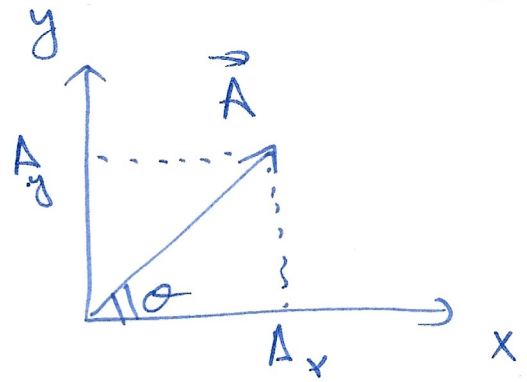
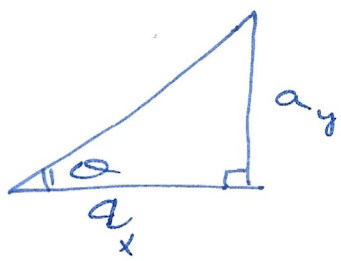
A Vector: { Magnitude
Direction.

$\vec{A} = a_x \hat{i} + a_y \hat{j}$ eg. $\vec{A} = 5\hat{i} - 2\hat{j}$





the Magnitude of $\vec{A}$ is: $A = \sqrt{a_x^2 + a_y^2}$

↳ $\begin{cases} a_x = A \cdot \cos\theta \\ a_y = A \sin\theta \end{cases}$; $\tan\theta = \frac{a_y}{a_x}$

↳ $\theta = \tan^{-1}\left(\frac{a_y}{a_x}\right)$

Adding two Vectors:

Example①: $\begin{cases} \vec{A} = 5\hat{i} + 2\hat{j} \\ \vec{B} = 2\hat{i} - 3\hat{j} \end{cases} \Rightarrow \vec{C} = \vec{A} + \vec{B}$

$= (A_x + B_x)\hat{i} + (A_y + B_y)\hat{j}$

in this case: $\vec{C} = ?$

$\vec{C} = (5+2)\hat{i} + (2-3)\hat{j}$

$\boxed{\vec{C} = 7\hat{i} - \hat{j}}$

↳ the Magnitude of $\vec{C}$ is:

$C = \sqrt{7^2 + (-1)^2} = \sqrt{50}$

Example (2)

$$\vec{D} = \vec{A} + \vec{B} + \vec{C}$$

Let:
$$\begin{cases} \vec{A} = 5\vec{i} - 2\vec{j} \\ \vec{B} = 2\vec{i} - \vec{j} \\ \vec{C} = 6\vec{i} + 3\vec{j} \end{cases}$$

$$\vec{D} = (a_x + b_x + c_x)\vec{i} + (a_y + b_y + c_y)\vec{j}$$

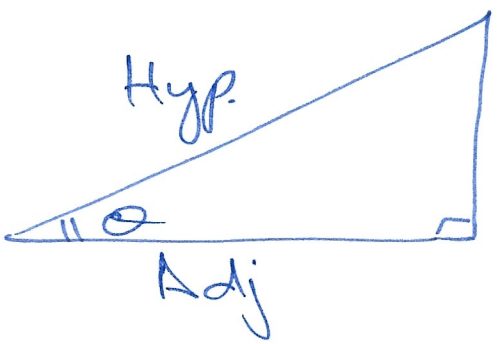
$$= (5 + 2 + 6)\vec{i} + (-2 - 1 + 3)\vec{j}$$

$$= 13\vec{i} + 0\vec{j}$$

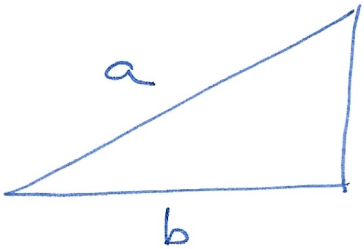
$$\boxed{\vec{D} = 13\vec{i}}$$

Is the Magnitude of $|\vec{D}| = D = 13$

Trigu. functions:



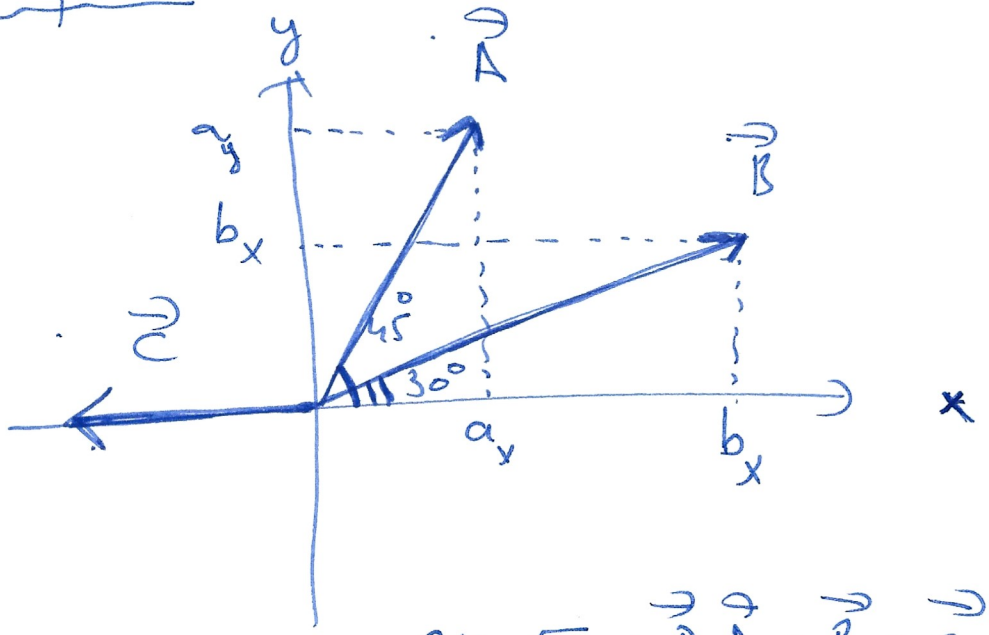
$$\Rightarrow \begin{cases} \cos\theta = \dfrac{Adj}{Hyp} \\ \sin\theta = \dfrac{opp}{Hyp} \\ tg\,\theta = \dfrac{opp}{Adj} \end{cases}$$



$$\Rightarrow a^2 = b^2 + c^2$$

$$\Rightarrow a = \sqrt{b^2 + c^2}$$

Example (3):

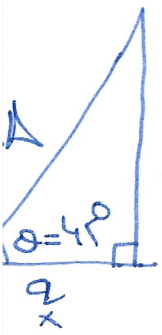


$A = 5$ m.
$B = 7$ m.
$C = 3$ m.

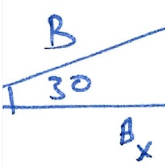
(1) Find $\vec{D} = \vec{A} + \vec{B} + \vec{C}$?

(2) Find the Magnitude of $\vec{D}$?

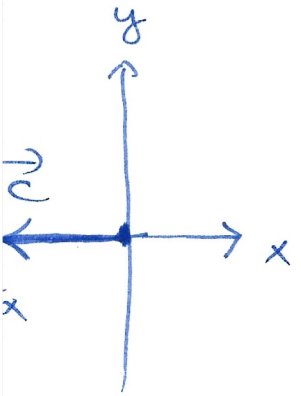
$$\vec{D} = \vec{A} + \vec{B} + \vec{C}$$
$$= (a_x + b_x + c_x)\hat{i} + (a_y + b_y + c_y)\hat{j}$$



$$\vec{A} \begin{cases} a_x = A\cos 45^\circ = 5\cos 45^\circ = 3.53 \text{ m.} \\ a_y = A\sin 45^\circ = 5\sin 45^\circ = 3.53 \text{ m.} \end{cases}$$



$$\vec{B} = \begin{cases} b_x = B\cdot\cos 30^\circ = 7\cdot\cos 30^\circ = 6.06 \text{ m.} \\ b_y = B\sin 30^\circ = 7\sin 30^\circ = 3.5 \text{ m.} \end{cases}$$



$$\vec{C} \begin{cases} c_x = C = -3 \text{ m.} \\ c_y = 0 \end{cases}$$

; here for $\vec{C}$ there is just one component: C_x

$$\vec{D} = (a_x + b_x + c_x)\vec{i} + (a_y + b_y + c_y)\vec{j}$$

$$= (3.53 + 6.06 + (-3))\vec{i} + (3.53 + 3.5 + 0)\vec{j}$$

$$\boxed{\vec{D} = 6.59\,\vec{i} + 7.03\,\vec{j}}$$

$\vec{D} \quad D_x \vec{i} + D_y \vec{j}$

↳ $|\vec{D}| = D = \sqrt{D_x^2 + D_y^2}$

$$D = \sqrt{(6.53)^2 + (7.03)^2}$$

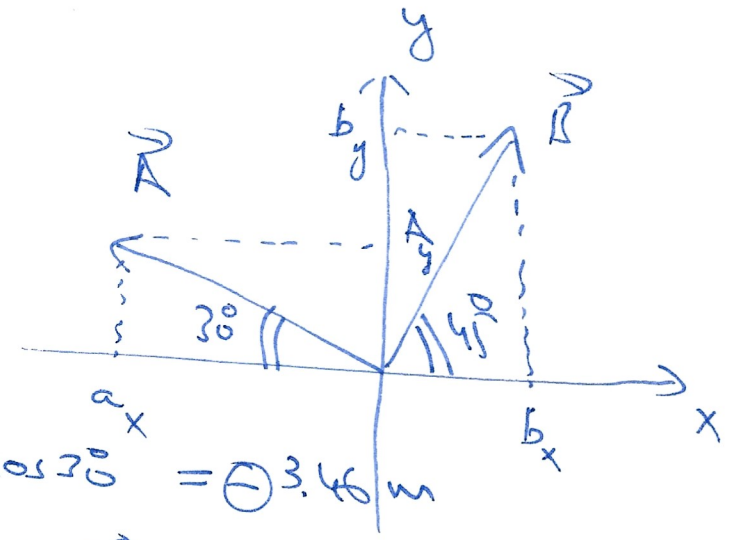
$$\boxed{D = 9.59}$$ → the magnitude of $\vec{D}$

Example 4

$A = 4$ m.

$B = 6$ m.

Find $\vec{A} + \vec{B}$?



↳ $\vec{A} = \begin{cases} a_x = -A\cos 30^\circ = -3.46 \text{ m} \\ a_y = A \cdot \sin 30^\circ = 2 \text{ m} \end{cases}$

↳ $\vec{B} = \begin{cases} b_x = B\cos 45^\circ = 4.24 \text{ m.} \\ b_y = B\sin 45^\circ = 4.24 \text{ m.} \end{cases}$

$$\vec{D} = \vec{A} + \vec{B} = (-3.46 + 4.24)\vec{i} + (2 + 4.24)\vec{j}$$

$$\boxed{\vec{D} = 0.78\,\vec{i} + 6.24\,\vec{j}}$$