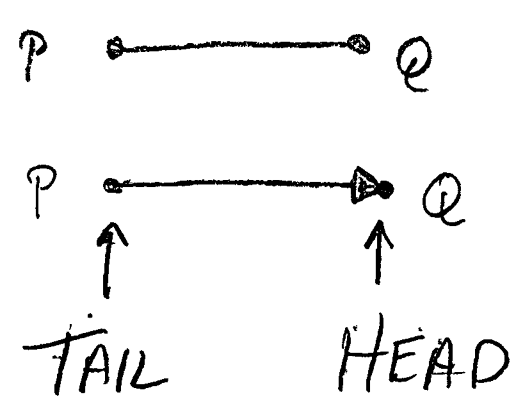
Mth 113 | Monday 3-11-13 | Class Notes

Ch. 6-3 Vectors

Scalar quantity A quantity with only magnitude. (how much)

Vector quantity A quantity with magnitude AND direction.

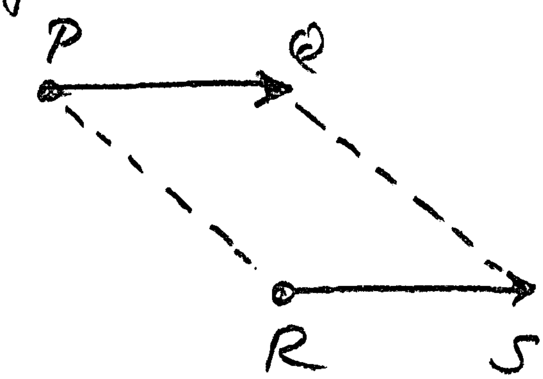
A vector is a directed line segment. It is represented by an arrow, pointing in the appropriate direction (directed) and the magnitude is equal to the length of the arrow.



Line segment

vector, points P, Q have a definite order.

A vector can be represented by an infinite number of equivalent directed line segments, you can refer to a particular one, say vector A is the directed line segment $\overrightarrow{PQ}$, (capital ⇒ vector (like matrices)) and $\overrightarrow{PQ}$ and say $\overrightarrow{RS}$ are equivalent if they form a parallelogram.



(Opposite side are congruent and parallel)

$\overrightarrow{PQ}$ and $\overrightarrow{RS}$ represent the same vector. If RS is say vector B then,

$$A = B$$

The magnitude of vector A is shown by $|A|$, if the direction is specified by θ, the vector is in Polar Form

Two forms of a vector:

Rectangular Form
(x-y plane)

$$A = (A_x, A_y)$$

A_x: horizontal component of the vector

A_y: vertical component of the vector

Polar Form
(r-θ plane)

$$A = (|A|, \theta_A)$$

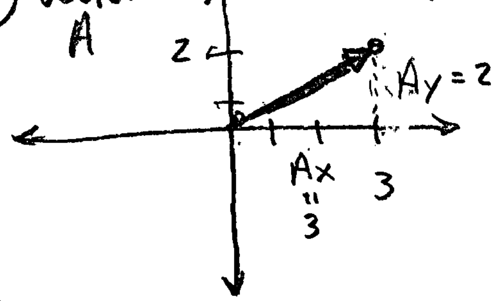
$|A|$: magnitude of vector (r)

θ_A: direction of vector

$$|A| \geq 0$$

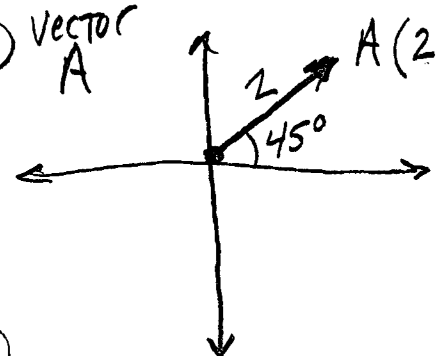
Ex Vector A

A(3, 2)



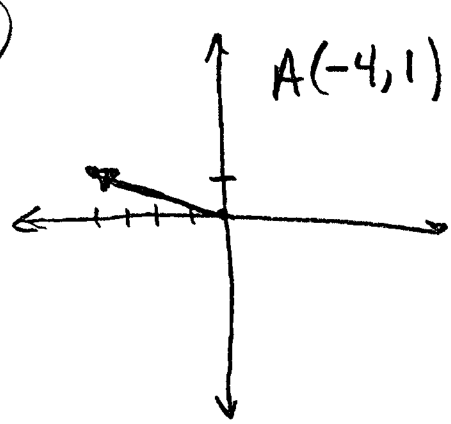
Ex Vector A

A(2, 45°)



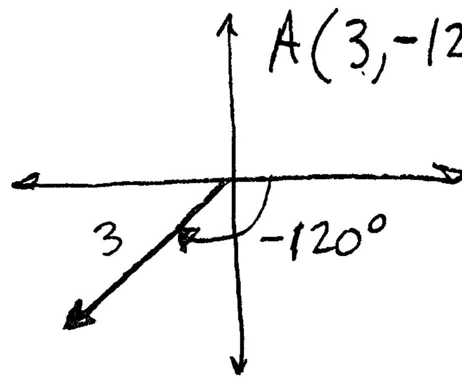
Ex

A(−4, 1)



Ex

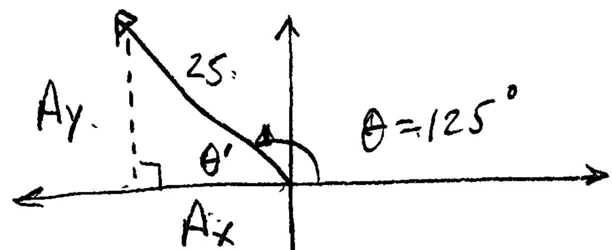
A(3, −120°)



Converting Polar to Rectangular:

(Ex) $A(25.0, 125°) = ?$ nearest tenth

6-3 A
pg 228



$\sin 125 = \dfrac{A_y}{|25|}$

$25 \sin 125 = A_y$

$20.5 = A_y$

$\cos 125 = \dfrac{A_x}{|25|}$

$\therefore A_x = 25 \underbrace{\cos 125}_{-}$

$A_x = -14.3$

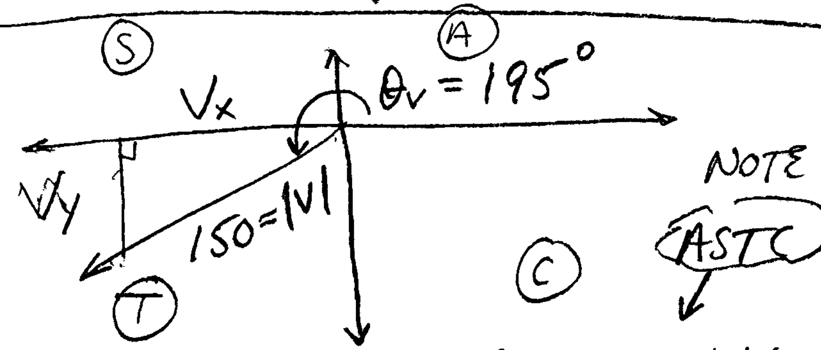
$\therefore A(-14.3, 20.5)$

Formula:

$$\boxed{A(|A|, \theta_A) = A(|A| \cos \theta_A, |A| \sin \theta_A)}$$

Ex 2
pg 226

Plane flying 15° SOUTH OF WEST AT 150 KNOTS. Find the
(1.15077945 mph)
FYI
EAST – WEST, NORTH – SOUTH components of its Velocity, V
VELOCITY VECTOR
to the nearest KNOT
AND interpret the results.



$V_x = |150| \cos 195° = -144.889$

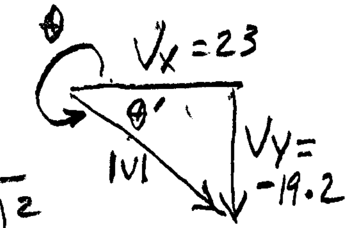
$V_y = |150| \sin 195° = -38.822$

$V_x = -145$ KNOTS to WEST

$V_y = -39$ KNOTS to SOUTH

Converting Rectangular to Polar:

(EX) Ex 6-3B pg 228 ① $V(\overset{V_x}{23.0}, \overset{V_y}{-19.2})$



$$|V| = \sqrt{23^2 + (-19.2)^2}$$

ASTC

$$|V| \cong 30$$

$$\theta_v' = \tan^{-1}\left(\frac{-19.2}{23}\right) = -39.854^\circ$$

$$\therefore \theta = 360 - 39.854 = 320.145$$

$$\theta = 320^\circ \quad \therefore \boxed{V(30, 320^\circ)}$$

$$\text{or } \boxed{V(30, -39.9^\circ)} \text{ BOOK}$$

NOTE: $\tan = \text{slope} = \frac{\text{rise}}{\text{run}} \Rightarrow \frac{Y}{X}$ NOT $\frac{X}{Y}$
(WARNING)

Formula:

$$\boxed{A(A_x, A_y) = \left(\sqrt{A_x^2 + A_y^2}, \tan^{-1}\frac{A_y}{A_x}\right)}$$

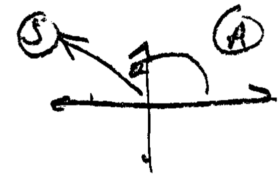
$A_x \neq 0$

If $A_x = 0$, then $\theta_v = +90^\circ$ if A_y is > 0
$\theta_v = -90^\circ$ if A_y in < 0

NOTE
see pg 227 ⇒ use ASTC

EX2 Pg 228

$R \rightarrow P$



$A(-43.2, 15.7)$

$$|A| = \sqrt{(-43.2)^2 + (15.7)^2} = \sqrt{2112.73}$$

$$= 45.96 \approx 46.0$$

$$\theta_A' = \tan^{-1}\left(\frac{15.7}{43.2}\right) = 19.97^\circ$$

$$\therefore \theta = 180 - 19.97 = 160.02 = 160^\circ$$

$$\therefore \boxed{A(46, 160^\circ)}$$