Some physical quantities that have both magnitude and direction are velocity, acceleration and force. For example, "a velocity of $30 \mathrm{~km} / \mathrm{h}$ due South" specifies both magnitude (i.e. $30 \mathrm{~km} / \mathrm{h}$ ) and direction (i.e. due South). Another example is "a force of 90 N acting upwards". Try to identify the magnitude and direction in this vector.

## B. Vector Representation and Notations

Since a vector has both magnitude and direction, it can be represented by a directed line segment. The direction of the line segment, indicated by an arrow, represents the direction of the vector, and the length of the line segment represents the magnitude of the vector.


The diagram shows a vector with an initial point $P$ and a terminal point $Q$. It is usually denoted by $\overrightarrow{P Q}$ or a bold letter, say $\mathbf{a}$. The magnitude of the vector is denoted by $|\overrightarrow{P Q}|$ or $|\mathbf{a}|$. Similarly, another vector as shown in the diagram is denoted by $\overrightarrow{R S}$ or $\mathbf{b}$, and its magnitude is $|\overrightarrow{R S}|$ or $|\mathbf{b}|$. When we write, we may denote these two vectors by $\vec{a}$ and $\vec{b}$, or $\underset{\sim}{a}$ and $\underset{\sim}{b}$ respectively.

## C. Equal Vectors



Two vectors are equal if they have equal magnitude and are in the same direction. In the diagram, $A B C D$ is a parallelogram. Since length of $A B=$ length of $D C$ (i.e. $|\overrightarrow{A B}|=|\overrightarrow{D C}|$ ), and $\overrightarrow{A B}$ and $\overrightarrow{D C}$ are in the same direction (i.e. $\overrightarrow{A B} / / \overrightarrow{D C}$ ), we have $\overrightarrow{A B}=\overrightarrow{D C}$. Similarly, $\overrightarrow{A D}=\overrightarrow{B C}$. On the other hand, $P Q R S$ is a trapezium with length of $P S=$ length of $Q R$ and $P Q / / S R$, but $\overrightarrow{P Q} \neq \overrightarrow{S R}$ and $\overrightarrow{P S} \neq \overrightarrow{Q R}$. Why?

The vector $\overrightarrow{Q P}$ is different from the vector $\overrightarrow{P Q}$.
$\overrightarrow{Q P}$ represents a vector with initial point $Q$ and terminal point $P$. Therefore, $\overrightarrow{P Q}$ and $\overrightarrow{Q P}$ are in different directions.

## Remark

The direction of a vector is also indicated by the arrow, as seen in the diagram. Thus, the two vectors in the diagram are named $\overrightarrow{P Q}$ and $\overrightarrow{R S}$.

## Remark

