3-1 Vectors and Scalars:

As we mentioned in Chapter 2 that Velocity has a magnitude as well as direction, any quantity such as Velocity is a **vector.**

eg: Displacement, Acceleration
Force and weight ...

Quantities with no direction are called **Scalar.**

eg: Distance, speed, mass, temperature and pressure ...

We represent each Vector by an arrow, to point in the direction. The length of the arrow represents the vector's magnitude.

How do we write the symbol for a vector?

[a] We use boldface type. (especially in books)

[b] or by drawing a tiny arrow over it.

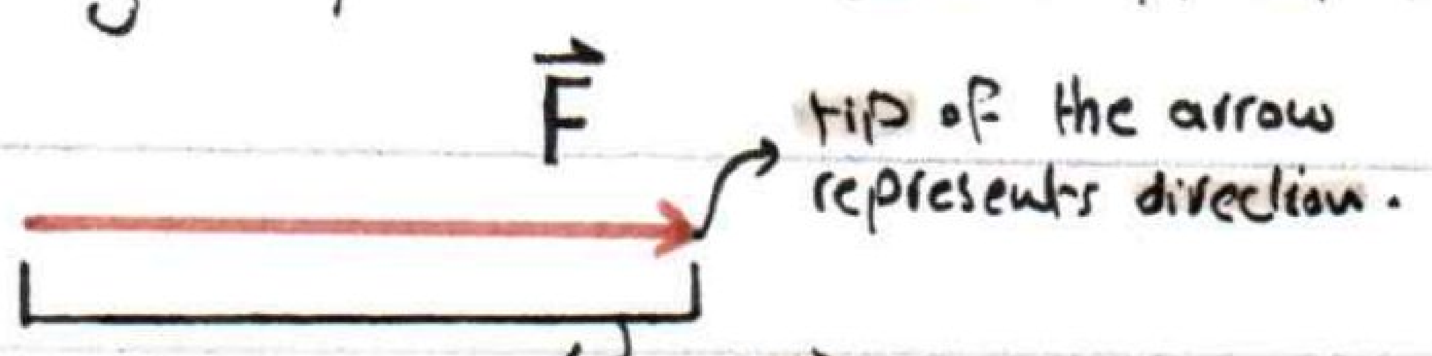
If we are only interested in the magnitude :-

[a] we write v in italics. (especially in books)

[b] or $\Rightarrow$ $|\vec{v}|$

Example (1)

A Force of magnitude 20 N acts on an obj along the positive x-direction. Represent it.



$|\vec{F}| = 20\ N$

3-2 Addition of Vectors - Graphical Methods:

We can use simple arithmetic for adding vectors but we must take both magnitude and direction into account, but it cannot be used if the vectors are not along the same line. However, these steps can help us to imagine the situation :-

[1] Draw the first vector.

[2] place the tail of the second vector on the tip of the first vector.

[3] The resultant vector starts from the tail of the first vector and ends on the tip of the second vector.

(This method is called the triangular method because the three vectors form a triangle.)

or (tail-to-tip method of adding vectors.)

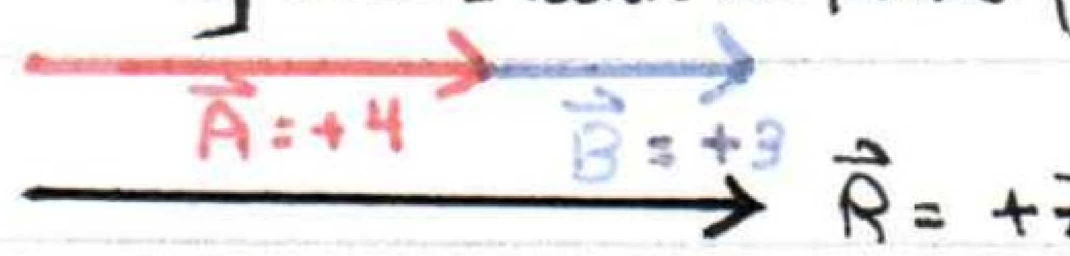
* (see the next page for examples) *

***Note** :- The resultant is not affected by the order in which the vectors are added.

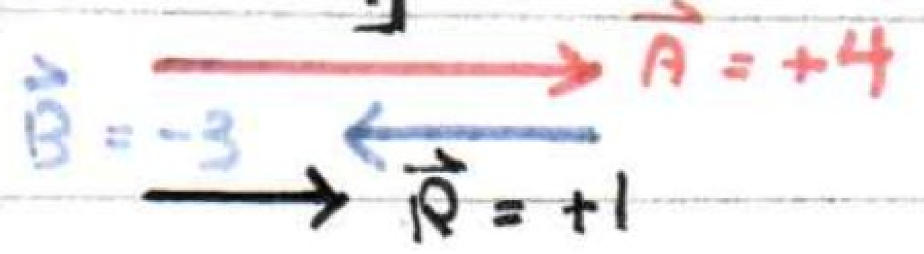
(mathematically is called the Commutative property of vector addition). applies in 2 or more vectors.

$$[\vec{A} + \vec{B} = \vec{B} + \vec{A}]$$

* $[R_{max} = A + B]$ when 2 vectors are parallel ($\theta = 0$)



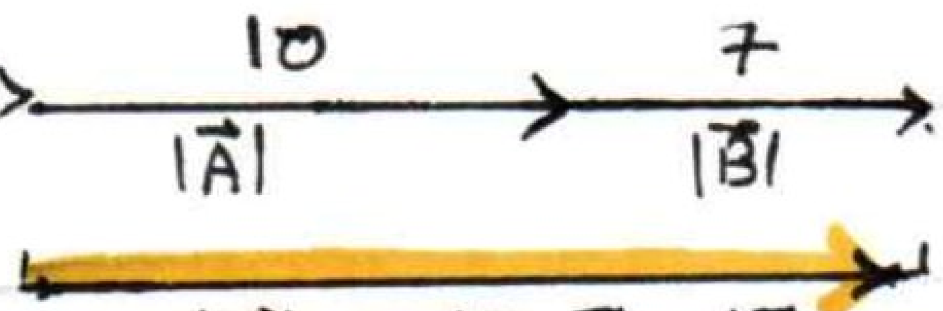
* $[R_{min} = |A - B|]$ when 2 vectors are antiparallel ($\theta = 180°$)



Example (1) (tail to tip method)

If $|\vec{A}| = 10$, $|\vec{B}| = 7$, Find $|\vec{R}|$ in:-

1) $|\vec{R}_{max}| \Rightarrow$

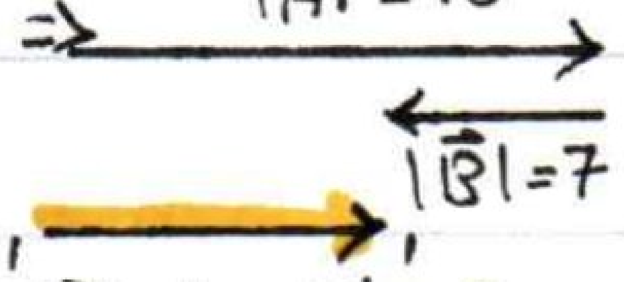


$\theta = 0$

$|\vec{R}| = 10 + 7 = 17$

Both in the same direction. *

2) $|\vec{R}_{min}| \Rightarrow$



$\theta = 180°$

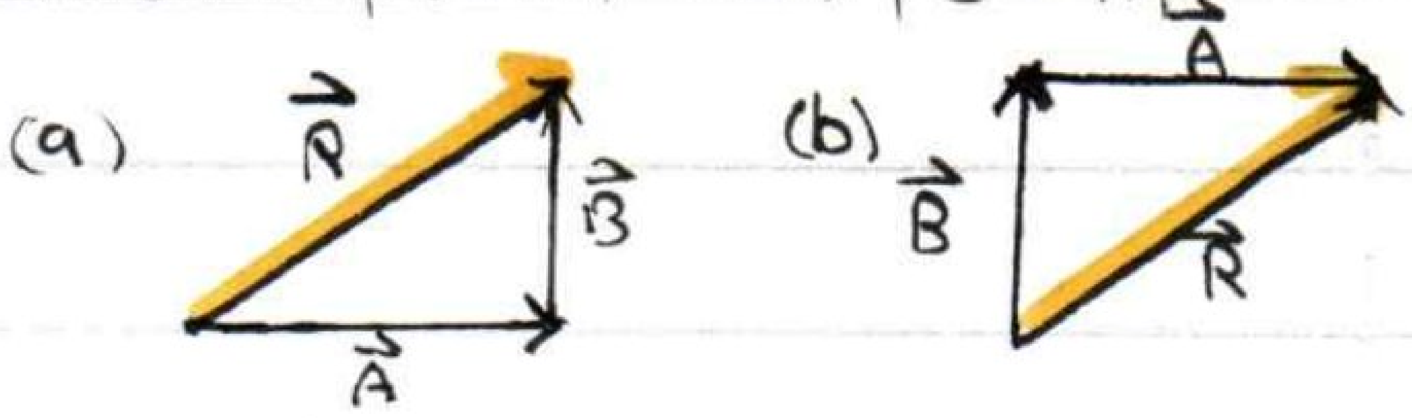
$|\vec{R}| = |10 - 7| = 3$

opposite directions. *

Example (2) (the triangular method) (the commutative law)

If $\vec{A} = 4m, x^+$, $\vec{B} = 3m, y^+$

Find: (a) $|\vec{A} + \vec{B}|$ (b) $|\vec{B} + \vec{A}|$



$|\vec{R}| = \sqrt{A^2 + B^2} = 5\,m$

Example (3)

If $|\vec{A}| = 6$, $|\vec{B}| = 20$, then find the magnitude of the resultant (which one is a possible value to $|\vec{R}|$)?

(a) 3 (c) 17

(b) 28 (d) 30

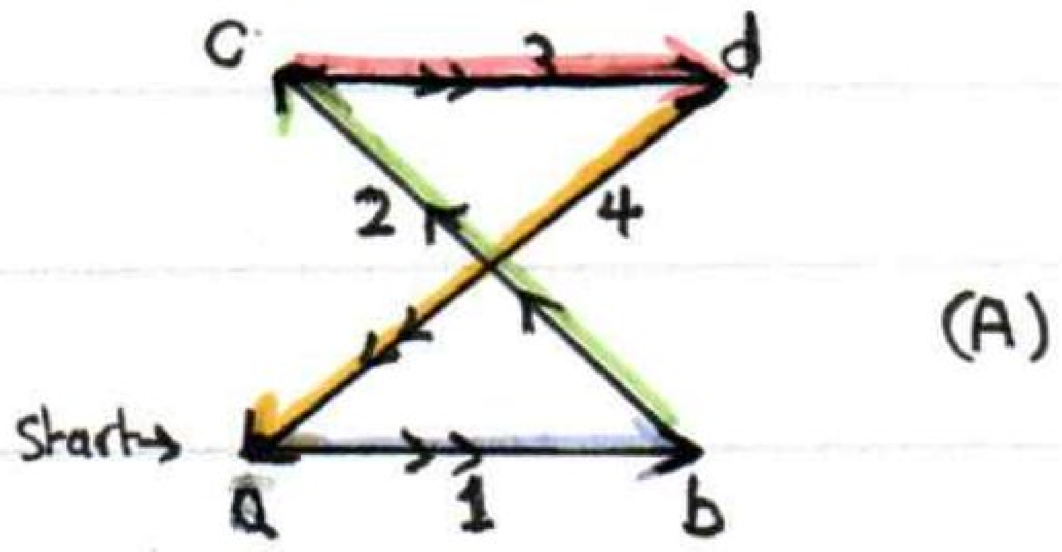
Sol. (C) $|A - B| \leq R \leq A + B$ ***

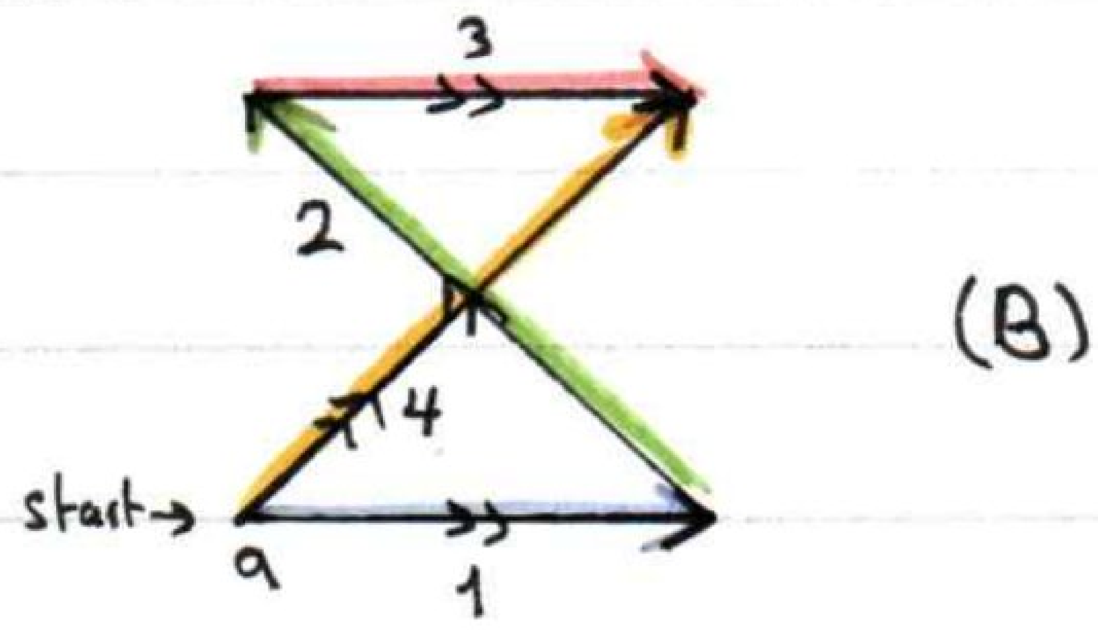
$14 \leq R \leq 26$

Example (4)

Which one of (A, B) represents a zero vector?

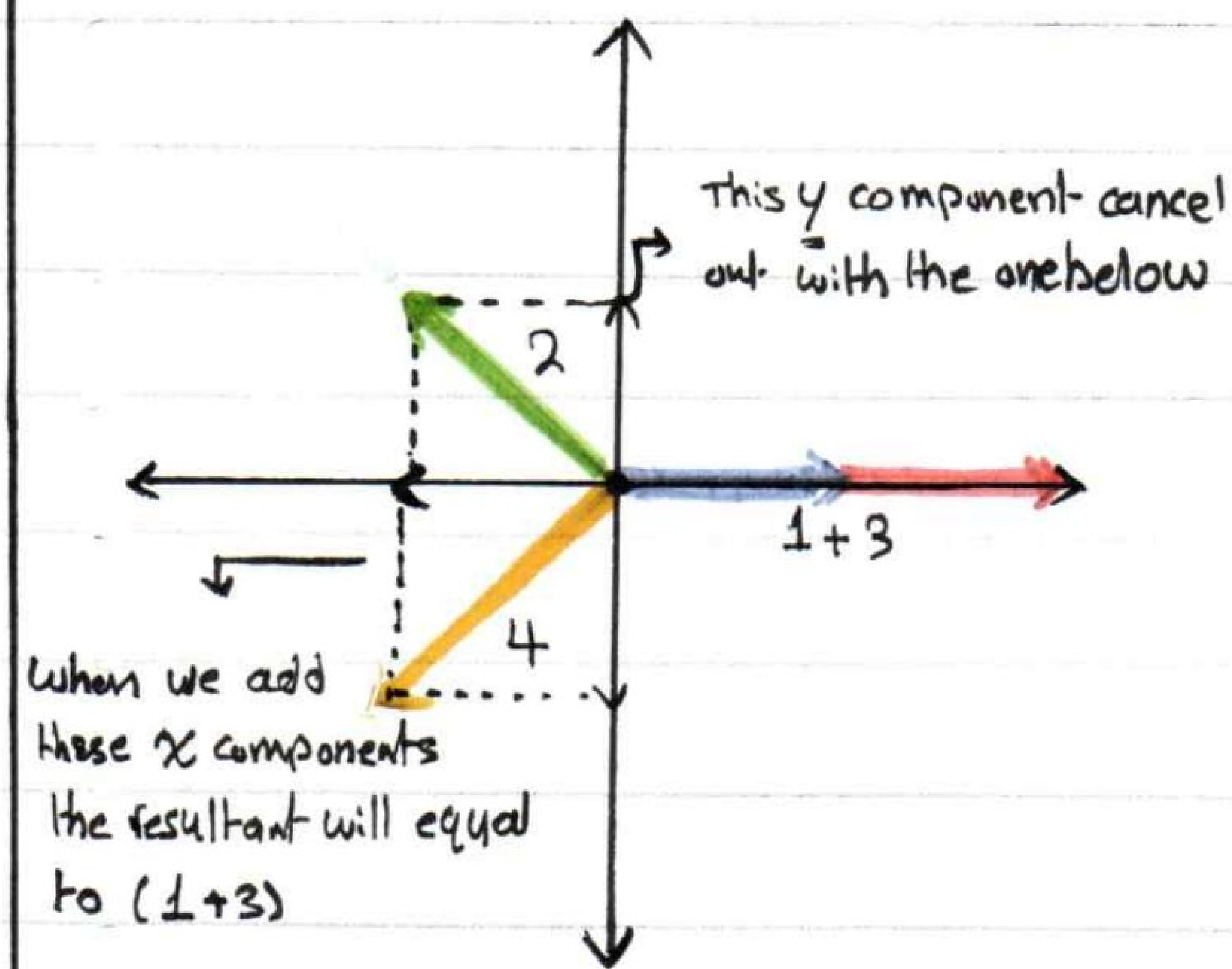
*** Note:- Distances are NOT to scale.





Sol. (A), because the starting point is the finishing point itself.

By drawing Vector Diagrams, we can express each vector by components, (chapter 3-4) will discus it in details, which explain how:-



$|\vec{R}| = 0$