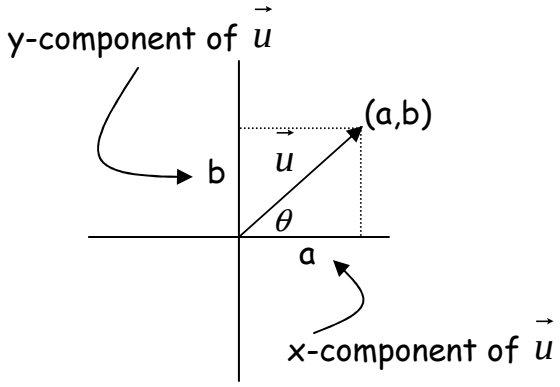
Geometric and Algebraic Vectors

Given the vector $\vec{u}$, $\vec{u}$ can be moved until its initial point is on the origin. Its endpoint will be at some point P with coordinates (a, b).



then we have $|\vec{u}| = \sqrt{a^2 + b^2}$ and $\theta = \tan^{-1}\left(\frac{b}{a}\right)$

NOTE: The actual direction will depend on the quadrant in which P(a,b) lies.

If we adopt a convention where the west-east direction is written first, then we will have the following:

[W θ N] = (-,+)	[E θ N] = (+,+)
[W θ S] = (-,-)	[E θ S] = (+,-)

Example: Express $\vec{v} = (-3,-2)$ as a geometric vector.

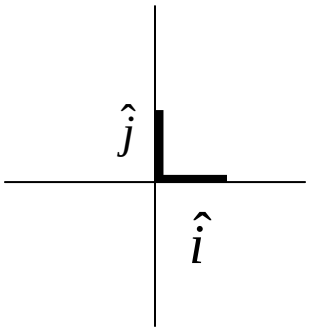
$|\vec{v}| = \sqrt{(-3)^2 + (-2)^2}$
$= \sqrt{13}$

$\theta = \tan^{-1}\left(\frac{2}{3}\right)$
$\approx 33.7°$

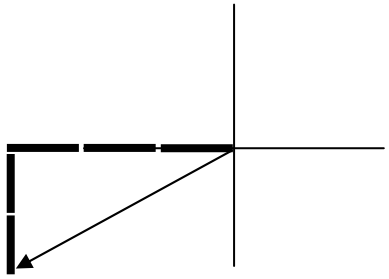
3rd quad so (W and S)

$\therefore \vec{v} = \sqrt{13}[W33.7°S]$

Vectors can be expressed using unit vector notation if we define $\hat{i} = (1,0)$ and $\hat{j} = (0,1)$ to be the unit vectors of length one which lie on the x- and y-axis



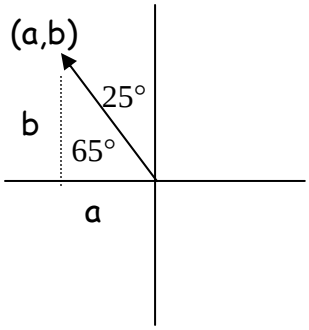
The vector (-3,-2) can be expressed in unit vector notation as



(-3,-2) = $-3\hat{i} - 2\hat{j}$

In general, if $\overrightarrow{OP} = (a,b)$ then $\overrightarrow{OP}$ can be written as $a\hat{i} + b\hat{j}$

Consider the vector $15m[N25°W]$



Then we have
$a = 15\cos 65°$ and $b = 15\sin 65°$ in the second quadrant.

You need to manually put in any "-" signs

$$\therefore 15m[N25°W] = 15m[W65°N] = (-15\cos 65°, 15\sin 65°)$$
$$\approx (-6.3, 13.6)$$

Example: Given the algebraic vector $\overrightarrow{OP} = (-3, \quad 7)$,

a) Sketch the corresponding position vector on the Cartesian Plane
b) Express the vector as a geometric vector.
c) Express the vector in unit vector notation.