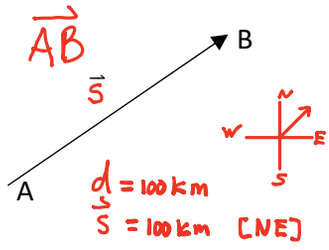
INTRODUCTION TO VECTORS

Scalar	vs	Vector
A quantity that has only **magnitude**.		A quantity that has both **magnitude** AND **direction**.
area	area	velocity
age	age	weight
speed	velocity [D]	force
mass	mass	displacement
temperature	weight [D]	acceleration
	speed	
	temperature	

Categorize each of the above quantities as either a vector or scalar.

CHARACTERISTICS OF VECTORS

A vector can be represented by a directed line segment:

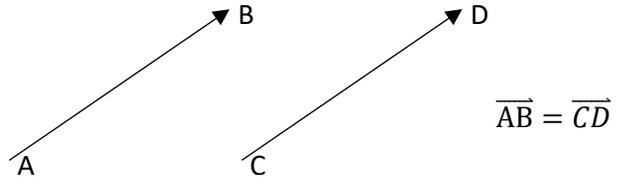


- A vector can be represented by a directed line segment:
- "A" is the **tail** of the given vector.
- "B" is the **head** (or **tip**) of the given vector.
- It is called $\overrightarrow{AB}$, or "vector AB"
- The magnitude of a vector is its size only (direction is eliminated) and is denoted by $|\overrightarrow{AB}|$
- Vectors can also be named using a single lower case letter ($\vec{u}, \vec{v}, \vec{w}$ are common)
  In this case $\vec{s} = \overrightarrow{AB}$

  Eg. If $\vec{v}$, represented the velocity of an airplane, the direction of the arrow would represent the direction of the plane and the length would represent its speed.

Equal (Equivalent) Vectors

- Two vectors are equal if they are parallel to each other, have the same direction, AND the magnitudes are equal. Equal vectors are not required to be located at the same position in space.



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

$x = 5$

$y = 5$

$x = y$

Opposite Vectors

- Two vectors are opposite if they have the same magnitude but point in opposite directions.

$x = 5 = -(-5)$

$\overrightarrow{FE}$ and $\overrightarrow{EF}$ are opposites

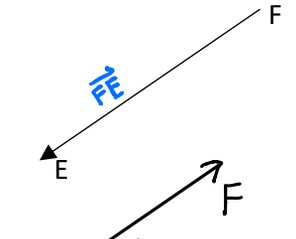
$\overrightarrow{FE} = -\overrightarrow{EF}$

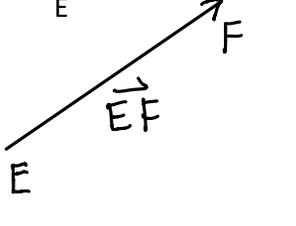
$|\overrightarrow{FE}| = |\overrightarrow{EF}|$

magnitudes/lengths of both vectors are equal

$\overrightarrow{FE}$ = 50 cm [N]

$|\overrightarrow{FE}|$ = 50 cm





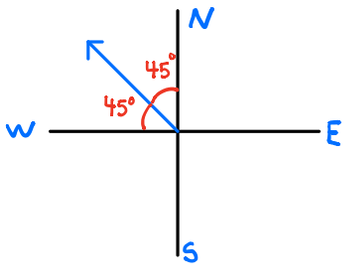
H I

Start (tail) end (tip)

Ex. 1

Using a scale of 1cm = 100km/h, draw a vector to represent the following:

a) an airplane heading northwest at 450 km/h



4.5 cm

magnitude direction

450 km/h [NW]

[N 45° W]

[W 45° N]

$\vec{u}$ = 17cm [W]

b) a cyclist biking due south at 100km/h

100 km/h [S]

1cm

Ex. 2

$\overrightarrow{CU}$ is a vector whose tail is at (-3, -1) and whose head is at (7,2).

a) Determine $|\overrightarrow{CU}|$.

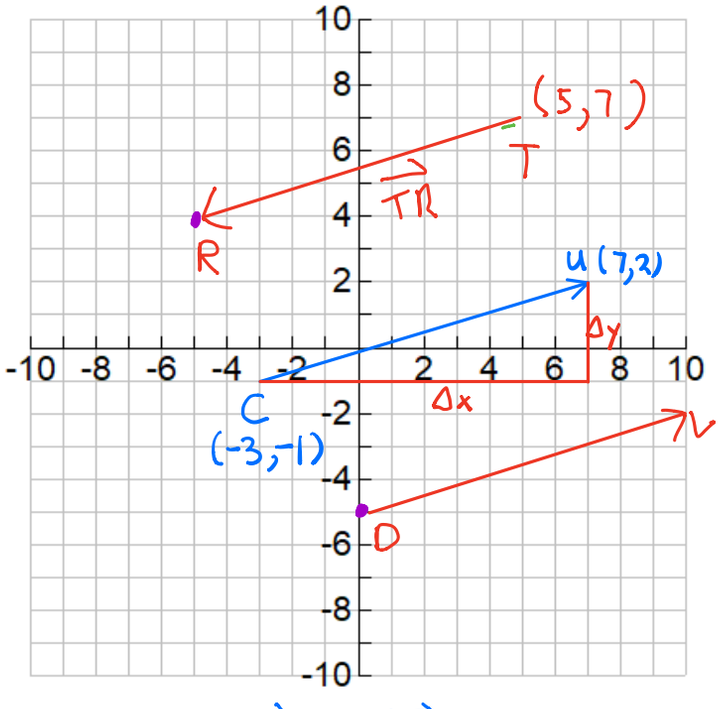
$|\vec{cu}|^2 = \Delta x^2 + \Delta y^2$

$= (7-(-3))^2 + (2-(-1))^2$

$= 100 + 9$

$= 109$

$|\vec{cu}| = \sqrt{109}$



b) Give the coordinates of the head of a vector equal to $\overrightarrow{CU}$ whose tail is located at (0, -5)

$\vec{DV} = \vec{cu}$

c) Give the coordinates of the tail of a vector opposite $\overrightarrow{CU}$ who's head is located at (-5,4).

T (5,7)

$\vec{DV} = \vec{cu} = -\vec{TR} = \vec{RT}$