Introduction to Vectors

Is it possible to swim straight across a river? The answer is "yes" only if there is no current. The truth of the matter is that most rivers have a current. So as a result, you really swim the displacement, which means that you swim a certain distance across the river in a direction that is affected by the current. You can see that the diagrams below demonstrate this idea.

No Current With a Current

Definitions

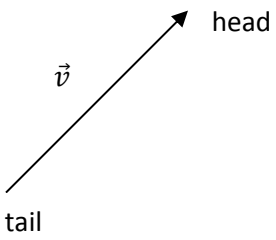
Scalar – is a quantity or measurement that has only magnitude and can be expressed using a single numerical value

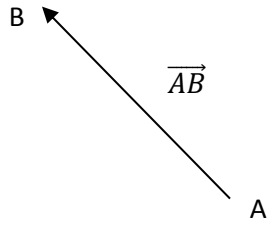
eg. time, temperature, volume, age, height, etc.

Vector – is a quantity that has both direction and magnitude

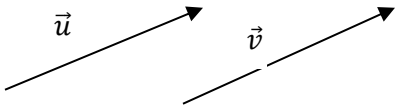
eg. Displacement (moving from A to B), force (such as gravity, which has magnitude and acts downward), velocity, magnetic fields

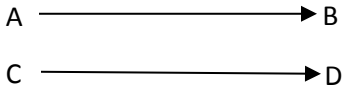
A **vector,** $\vec{v}$, can be represented as a directed line segment with an arrowhead that indicates the direction. The **magnitude** of the vector, $|\vec{v}|$, is represented by the length of the directed line segment. The **tail** of the vector defines the origin of the vector and the **head** defines the tip with an arrowhead. Sometimes a vector can be represented as $\overrightarrow{AB}$ and its magnitude is given by $\left|\overrightarrow{AB}\right|$.



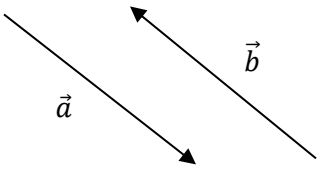


Equivalent vectors, or **equal vectors**, have the same magnitude and direction, but may have different positions.





Opposite vectors have the same magnitude but are opposite in direction.

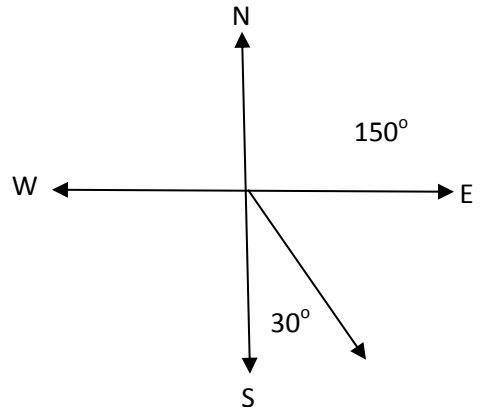


$$\vec{a} = -\vec{b} \ \ and \ \ \vec{b} = -\vec{a}$$

The **direction** of a vector can be expressed in 2 ways as either a:

1. **True bearing** (sometimes called bearing or compass form) – an angle measured clockwise from north and expressed as a three digit number

2. **Quadrant bearing** – is an angle between 0^o and 90^o measured east or west of the north-south line



The same vector can be expressed as being 150^o or S30°E.

Example Express as a true bearing.

a. N50°E

b. S10°W

Example You are crossing a 12 m river in a rowboat. When you reach the other side, you discover that the current caused you to reach a point which was 5 m away from where you should have landed. Calculate the magnitude of the displacement vector.