Chapter 8: Right Triangles & Trigonometry

SECTION 6: VECTORS

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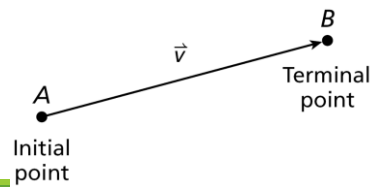
I Can

- Find the magnitude and direction of a vector
- Use vectors and vector addition to solve real problems

Vectors

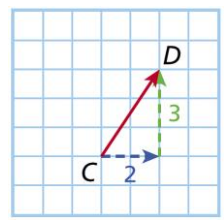
The speed and direction an object moves can be represented by a *vector*. A **vector** is a quantity that has both length and direction.

You can think of a vector as a directed line segment. The vector below may be named $\overrightarrow{AB}$ or $\vec{v}$.



Component Form

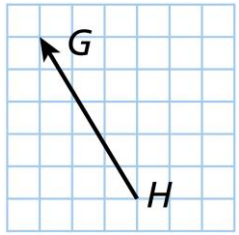
A vector can also be named using *component form*. The **component form** $\langle x, y \rangle$ of a vector lists the **horizontal** and **vertical** change from the initial point to the terminal point. The component form of $\overrightarrow{CD}$ is <**2**, **3**>.



Component Form

Write the vector in component form.

$\overrightarrow{HG}$



Component Form

Write the vector in component form.

$\overrightarrow{MN}$ **with** ***M*****(–8, 1) and** ***N*****(2, –7)**

Magnitude

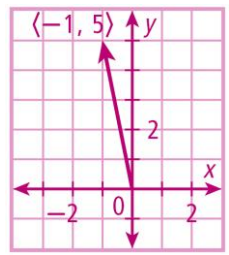
The **magnitude** of a vector is its length. The magnitude of a vector is written $|\overrightarrow{AB}|$ or $|\vec{v}|$.

When a vector is used to represent speed in a given direction, the magnitude of the vector equals the speed.

For example, if a vector represents the course a kayaker paddles, the magnitude of the vector is the kayaker's speed.

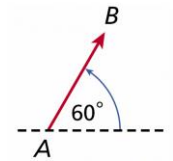
Magnitude

Draw the vector <–1, 5> on a coordinate plane. Find its magnitude to the nearest tenth.

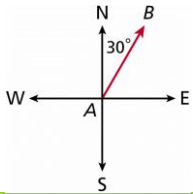


Direction

The **direction** of a vector is the angle that it makes with a horizontal line. This angle is measured counterclockwise from the positive *x*-axis. The direction of $\overrightarrow{AB}$ is 60°.

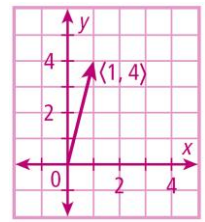


The direction of a vector can also be given as a bearing relative to the compass directions *north*, *south*, *east*, and *west*. $\overrightarrow{AB}$ has a bearing of N 30° E.



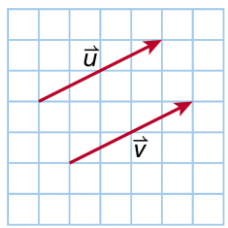
Direction

The force exerted by a skier is given by the vector <1, 4>. Draw the vector on a coordinate plane. Find the direction of the vector to the nearest degree.



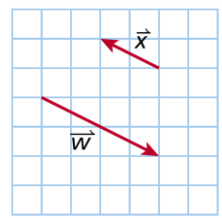
Equal Vectors

Two vectors are **equal vectors** if they have the same magnitude and the same direction. For example, $\vec{u} = \vec{v}$. Equal vectors do not have to have the same initial point and terminal point.



Parallel Vectors

Two vectors are **parallel vectors** if they have the same direction or if they have opposite directions. They may have different magnitudes. For example, $\overrightarrow{w} \parallel \overrightarrow{x}$. Equal vectors are always parallel vectors.

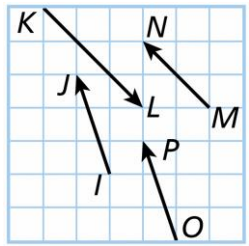


Example

Identify each of the following.

A. equal vectors

B. parallel vectors



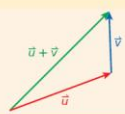
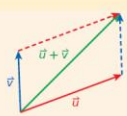
Resultant Vectors

The **resultant vector** is the vector that represents the sum of two given vectors. To add two vectors geometrically, you can use the head-to-tail method or the parallelogram method.

To add vectors numerically, add their components. If $\vec{u} = \langle x_1, y_1 \rangle$ and $\vec{v} = \langle x_2, y_2 \rangle$, then $\vec{u} + \vec{v} = \langle x_1 + x_2, y_1 + y_2 \rangle$.

Vector Addition

Vector Addition

METHOD	EXAMPLE
Head-to-Tail Method Place the initial point (tail) of the second vector on the terminal point (head) of the first vector. The resultant is the vector that joins the initial point of the first vector to the terminal point of the second vector.	
Parallelogram Method Use the same initial point for both of the given vectors. Create a parallelogram by adding a copy of each vector at the terminal point (head) of the other vector. The resultant vector is a diagonal of the parallelogram formed.	

Example

An airplane is flying at a constant speed of 400 mi/h at a bearing of N 70° E. A 60 mi/h wind is blowing due north. What are the plane's actual speed and direction? Round the speed to the nearest tenth and the direction to the nearest degree.

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