L1 – Introduction to Vectors Unit 4
MCV4U
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Part 1: What is a Vector?

A **SCALAR** quantity describes magnitude or size only. It does NOT include a direction.

Examples: temperature (-5°C), distance (5 km), speed (100 km/h), mass (10 kg)

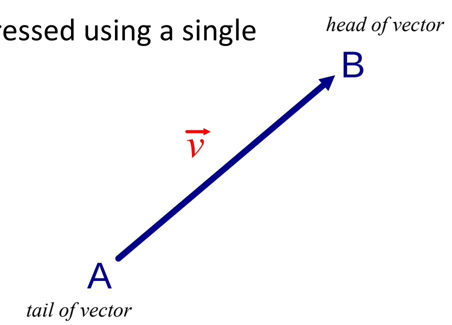
A **VECTOR** is a mathematical quantity having both MAGNITUDE and DIRECTION

Examples: velocity (80 km/h west), force (10 N downward)

Vectors are represented with directed line segments. A directed line segment has a **length**, called its magnitude, and a **direction** indicated by an arrowhead.

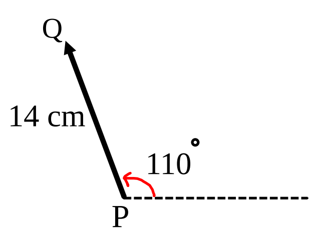
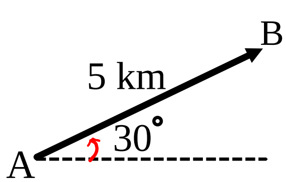
Vector $\overrightarrow{AB}$ has a starting point at A and ends at point B. It could also be expressed using a single letter $\vec{v}$

The magnitude, or size, of a vector is designated using absolute value brackets. The magnitude of vector $\overrightarrow{AB}$ or $\vec{v}$ is written as $|\overrightarrow{AB}|$ or $|\vec{v}|$. Magnitude is always a non-negative value.

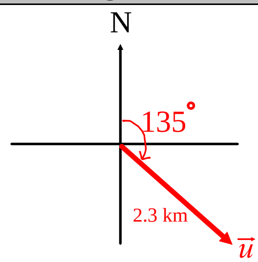
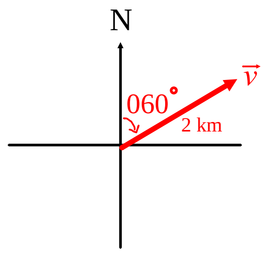


A vectors direction can be expressed in several different ways:

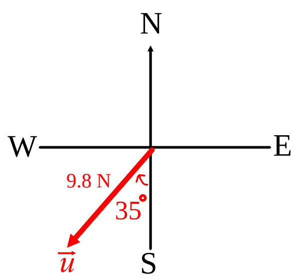
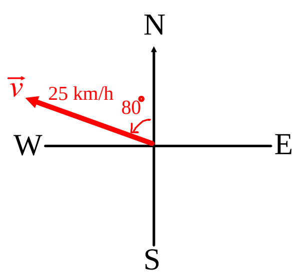
i) As an angle moving counter-clockwise with respect to a horizontal line

Diagram	Description of Direction
	14 cm at 110° to the horizontal
	5 km at 30° to the horizontal

ii) A True Bearing is a compass measurement where the angle is measured from North in a clockwise direction.

Diagram	Description of Direction
	2.3 km at a true bearing of 135°
	2 km at a true bearing of 060°

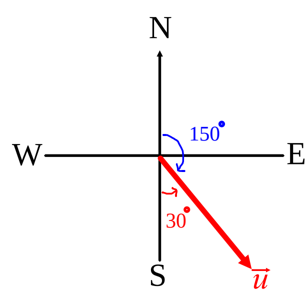
iii) A Quadrant Bearing is a measurement between 0° and 90° east or west of the north-south line.

Diagram	Description of Direction
	9.8 N at a quadrant bearing of S35°W
	25 km/h at a quadrant bearing of N80°W

Example 1: Convert the following

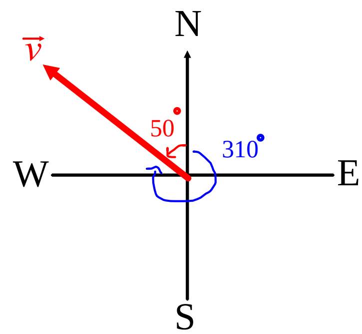
a) Write the true bearing 150° as a quadrant bearing.

$S30°E$



b) Write the quadrant bearing N50°W as a true bearing.

True bearing of 310°



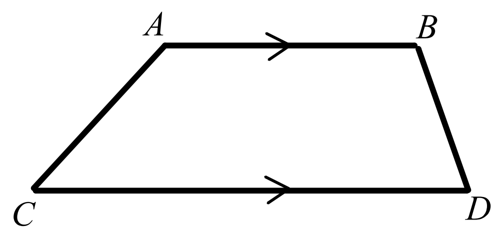
Part 2: Equivalent and Opposite Vectors

Parallel Vectors: Vectors that have the same OR opposite direction, but not necessarily the same magnitude.

$\overrightarrow{AB} \parallel \overrightarrow{DC}$

And

$\overrightarrow{AB} \parallel \overrightarrow{CD}$



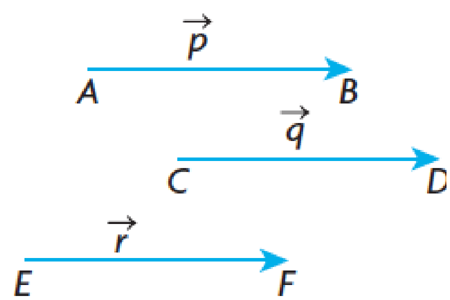
Equivalent Vectors: Vectors that have the same magnitude AND direction. The location of the vectors does NOT matter.

Notice that any of these vectors could be translated to be coincident with either of the other two.

$\vec{p} = \vec{q} = \vec{r}$

Or

$\overrightarrow{AB} = \overrightarrow{CD} = \overrightarrow{EF}$

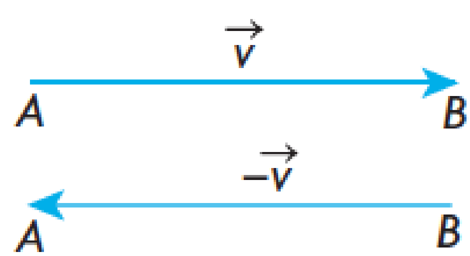


Opposite Vectors: Vectors that have the same magnitude but point in opposite directions.

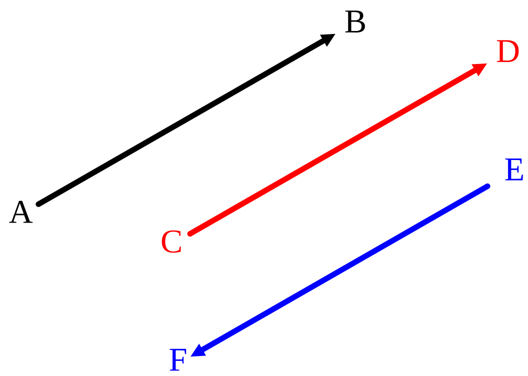
Notice that $|\overrightarrow{AB}| = |\overrightarrow{BA}|$ but they point in opposite directions. Therefore $\overrightarrow{AB} \neq \overrightarrow{BA}$.

You can write an expression for an opposite vector by placing a negative sign in front of it or by reversing the order of the letters. The opposite of $\overrightarrow{AB}$ can be written as $-\overrightarrow{AB}$ or $\overrightarrow{BA}$

An equivalent expression between the two vectors shown could be $\overrightarrow{AB} = -\overrightarrow{BA}$



Example 2: Given $\overrightarrow{AB}$, draw an equivalent vector $\overrightarrow{CD}$ and an opposite vector $\overrightarrow{EF}$. Write equations to show the relationship between the vectors.



$\overrightarrow{AB} = \overrightarrow{CD}$

$\overrightarrow{AB} = -\overrightarrow{EF}$