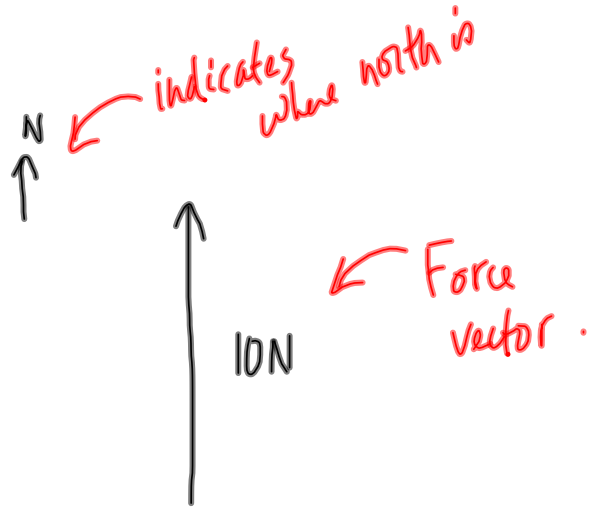
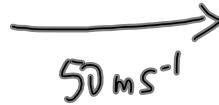


## Representation of Vectors

$$\vec{F} = 10\text{ N } \overset{[N]}{\text{north}}$$



$$\vec{V} = 50\text{ ms}^{-1} \text{ east}$$

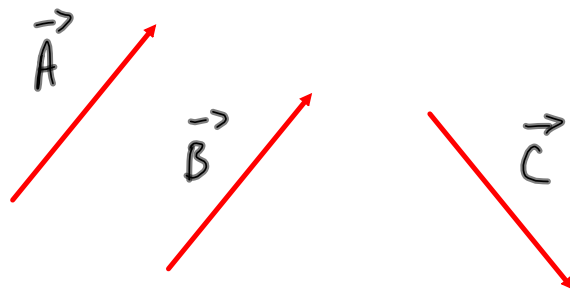


## Equality of Vectors

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

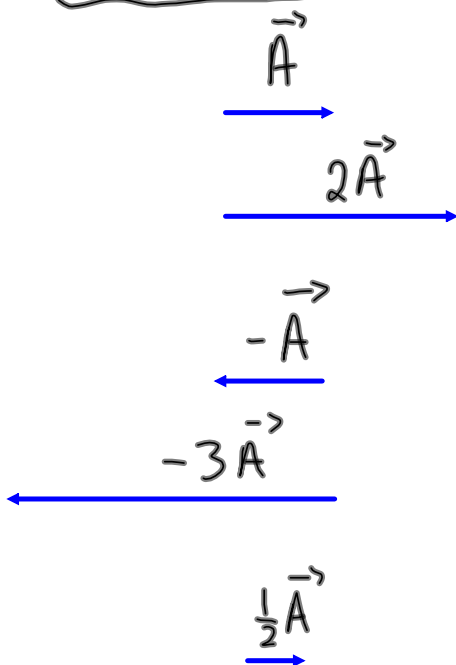
$$\vec{A} \neq \vec{C}$$

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



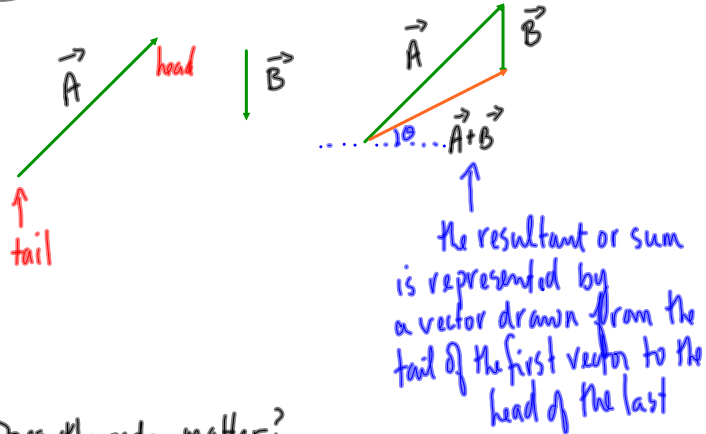
← these lines mean magnitude.

## Multiplication of a vector by a scalar:



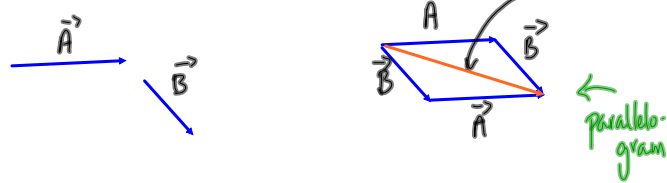
- Direction stays the same unless multiplying by a negative scalar
- The magnitude changes.

Addition of Vectors



Does the order matter?

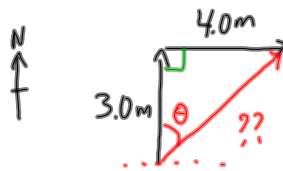
i.e. Is  $\vec{A} + \vec{B} = \vec{B} + \vec{A}$  ??



The order of vector addition does not matter

Example

Find the sum of two displacement vectors 3.0m north and 4.0m east.



$$c^2 = a^2 + b^2$$

$$c^2 = (3.0m)^2 + (4.0m)^2$$

$$c = 5.0m$$

↑ only the magnitude.

SOH CAH TOA

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

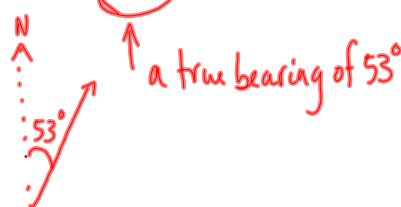
$$\tan \theta = \frac{4.0m}{3.0m}$$

The sum of the displacement vectors is 5.0m [N53°E]

$$\theta = \tan^{-1} \left( \frac{4.0m}{3.0m} \right)$$

$$\theta = 53^\circ$$

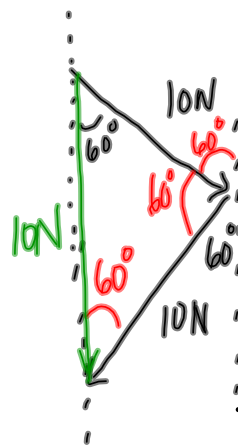
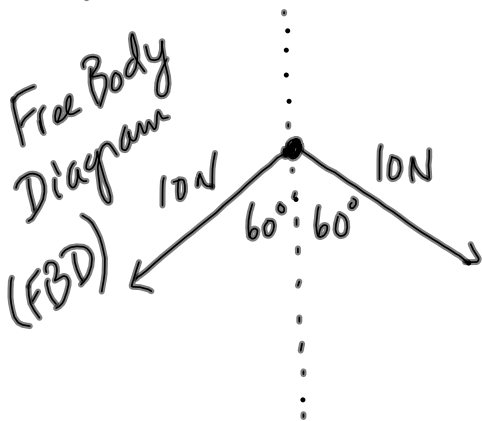
or 5.0m 53°T



Example

Two forces, each of magnitude 10N, act on a nail. One force is inclined downwards at  $60^\circ$  to the left of vertical and the other is inclined downwards at  $60^\circ$  to the right of vertical.

What is the resultant force on the nail?

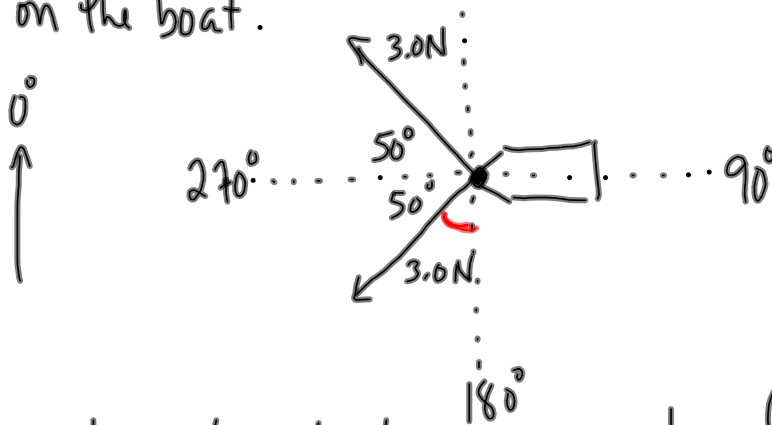


Vector Addition diagram

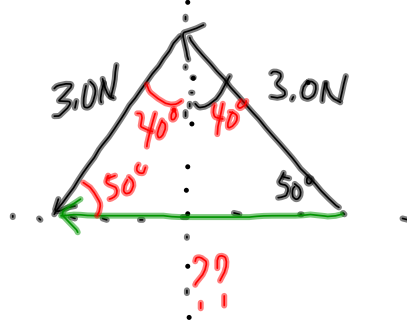
The resultant force acting on the nail is 10N [downwards]

Example

Two forces, each of magnitude 3.0N, act on the front of a toy boat. One of the forces acts in a direction of  $320^\circ\text{T}$  and the other in a direction of  $220^\circ\text{T}$ . Determine the total force acting on the boat.



Joining the vectors head-to-tail:



The resultant force is  
3.9N  $270^\circ\text{T}$

Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{3.0\text{N}}{\sin 50^\circ} = \frac{b}{\sin 80^\circ}$$

$$b = \frac{(3.0\text{N})\sin 80^\circ}{\sin 50^\circ}$$

$$b = 3.9\text{N}$$