# VECTORS

## *Chapter 6 –Introduction to Vectors*

(*Material adapted from Chapter 6 of your text*)

A∞Ω
MATH@TD

# 6.1 An Introduction to Vectors

**Definition 6.1.1**

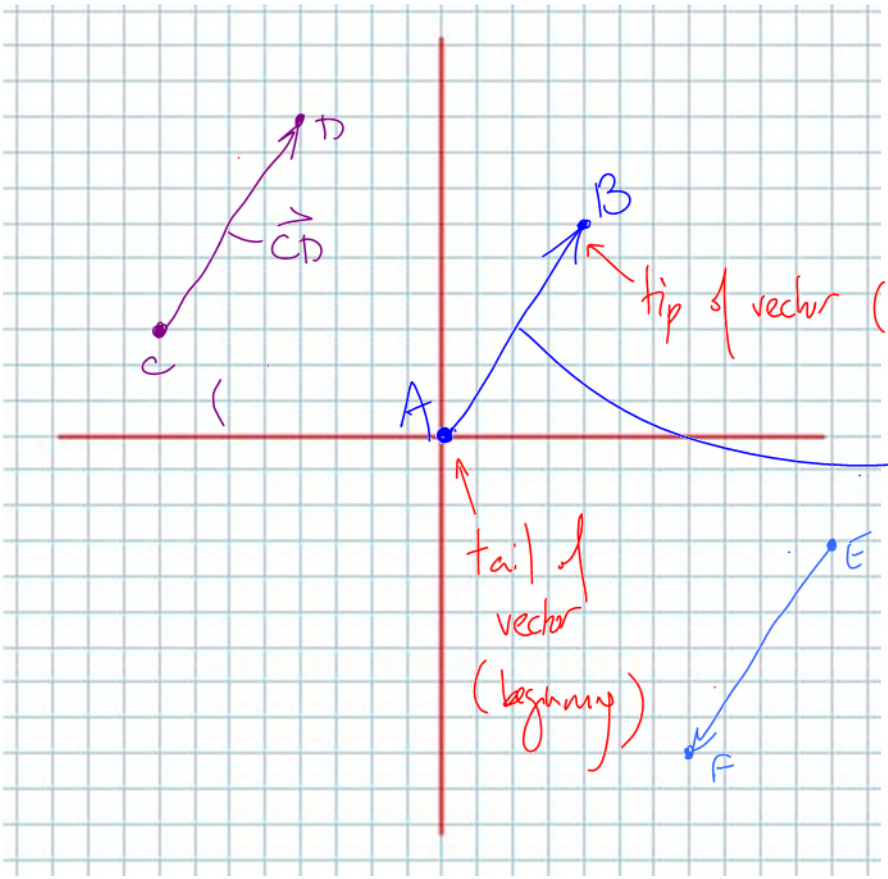
A **vector** is a **mathematical object** which carries **two characteristics:**

1) Magnitude (size or length)

2) Direction

Geometrically we can think of (or visualize) vectors as **directed line segments**

**Picture**



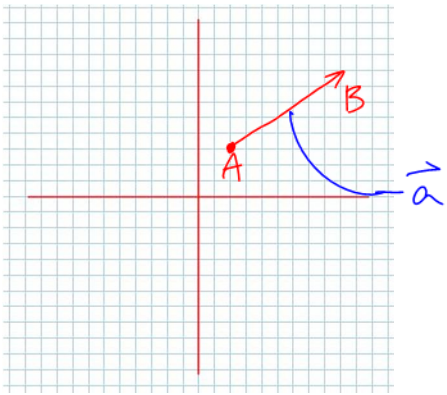

**Notes**:

$\vec{AB} = \vec{CD}$

$\vec{AB} \neq \vec{EF}$

(different directions)

## Some Basic Notations




1) In general we "write" vectors (or algebraically represent vectors):

a) With **capital letters** indicating the "**tip**" and "**tail**" **points** of the vector

$\overrightarrow{AB}$

b) With a single lower case letter

$\vec{a}$

2) We write the **Magnitude** of vectors with "absolute value bars"

(**KNOW YOUR CONTEXT**!)

e.g. The magnitude of $\vec{a}$ is given by

$|\vec{a}|$

The magnitude of $\overrightarrow{AB}$ is

$|\overrightarrow{AB}|$

Concerning Magnitude

a) **Magnitude** is just a **number**

b) The **magnitude** of any vector is ~~always positive~~ non-negative (since it represents the **length** of the vector).

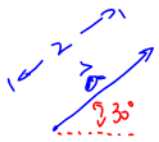
$|\vec{a}| \geq 0$

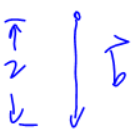
3) Two vectors $\vec{a}$ and $\vec{b}$ are said to be **equal** (or **equivalent**) if:

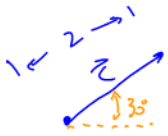
a) $|\vec{a}| = |\vec{b}|$

b) The same direction.

Pictures






$\vec{a} = \vec{c}$

$\vec{a} \neq \vec{b}$ even though $|\vec{a}| = |\vec{b}|$

numbers without direction.

4) A **scalar** is a (mathematical) quantity which can "scale" vectors (describing size)

Examples:

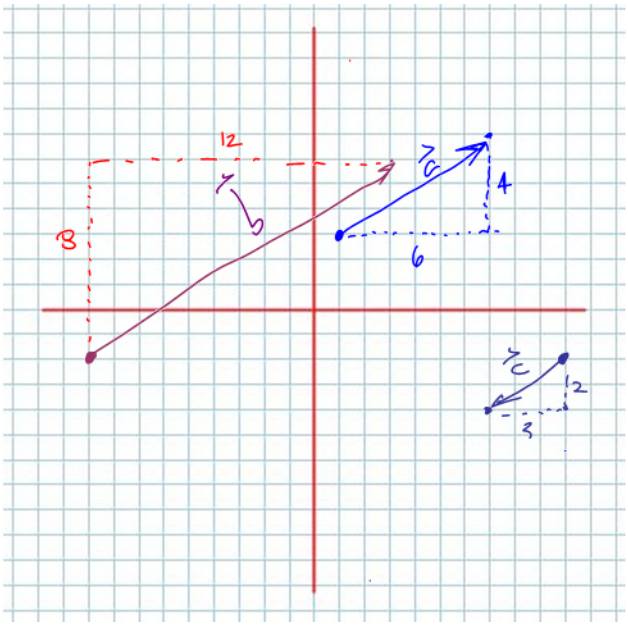
Magnitude is a scalar (length is a number!)

Speed is a scalar (eg 45 km/hr)

Velocity is a vector (eg 45 km/hr [E])
magnitude direction.

Scalars can "stretch" or "shrink" vectors (in terms of magnitude).
Scalars can be negative.

Picture:




$2\vec{a} = \vec{b}$

or

$\vec{a} = \frac{1}{2}\vec{b}$

negative scalars reverse direction

$-2\vec{c} = \vec{c}$

or

$-4\vec{c} = \vec{b}$

**Comment**

Let $|\vec{c}| = 3|\vec{a}|$

Then $\vec{c} = 3\vec{a}$ CANNOT BE CONCLUDED because we don't have info. about direction

Q. Can we write

$\vec{c} = 3|\vec{a}|$ NO : vectors cannot equal scalars!
vector scalar

5) If $\vec{a} = -\vec{b}$, then we have that

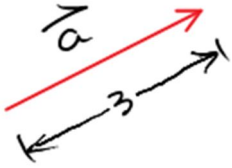
a) $\vec{a}$ and $\vec{b}$ are pointing in opposite directions, but

b) $|\vec{a}| = |\vec{b}|$

We sometimes call $\vec{a}$ and $\vec{b}$ opposite vectors

**Example 6.1.1**

Given the vector

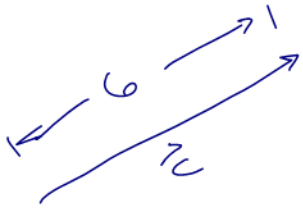



Draw a) $\vec{b}$ so that $|\vec{b}| = |\vec{a}|$ but $\vec{b} \neq \vec{a}$

b) $\vec{c}$ so that $\vec{c} = 2\vec{a}$

a)

b)

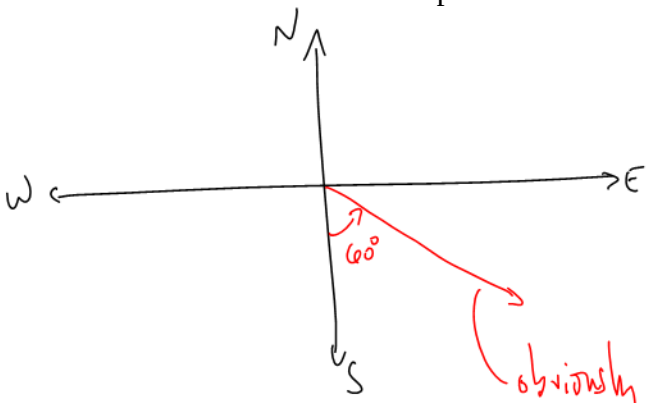



(same direction as $\vec{c}$)

**Example 6.1.2**

Using a scale of $1cm = 5km/hr$ draw a vector which represents

$25km/hr\ [S60^\circ E]$




(obviously this is 5 cm long)

*Class/Homework for Section 6.1*

*Pg. 279 – 281 #1, 2, 4 – 10*