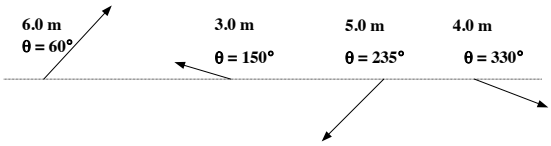
Vectors

Vectors

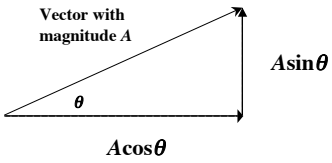
A *vector* quantity has both a magnitude (length) and a direction (angle).

- **A vector can be graphically represented by using an arrow whose length is proportional to the vector's magnitude.**
- **It is conventional to represent a vector's direction by the angle it forms with the positive *x*-axis. This angle is measured counterclockwise.**



Vector Components

The *components* of a vector can be found from the vector's magnitude and direction using trigonometry.

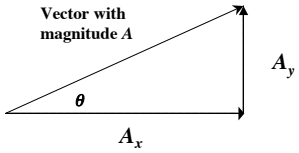


$$x\text{-component} = A_x = A\cos\theta$$

$$y\text{-component} = A_y = A\sin\theta$$

Vector Components

The magnitude and direction of a vector can also be determined from its components.

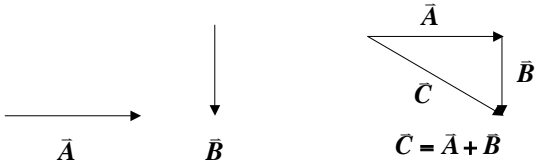


$$A = \sqrt{A_x^2 + A_y^2}$$

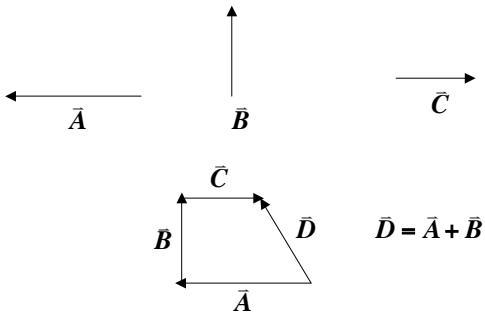
$$\theta = \tan^{-1}\frac{A_y}{A_x}$$

Vector Addition (Graphically)

1.) **Vectors can be added graphically by placing the *tail* of one vector at the *head* of another vector.**
2.) **A third vector is then drawn *connecting the tail* of the first vector *to the head* of the second vector.**
3.) **This third vector represents the sum of the two vectors and is called the *resultant* of the two vectors.**

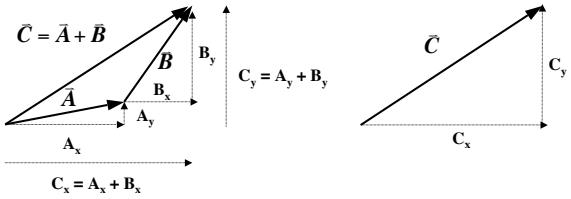


Vector Addition (Graphically)

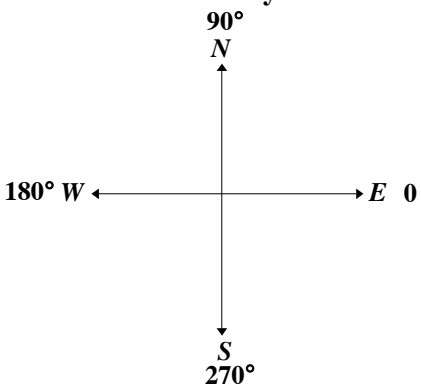


Vector Addition (Addition of Components)

Vectors can be added by adding their *x* components to get the *x* component of the resultant and then adding their *y* components to get the *y* component of the resultant.



Coordinate System

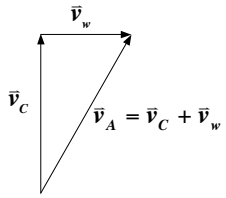


Applications

1.) Crossing rivers.

2.) Flying with wind.

Crossing a River

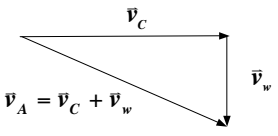


$\vec{v}_w$ = water velocity

$\vec{v}_C$ = course velocity

$\vec{v}_A$ = actual velocity

Flying in the Wind



$\vec{v}_w$ = wind velocity

$\vec{v}_C$ = course velocity

$\vec{v}_A$ = actual velocity