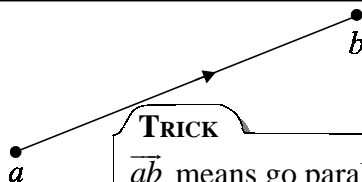


1. BASIC VECTORS

[A] DEFINITION OF A VECTOR

A vector is a line segment with size (length) and direction.

\vec{ab} is a line segment of length $|ab|$ directed from a to b .



TRICK

\vec{ab} means go parallel to $[ab]$ a distance $|\vec{ab}|$ in the direction a to b .

[B] EQUALITY

Vectors are equal if they have the same size and direction.

Example 1: If $abcd$ is a parallelogram write down 4 vectors which are equal.

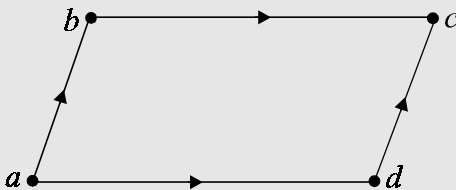
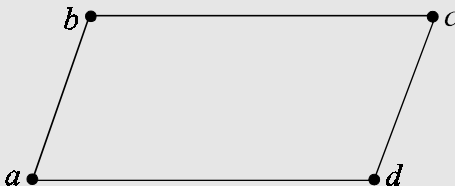
SOLUTION

$$\vec{ab} = \vec{dc}$$

$$\vec{bc} = \vec{ad}$$

$$\vec{ba} = \vec{cd}$$

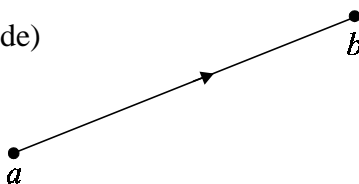
$$\vec{cb} = \vec{da}$$



[C] MODULUS (norm, size, magnitude)

$|\vec{ab}|$ = Length of a vector

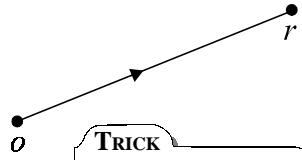
$|ab|$ = Length of line segment $[ab]$



[D] THE GHOST VECTOR

A vector must have 2 letters, e.g. \vec{ab} .
 If it only has one letter the other letter is o , the origin, and must be on the left of the given letter.

$$\therefore \vec{r} = \vec{or}$$

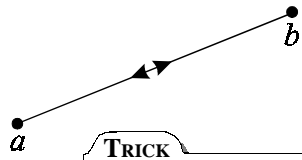


TRICK
 You can drop the o if it is on the left.

[E] NEGATIVE VECTOR

$-\vec{ab}$ = vector with the same length as \vec{ab} but in the opposite direction.

$$\therefore -\vec{ab} = \vec{ba}$$



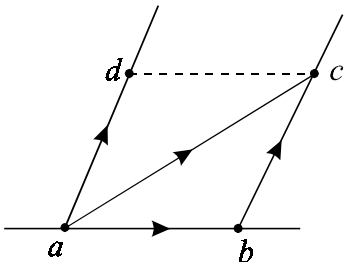
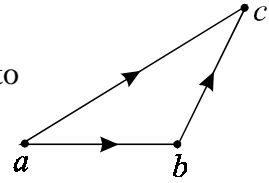
TRICK
 \ominus flips the order of the letters.

[F] ADDITION OF VECTORS (Triangle Law)

$$\vec{ab} + \vec{bc} = \vec{ac}$$

Going from a to b and then going from b to c is the same as going from a to c .

Roundabout (2 ways) = Direct (1 way)

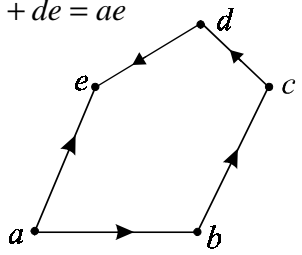


$$\vec{ab} + \vec{ad} = \vec{ab} + \vec{bc} = \vec{ac}$$

= Diagonal of parallelogram $abcd$.

More than 2 vectors are added by the polygon law.

$$\vec{ab} + \vec{bc} + \vec{cd} + \vec{de} = \vec{ae}$$



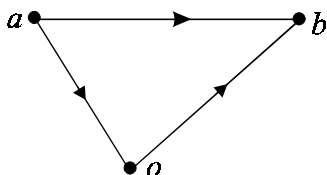
TRICK
Walkabout Trick (WT):
 Two vectors are added using the triangle law (guided by the sides of a parallelogram).

[G] THE NIFTY TRICK (NT)

$$\vec{ab} = \vec{b} - \vec{a}$$

Direct Roundabout

$$\begin{aligned} \vec{ab} &= \vec{ao} + \vec{ob} = -\vec{oa} + \vec{ob} \\ &= -\vec{a} + \vec{b} \Rightarrow \vec{ab} = \vec{b} - \vec{a} \end{aligned}$$



TRICK

You can write any single vector \vec{ab} in terms of 2 other vectors, \vec{a} and \vec{b} , from the origin.

$$\vec{ab} = \vec{b} - \vec{a}$$

Example 2: $oacb$ is a parallelogram.

Express \vec{c} in terms of \vec{a} and \vec{b} .

SOLUTION

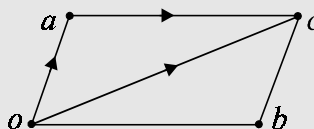
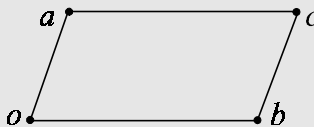
Use the Walkabout trick (WT)

$$\vec{c} = \vec{oc} = \vec{oa} + \vec{ac} \Rightarrow \vec{c} = \vec{a} + \vec{b}$$

OR

$$\vec{ac} = \vec{ob} \Rightarrow \vec{c} - \vec{a} = \vec{b} \quad (\text{NT})$$

$$\therefore \vec{c} = \vec{a} + \vec{b}$$



Example 3: $acbd$ is a parallelogram.

Express \vec{b} in terms of \vec{a} , \vec{c} and \vec{d} .

SOLUTION

$$\begin{aligned} \vec{cb} &= \vec{ad} \Rightarrow \vec{b} - \vec{c} = \vec{d} - \vec{a} \\ \Rightarrow \vec{b} &= \vec{c} + \vec{d} - \vec{a} \end{aligned}$$

