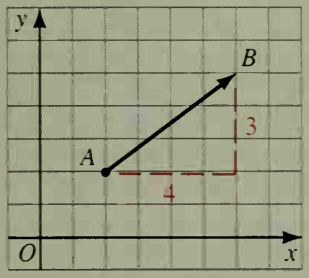
13-4 Vectors

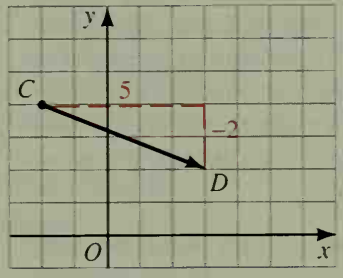
The journey of a boat or airplane can be described by giving its speed and direction, such as 50 km/h northeast. Any quantity such as force, velocity, or acceleration, that has both *magnitude* (size) and *direction*, is a **vector.**

When a boat moves from point A to point B, its journey can be represented by drawing an arrow from A to B, $\overrightarrow{AB}$ (read "*vector AB*"). If $\overrightarrow{AB}$ is drawn in the coordinate plane, then the journey can also be represented as an ordered pair.

$\overrightarrow{AB}$ = (change in x, change in y)



$\overrightarrow{AB} = (4, 3)$



$\overrightarrow{CD} = (5, -2)$

The **magnitude** of a vector $\overrightarrow{AB}$ is the length of the arrow from point A to point B and is denoted by the symbol $|\overrightarrow{AB}|$. You can use the Pythagorean Theorem or the Distance Formula to find the magnitude of a vector. In the diagrams above,

$$|\overrightarrow{AB}| = \sqrt{4^2 + 3^2} = 5$$

and $$|\overrightarrow{CD}| = \sqrt{5^2 + 2^2} = \sqrt{29}.$$

Example 1 Given: Points $P(-5, 4)$ and $Q(1, 2)$

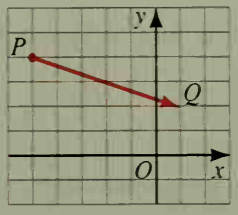
a. Sketch $\overrightarrow{PQ}$.

b. Find $\overrightarrow{PQ}$.

c. Find $|\overrightarrow{PQ}|$.

Solution

a.



b. $\overrightarrow{PQ} = (1 - (-5), 2 - 4) = (6, -2)$

c. $|\overrightarrow{PQ}| = \sqrt{6^2 + (-2)^2} = \sqrt{40} = 2\sqrt{10}$