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Mathematics (II)

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Vector

1.1 Definitions

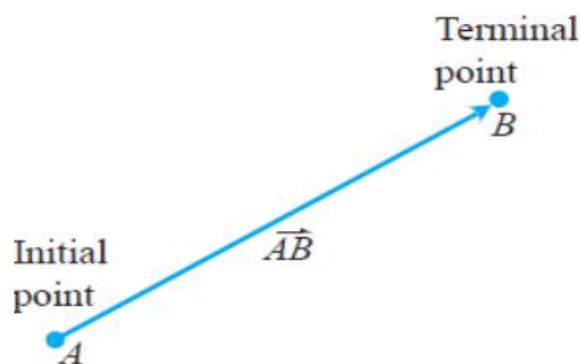
A quantity having direction as well as magnitude, especially as determining the position of one point in space relative to another

Application of vector:

1. Antenna
2. Circuit analyzes
3. Communication field
4. Fiber optical
5. Microwave
6. Motor ect

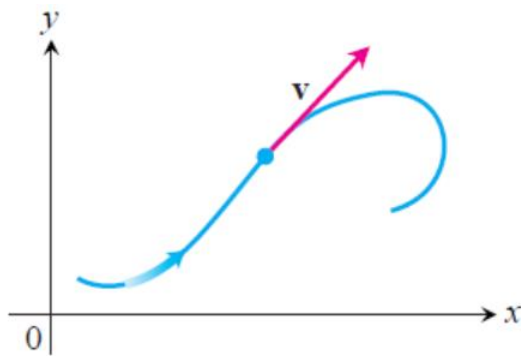
1.2 Component Form

A quantity such as force, displacement, or velocity is called a vector and is represented by a directed line segment. **The arrow points in the direction of the action and its length gives the magnitude** of the action in terms of a suitably chosen unit. A vector in the plane is a directed line segment. The directed line segment has initial point A and terminal point B; its length is denoted by $|\overline{AB}|$. Two vectors are equal if they have the same length and direction.

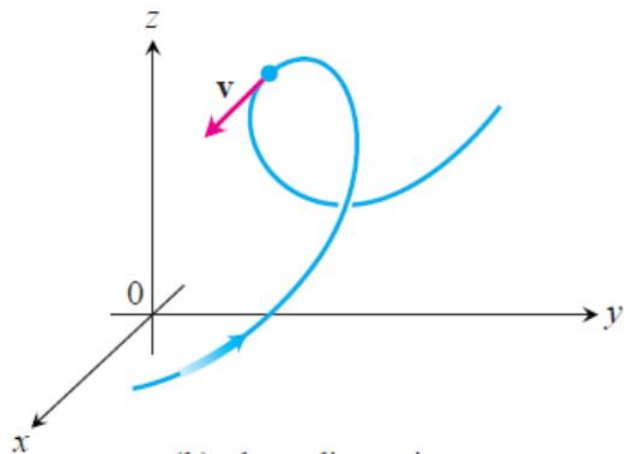


The vector classify two types:

1. Two-Dimensional vector in the plane equal to the vector with initial point at the origin and terminal point then the component form of $\mathbf{v}$ is $\mathbf{V} = V_1, V_2$.
2. Three-Dimensional vector equal to the vector with initial point at the origin and terminal point then the component form of $\mathbf{v}$ is $\mathbf{V} = V_1, V_2, V_3$

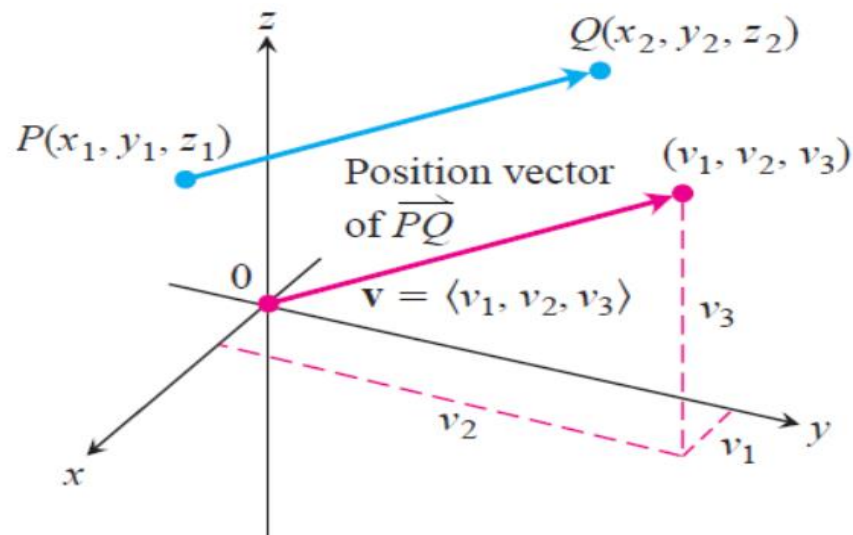


(a) two dimensions



(b) three dimensions

Observe that $\mathbf{V} = (v_1, v_2, v_3)$ is represented by the directed line segment $\overrightarrow{PQ}$ where the initial point $P = (x_1, y_1, z_1)$ is and the terminal point $Q = (x_2, y_2, z_2)$



$\overrightarrow{PQ}$:is a 3D vector for analysis this vector to three components (v_1 , v_2 , v_3) a standard position vector for $\overrightarrow{PQ}$ is

$$\mathbf{V}=(x_2-x_1, y_2-y_1, z_2-z_1)$$

The magnitude or length of the vector $\overrightarrow{PQ}$ is the length of any of its equivalent directed line segment representations. In particular, $\mathbf{v} = (x_2 - x_1, y_2 - y_1, z_2 - z_1)$. the distance formula gives the magnitude or length of $\mathbf{v}$, denoted by the symbol $|\mathbf{v}|$, $\|\mathbf{v}\|$.

The **magnitude** or **length** of the vector $\overrightarrow{PQ}$ is the nonnegative number

$$|\mathbf{v}|=\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

Example: initial point is P (-3, 4, 1) and terminal point is Q (-5, 2, 2)
Find the (a) component form or position and (b) length or magnitude.

Sol:

a- $\mathbf{V}=(x_2-x_1, y_2-y_1, z_2-z_1)$

$$v_1=x_2-x_1 \qquad v_2= y_2-y_1 \qquad v_3=z_2-z_1$$

$$v_1 = -2 \qquad v_2= -2 \qquad v_3=1$$

b-

$$|\mathbf{v}|=\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

$$|\mathbf{v}|=\sqrt{(-2)^2 + (-2)^2 + (1)^2}$$

$$|\mathbf{v}|=3$$

H.W1

$$P_1(1, 1, 1), \quad P_2(3, 3, 0)$$

$$P_1(-1, 1, 5), \quad P_2(2, 5, 0)$$

$$P_1(1, 4, 5), \quad P_2(4, -2, 7)$$

$$P_1(3, 4, 5), \quad P_2(2, 3, 4)$$

$$P_1(0, 0, 0), \quad P_2(2, -2, -2)$$

$$P_1(5, 3, -2), \quad P_2(0, 0, 0)$$