Introduction to Vectors (6.1)

Math Learning Target:

"I know what a scalar and vector quantity is, and I cite several examples. I know some fundamental properties of vectors. I can describe and represent geometric vectors."

A **scalar quantity** is a physical quantity that can be described by one real number, often accompanied by units of measurement. This real number is the scalar's size or **magnitude**.

Examples:

A **vector quantity** is a physical quantity that has both magnitude and direction. Vectors are drawn as arrows.

Examples:

Notation:

A *vector's* magnitude is always non-negative. If it is not a vector, it may be any real number.

A **geometric vector** is a vector without regard to a coordinate system.

Common Examples of Scalar and Vector Quantities

Scalar

Distance: the length between two positions of an object.

Speed: the rate of change of distance, per unit of time.

Mass: the amount of matter contained within an object.

Vector

Position: the distance and direction of an object, relative to a point of reference.

Displacement: the change in position of an object, in a given direction.

Velocity: the rate of change in position of an object, per unit of time, in a given direction. Thus, it is the rate of displacement per unit of time, in a given direction.

Acceleration: the rate of change of velocity, per unit of time, in a given direction.

Weight: the resultant (net) force of gravity on an object, in a given direction.

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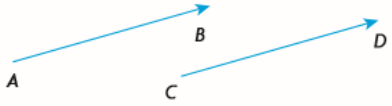
Opposite Vectors

Two vectors that are opposites have the same magnitude but point in opposite directions.

$\overrightarrow{AB}$ and $\overrightarrow{BA}$ are opposites, and $\overrightarrow{AB} = -\overrightarrow{BA}$. In this case, $|\overrightarrow{AB}| = |\overrightarrow{BA}|$ and the vectors are parallel but point in opposite directions. Vectors can also be represented with lower-case letters. In the diagram above, vectors $\vec{v}$ and $-\vec{v}$ have the same magnitude, i.e., $|\vec{v}| = |-\vec{v}|$, but point in opposite directions, so $\vec{v}$ and $-\vec{v}$ are also opposites.

Equal Vectors



Two vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are equal (or equivalent) if and only if

1. $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are parallel to each other, and the direction from A to B is the same as the direction from C to D
2. the magnitude of $\overrightarrow{AB}$ equals the magnitude of $\overrightarrow{CD}$, i.e., $|\overrightarrow{AB}| = |\overrightarrow{CD}|$

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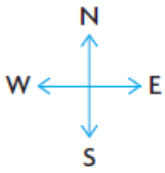
When drawing a vector, its length is always proportional to its magnitude.

Example A car is travelling East at 80 km/h. Draw this vector using the scale 1 cm: 10 km/h



https://youtu.be/LWGJA9i18Co **<<<<< How can the Force of gravity be $\vec{0}$ on Earth? Huh?**

MathSIP!

Page 279 #2, 1, 3, 4, 6*, 8, 9, 10.
*In 6e, change "east" to "south".