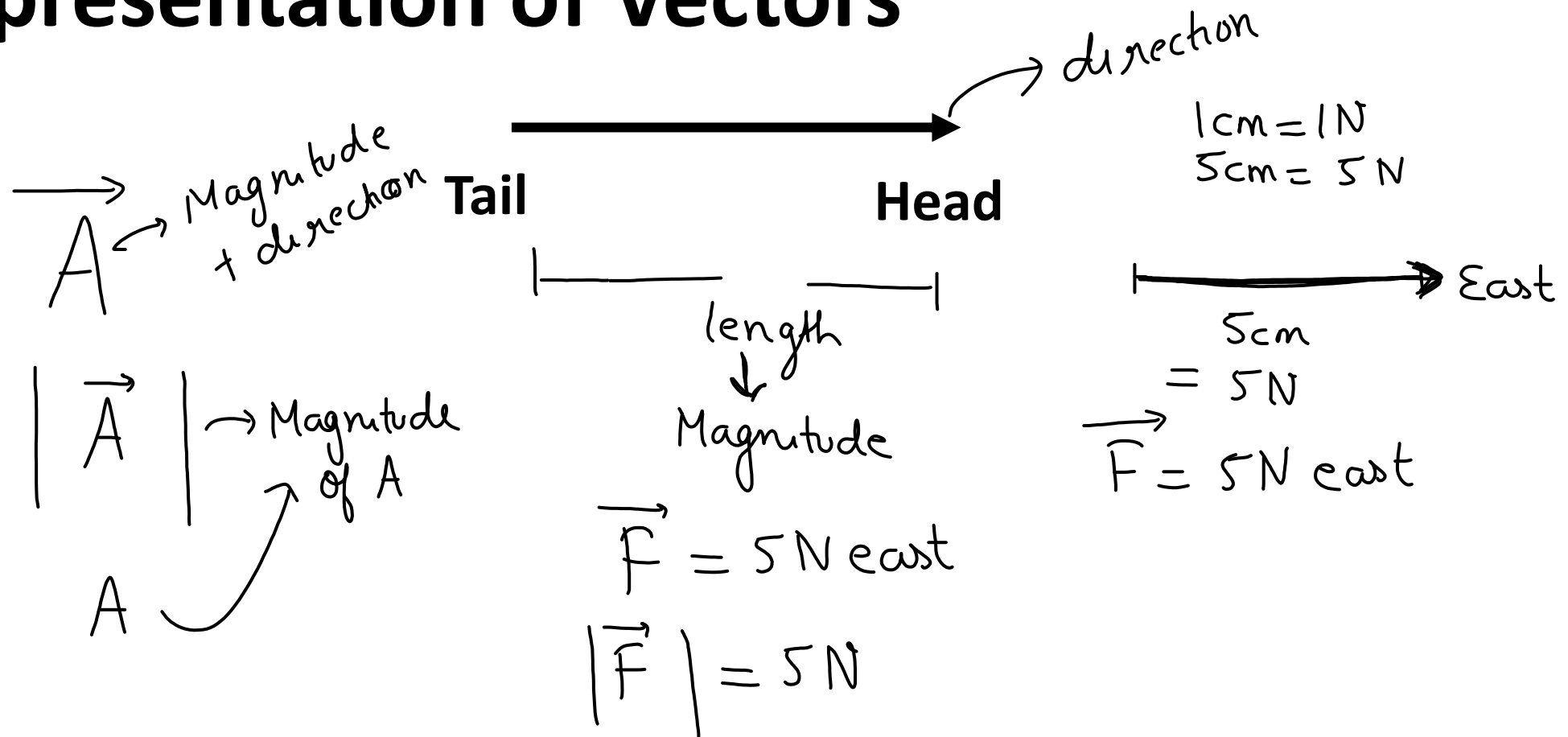
**Note: All vector Quantities have direction
But
All Quantities that have direction are not Vectors.**

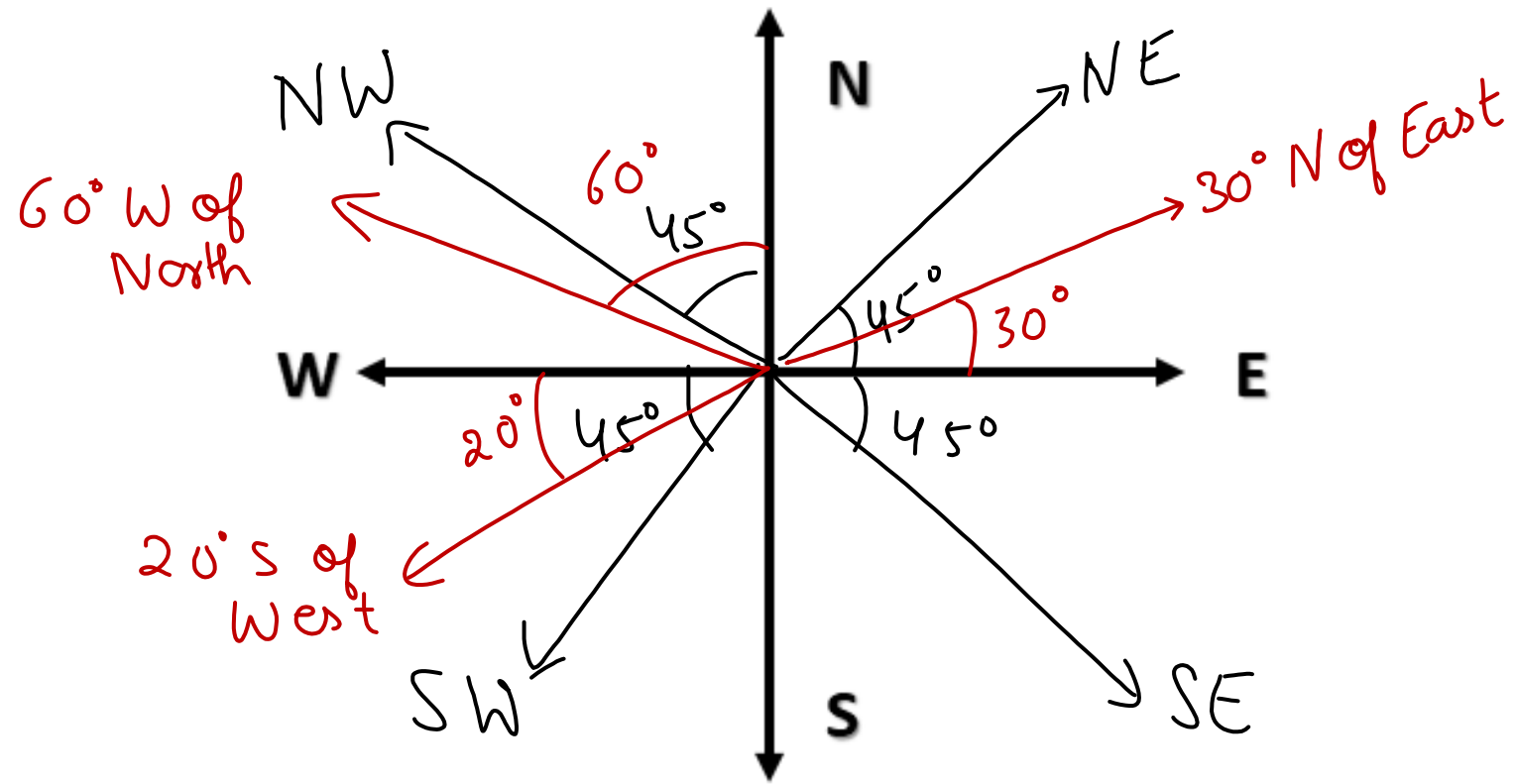
Vector condition \rightarrow obeys Vector law of Addition

For example \rightarrow Electric Current, Pressure



Representation of Vectors

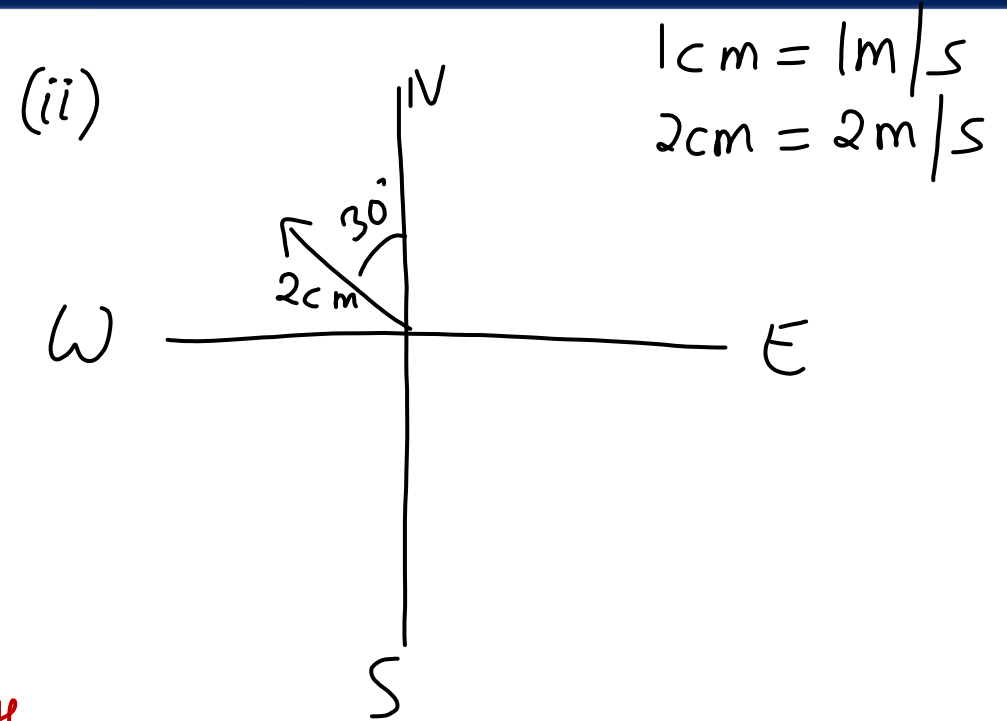
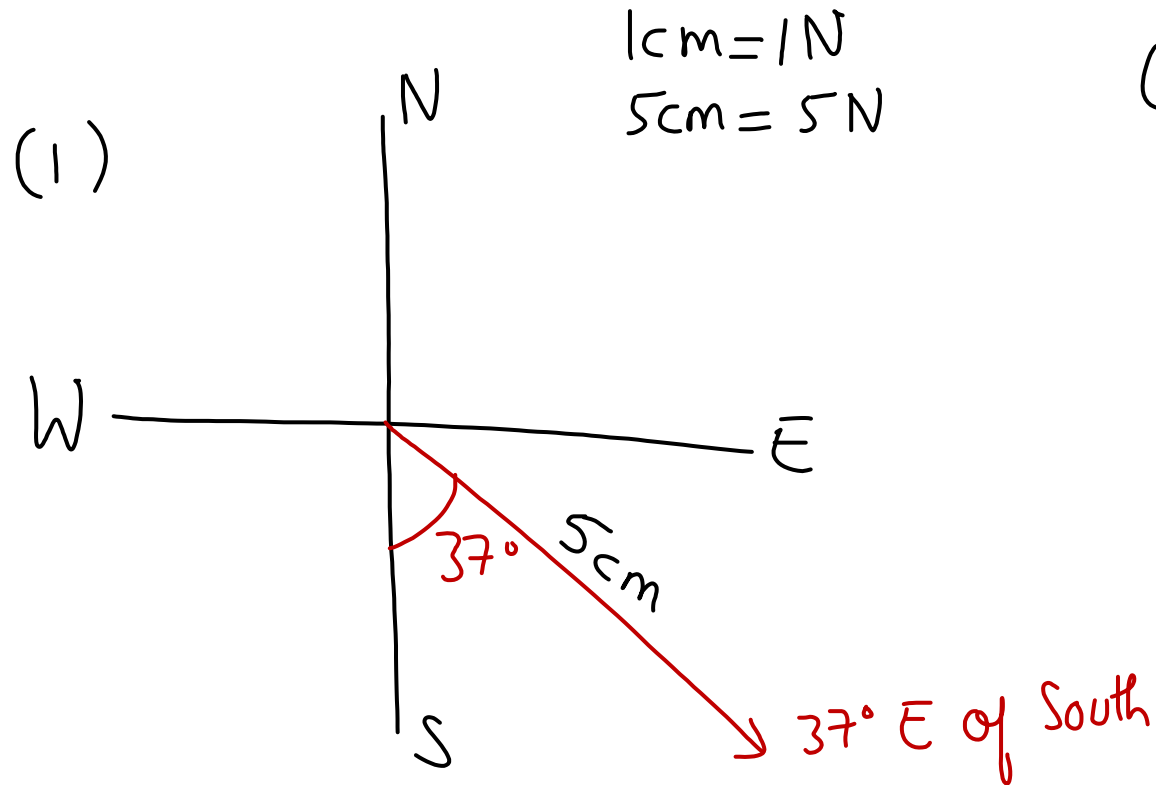




Q1) Draw the following Vectors :

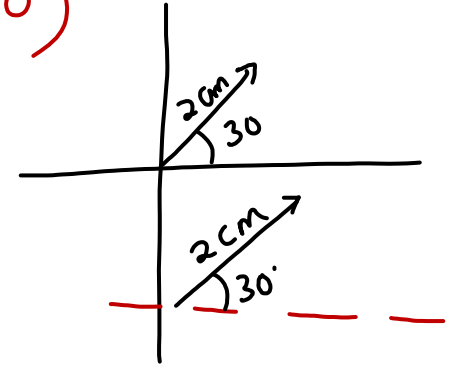
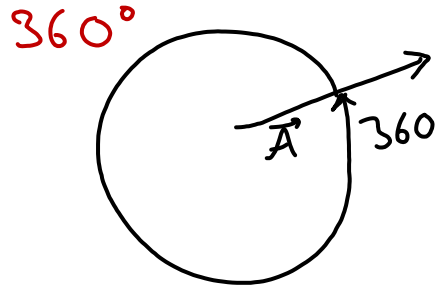
(i) 5N 37° East of South

(ii) 2m/s 30° West of North

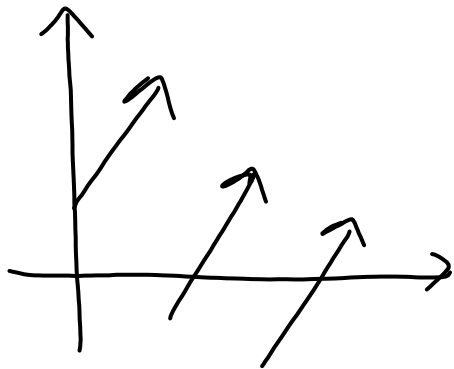


Important Points related to Vector

i. On Rotating 2π Vector does not change. ($\pi \rightarrow 180^\circ$)

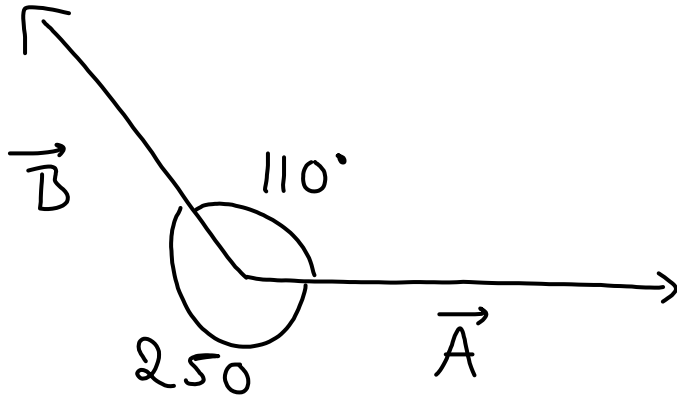


ii. A vector can shift parallel to itself. (Parallel shifting of Vectors)



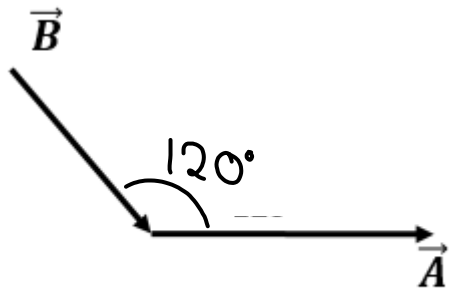
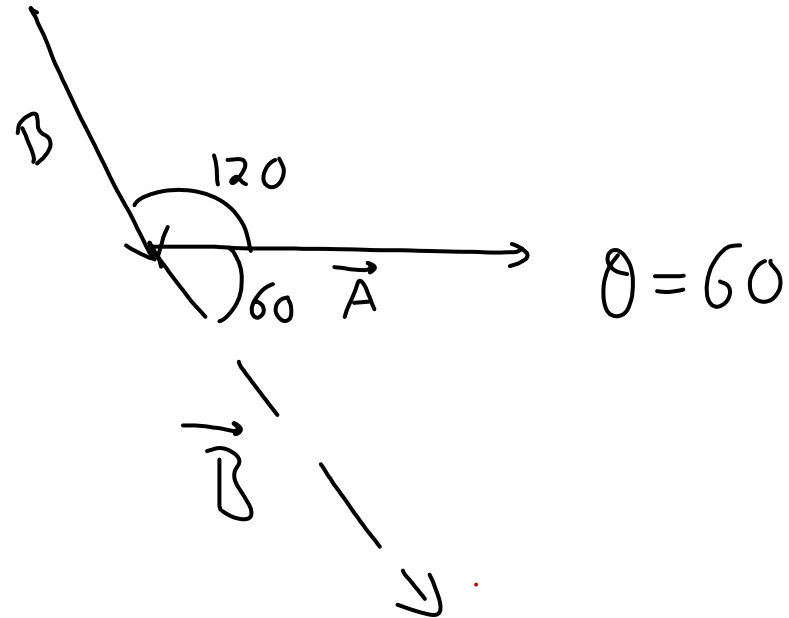
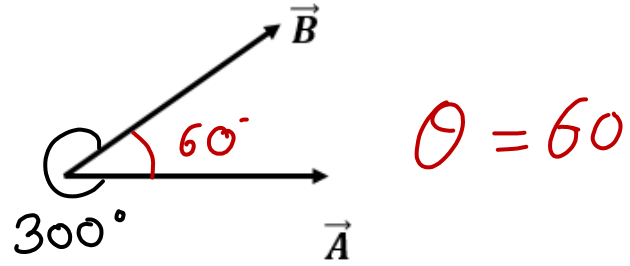
- iii. The Angle between two vectors is the smaller of the two angles between the vectors when they are joined tail to tail

$$0^\circ \leq \theta \leq 180^\circ$$

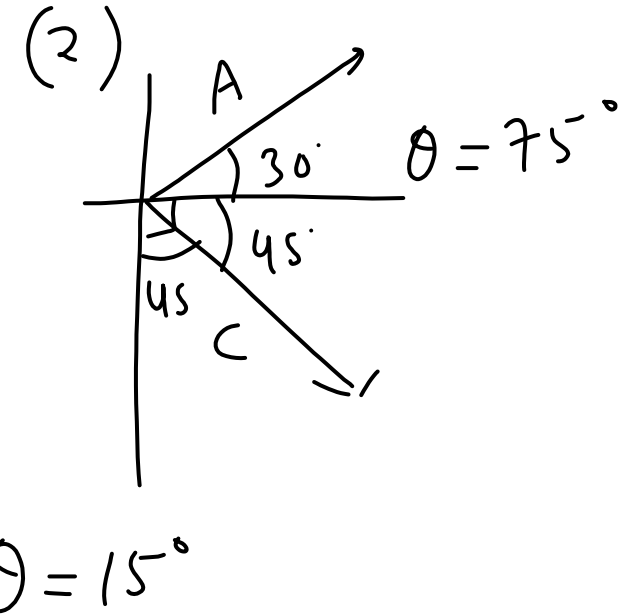
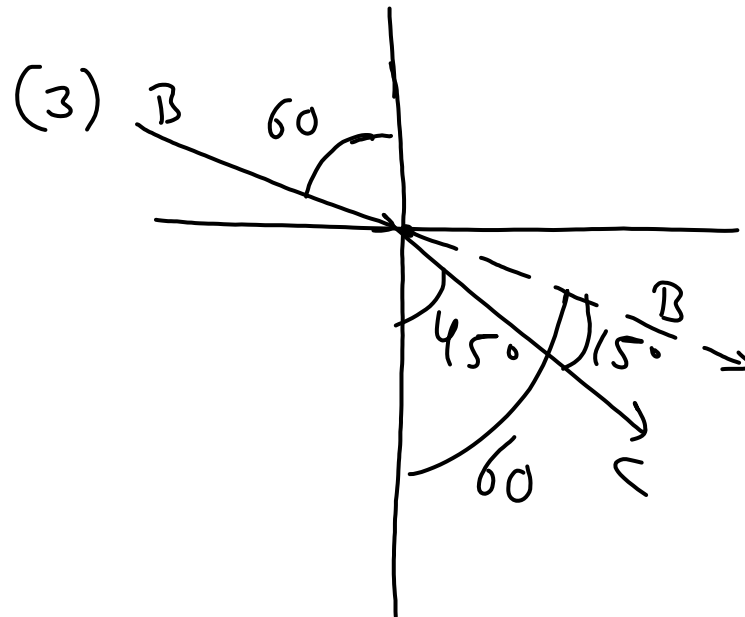
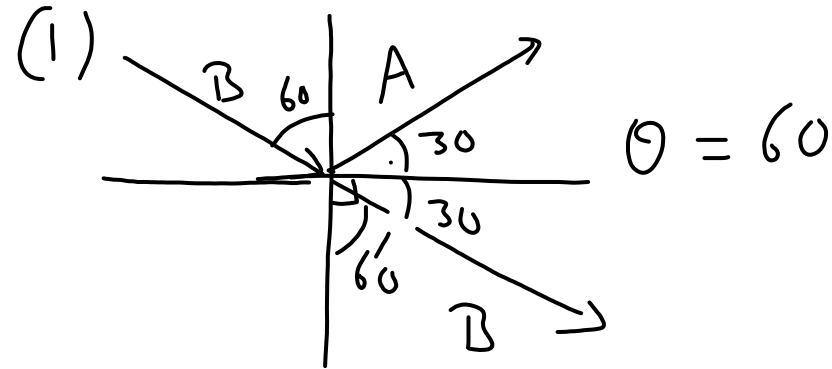
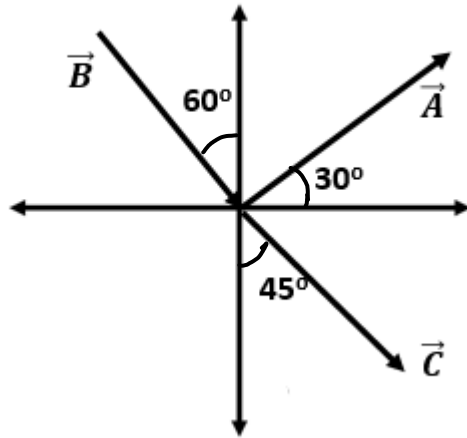


$$\theta = 110^\circ$$

Q) Find the angle between \vec{A} & \vec{B}



Q1) Find angle between (1) \vec{A} & \vec{B} (2) \vec{A} & \vec{C} (3) \vec{B} & \vec{C}



Types of Vectors

Equal Vectors

Two Vectors are

equal if they have

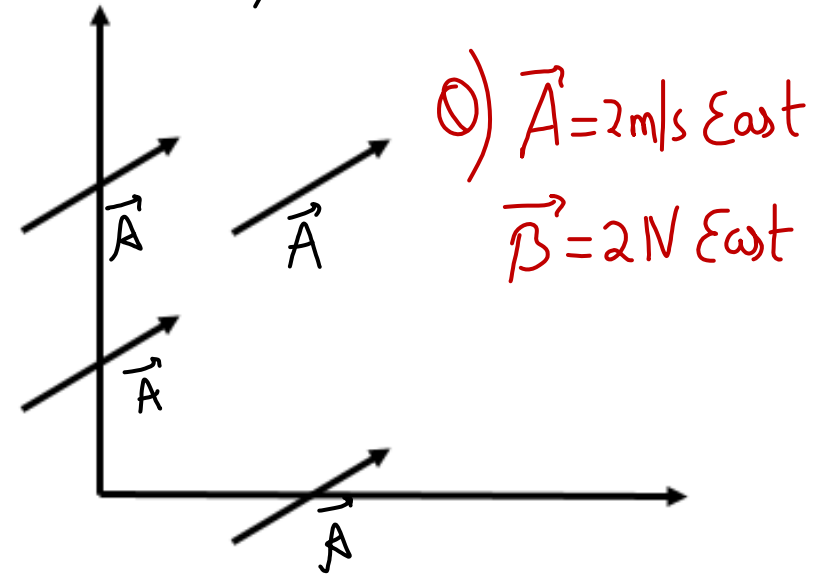
- i) equal Magnitude
- ii) Same direction
- iii) Same units

$$\left. \begin{array}{l} \vec{A} \quad \vec{B} \\ \vec{A} = 2\text{m/s east} \\ \vec{B} = 2\text{m/s West} \\ |\vec{A}| = |\vec{B}| \\ \vec{A} \neq \vec{B} \end{array} \right\}$$

$$\vec{A} = 2\text{m/s east}$$

$$\vec{B} = 2\text{m/s east} \quad |\vec{A}| = |\vec{B}|$$

$$\vec{A} = \vec{B} \quad \checkmark$$



Negative of a Vector

Same Magnitude but opposite direction

$$\vec{A} = 2\text{m/s East}$$

$$\vec{B} = 2\text{m/s West}$$

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

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



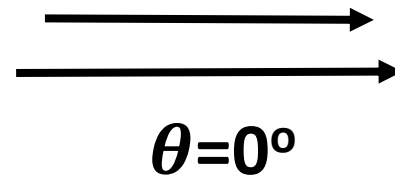
$$\vec{A} = 2\text{m/s East}$$

$$\vec{B} = 4\text{m/s West}$$

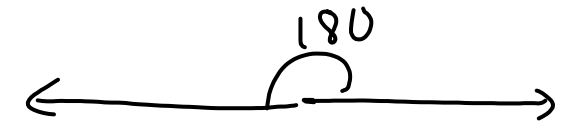
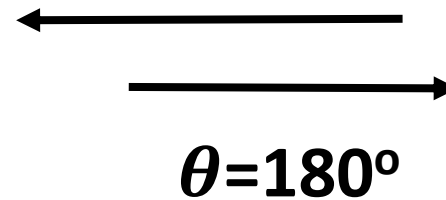
$$\vec{A} = -\vec{B}$$

Parallel & Antiparallel Vectors

- Parallel Vectors



- Antiparallel Vectors



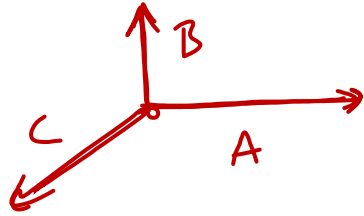
Collinear & Coplanar Vectors

- **Collinear Vectors** which lie on same line (same path)

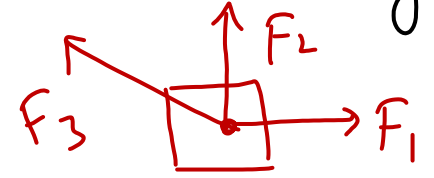


- **Coplanar Vectors** which lie in the same plane
 - ⇒ Two Vectors will always be Coplanar
 - ⇒ Three Vectors may or may not be Coplanar $[abc] = 0$

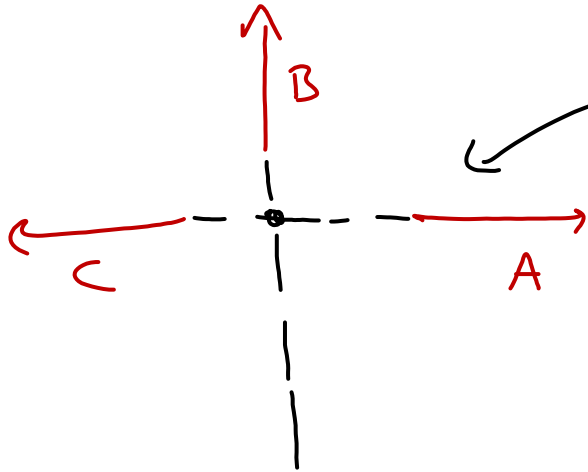
Concurrent Vectors



Two or more Vectors intersecting
at the same point
OR



Two or more Vectors whose line
of Action intersect at a common
point



Unit & Zero/Null Vector

Most imp
• Unit Vector

A vector whose magnitude is 1 (unity) $|\hat{A}| = 1$ → Read as

If A is a unit vector, it is represented as \hat{A} (A cap)

$$\hat{A} = \frac{\vec{A}}{|A|}$$

Unit vector has only one use to give direction to a vector

• Zero/Null Vector

↓
(Cross product)

• whose magnitude is zero & which has arbitrary direction

↓
 $\vec{0}$

Thank You

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