- Caveat: I believe that, logically, the topics in chapter 3 should precede that in chapter 2. Thus I will not cover them in the same order as the text, but rather, will start with chapter 3!

- A "typical" day for an airline pilot:

⇒ Temperature (درجة الحرارة): 42°C. (or 107°F).

⇒ On the highway ⇒ Speed (السرعة): 70 Km/h.
The pilot speeds up ⟶ Speed limit: 100 Km/h.

⇒ On the runway, the pilot is ready to take off ⇒ Velocity of the wind (السرعة):
Velocity = 20 mile/h East.

- Thermometer = مقياس حرارة : Magnitude (مقدار)
- Speedometer = عداد السرعة : Magnitude.
- Many quantities in physics, like speed and temperature, have a magnitude only.
Such quantities are called Scalars (كميات قياسية)

⇒ Other scalars: mass (كتلة), time (زمن) ...etc

☒ Other quantities in physics, like velocity, have a magnitude and a direction. Such quantities are called Vectors (كميات متجهة).

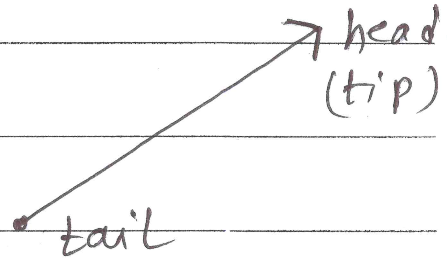
⇒ Other vectors: Force (قوة), Torque (عزم) ..etc.

☒ Vector Analysis: (sections 3.1, 3.2, 3.3, 3.4):

⇒ Take a vector A ≡ **A** boldface type or $\vec{A}$

Take a scalar A ≡ *italics*.

$\vec{A}$ is represented by an arrow:



- magnitude of $\vec{A} = |\vec{A}|$ equals the length of the arrow from the tail to the head.
- direction of $\vec{A}$ is the direction labeled by the arrowhead.
- magnitude ⇒ ruler • direction ⇒ protractor

☒ Algebraic sum Vs Vector sum

$V_1 \pm V_2$ Vs $\vec{V_1} \pm \vec{V_2}$

speed velocity

- Recall: Newton's 2nd law: $\sum \vec{F}$ = resultant forces
  net "
  total "

Two methods of vector addition (subtraction):

Let's start with the graphical approach: Recipe:

i) draw the 1st vector $\vec{A}_1$

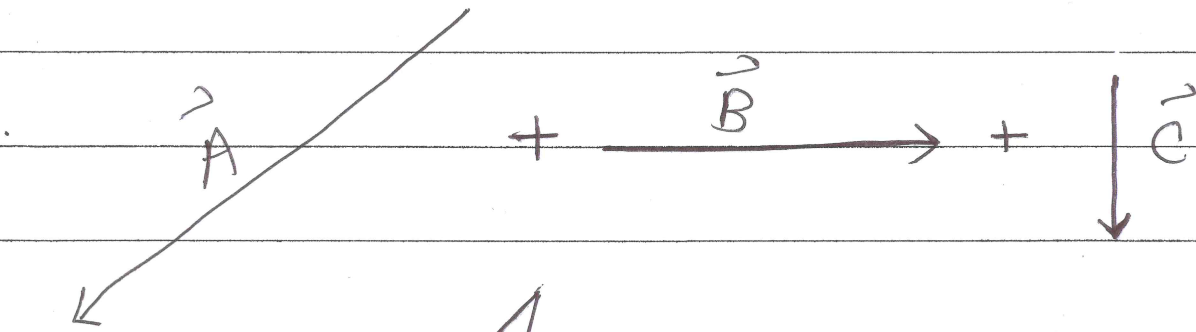
ii) Starting at the head of $\vec{A}_1$, draw the 2nd vector $\vec{A}_2$,

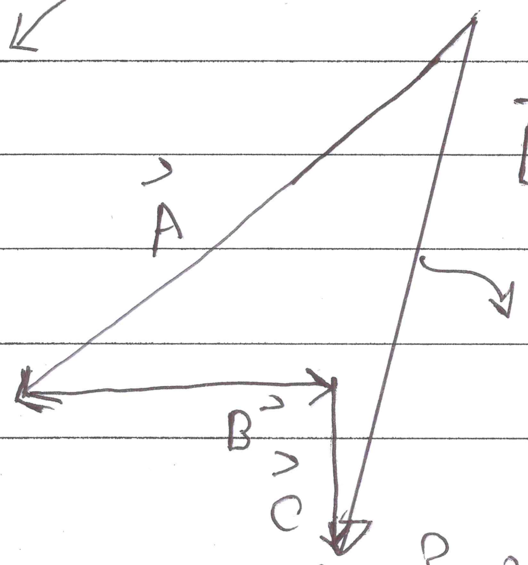
iii) Continue to draw other vectors (tail-to-head).

iv) The vector sum is represented by the arrow drawn from the first tail to the last head:

The sum is represented by the closing side of the polygon.

example: Take the 3 vectors:





$\vec{D}$ = resultant "net, total" vector sum

this is the closing side of the polygon!

- Quiz: $\vec{A} + \vec{B} \stackrel{?}{=} \vec{B} + \vec{A}$

addition is commutative ✓

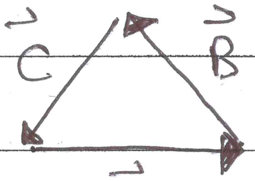
- Quiz: If $\vec{A}$ points to east and has a mag. of 3 units. What is the vector $\vec{B} = -\vec{A}$?
- Recall: mass (m) is a scalar ≡ +ve number (kg).
  : Force ($\vec{F}$) is a vector = mag. (N) & direction.

Newton's 2nd law ⇒ $\dfrac{\vec{F}}{m} = ?$

⇒ The vector can be multiplied (or divided) by a scalar. The result is another vector with the same direction! $\vec{a}$ = acceleration (التسارع)

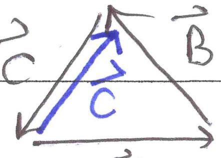
∴ As long as m is +ve (might be −ve @ JU!!) then the direction of $\vec{a}$ is in the direction of $\vec{F}$.

- Past Exam: The 3 given vectors are all of equal length. Which statement is true?



(i) $\vec{A}+\vec{B} = \vec{A}-\vec{C}$
(ii) $\vec{A}+\vec{B} = \vec{B}-\vec{C}$
(iii) $\vec{A}-\vec{B} = 2\vec{A}-\vec{C}$
(iv) $\vec{A}-\vec{B} = 2\vec{A}+\vec{C}$
(v) $2\vec{A}+2\vec{B} = 2\vec{C}$

Answer: Right off: $\vec{C}$ is NOT the closing side of the polygon.
$\vec{C}$ is the closing side



∴ $\vec{A}+\vec{B} = \vec{C} = -\vec{C}$

choice (iv) $\vec{A}-\vec{B} = 2\vec{A}+\vec{C}$

$2\vec{A}-\vec{A}+\vec{B}+\vec{C} = 0$

$\vec{A}+\vec{B}+\vec{C} = 0$

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

Hmm.... welcome to PHY 105!