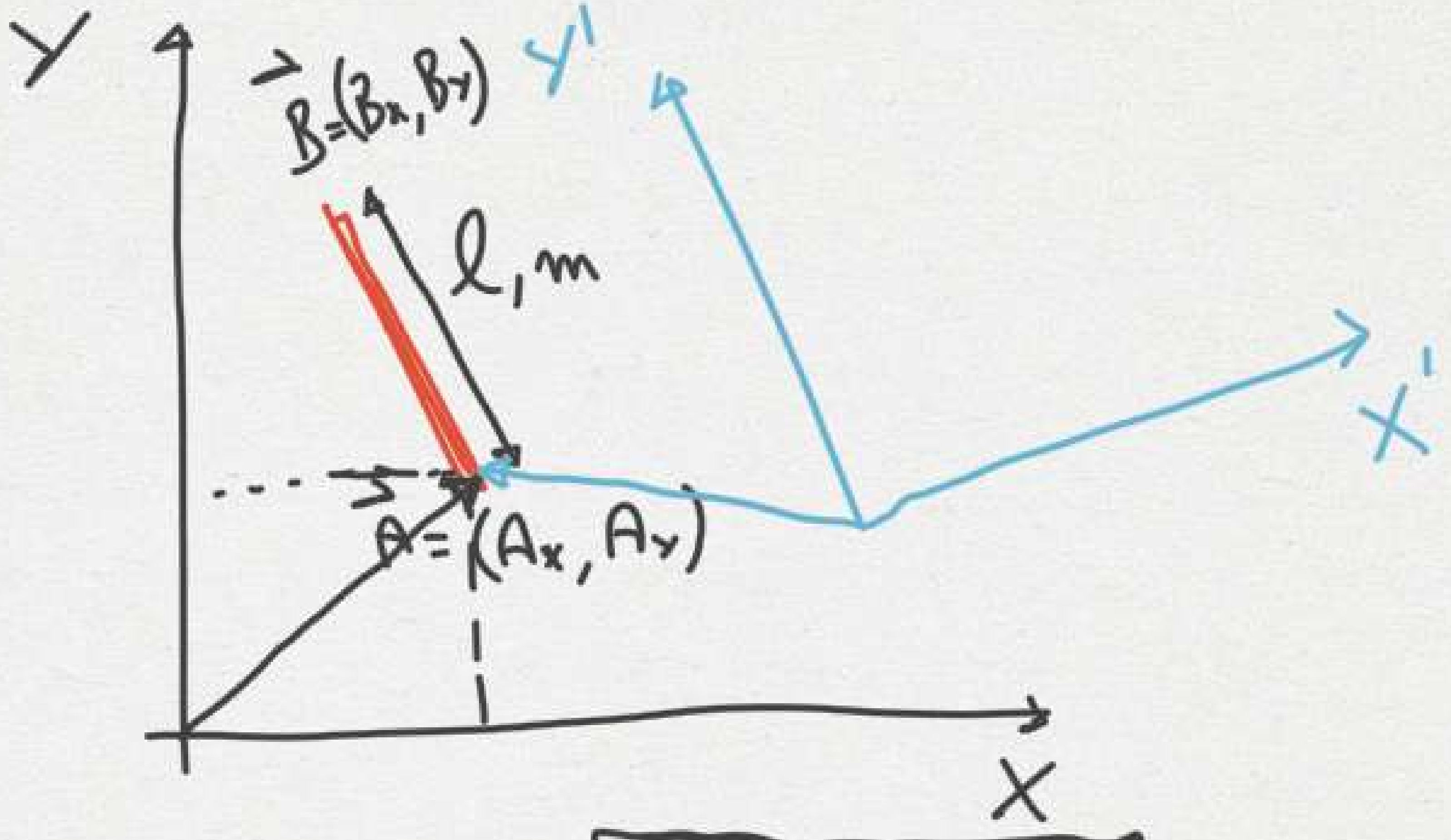
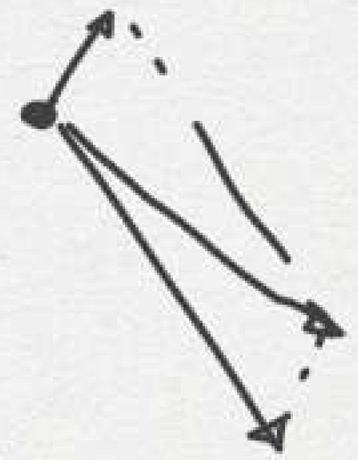
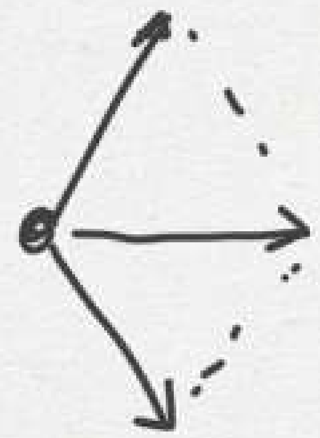


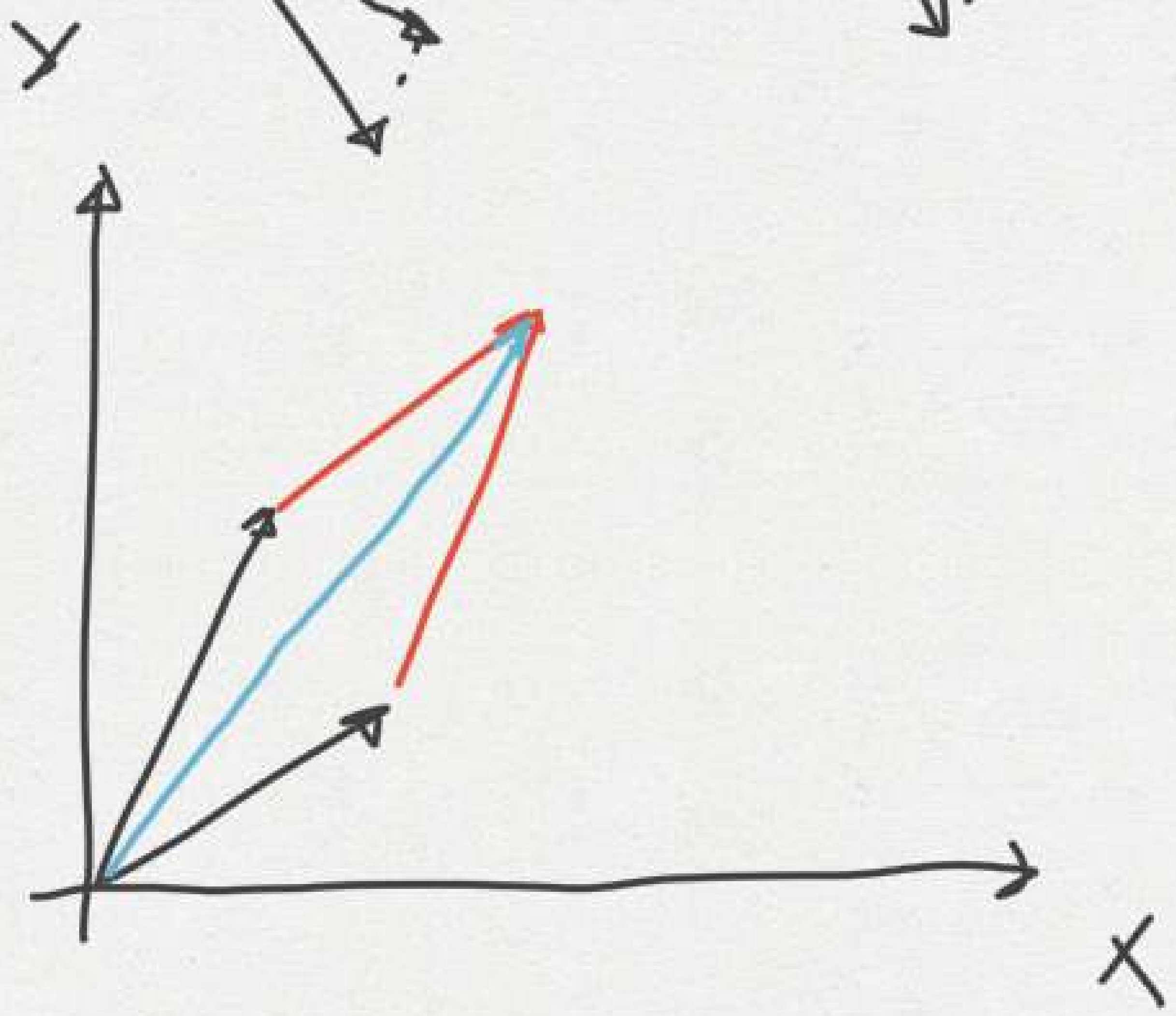
$\mathbb{R}^2 \quad \mathbb{R}^3$

$$\boxed{\vec{v} = (v_x, v_y, v_z)}$$

$\vec{v} = a \,, \quad \vec{v} = 0$







① $v = |\vec{v}| = \sqrt{v_x^2 + v_y^2 + v_z^2}$,

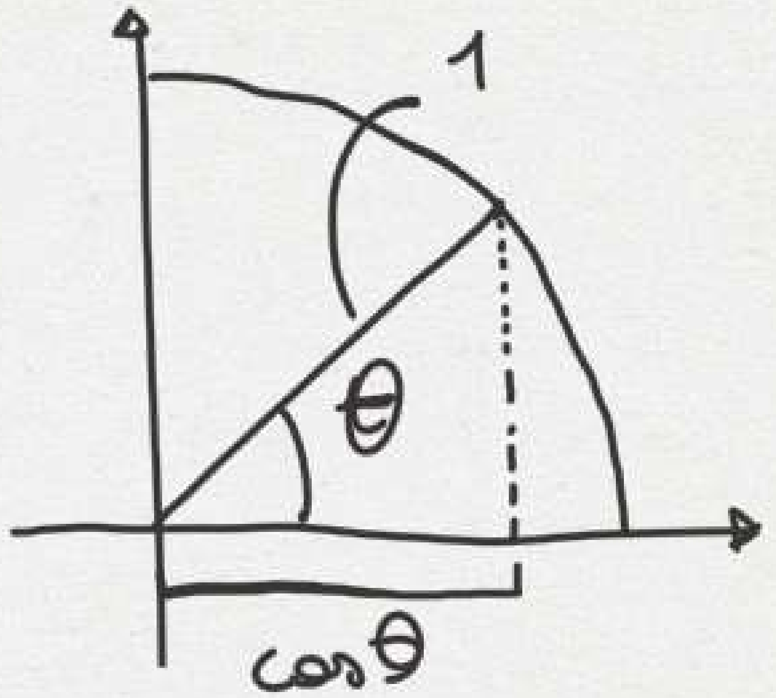
② $\hat{v} \equiv \dfrac{\vec{v}}{v}$, $|\hat{v}| = 1$

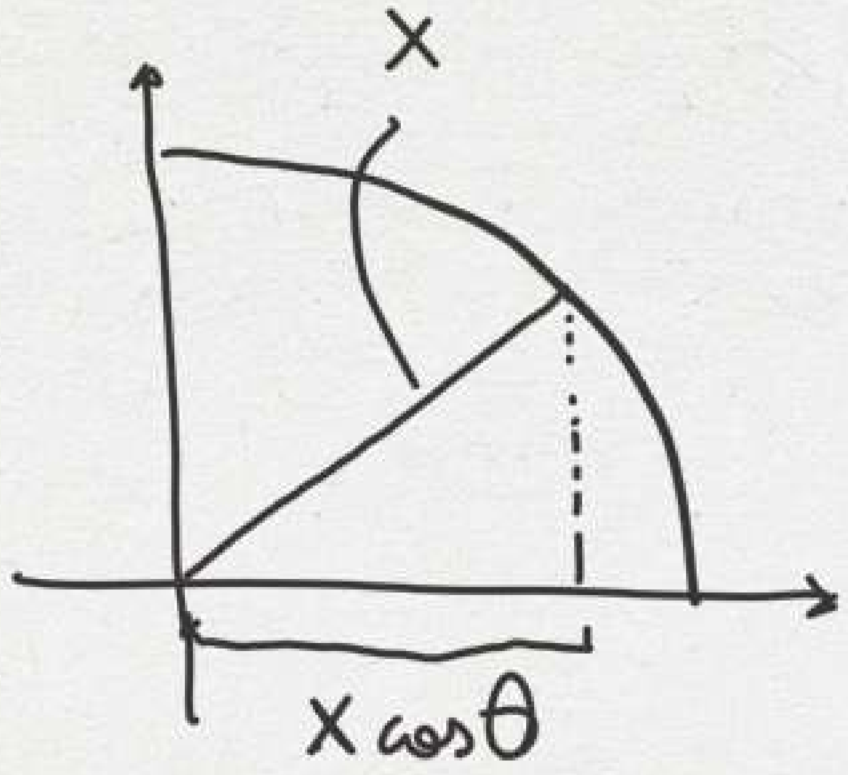
③ $\vec{X}, \vec{Y}$, $\vec{X} + \vec{Y} = (X_1 + Y_1, X_2 + Y_2, X_3 + Y_3)$

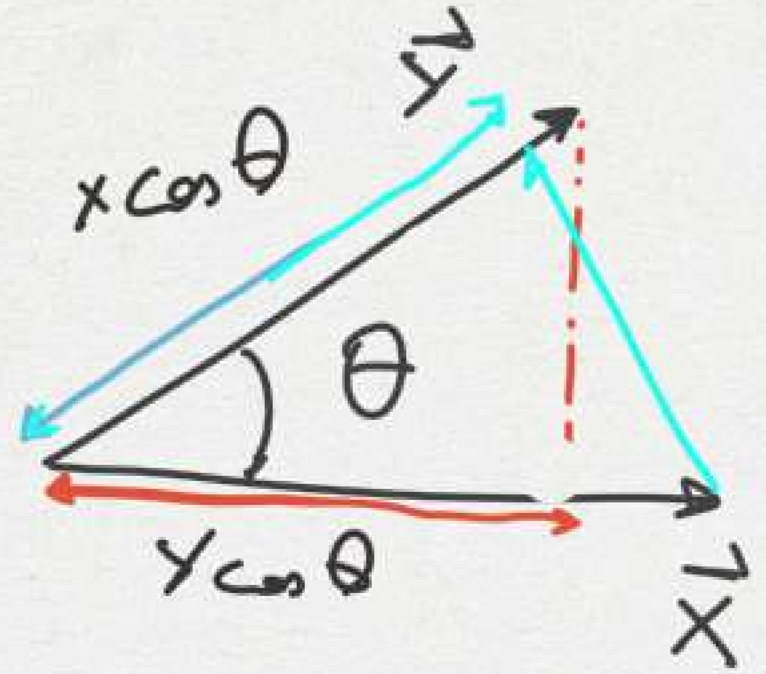
$\vec{X} + a$ = BOCCIATO

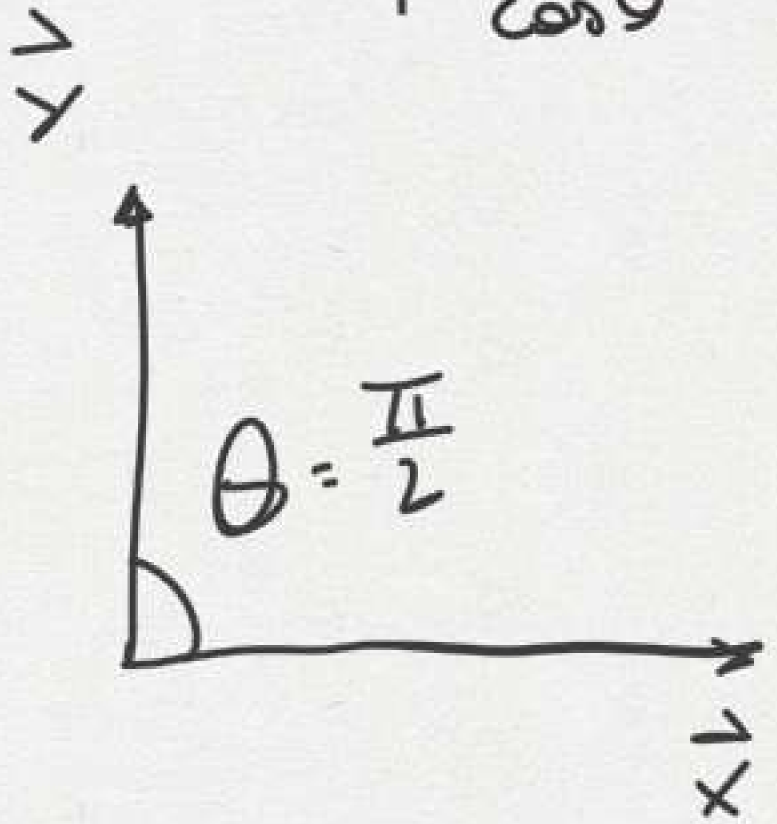
④ $a\vec{X} = (aX_1, aX_2, aX_3)$

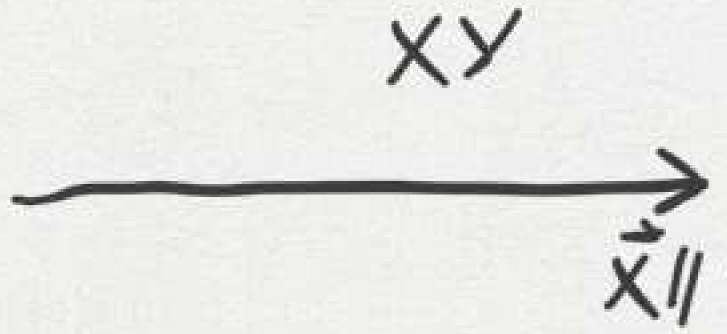
5) $\vec{x} \cdot \vec{y} = x_1 y_1 + x_2 y_2 + x_3 y_3 = xy \cos\theta$





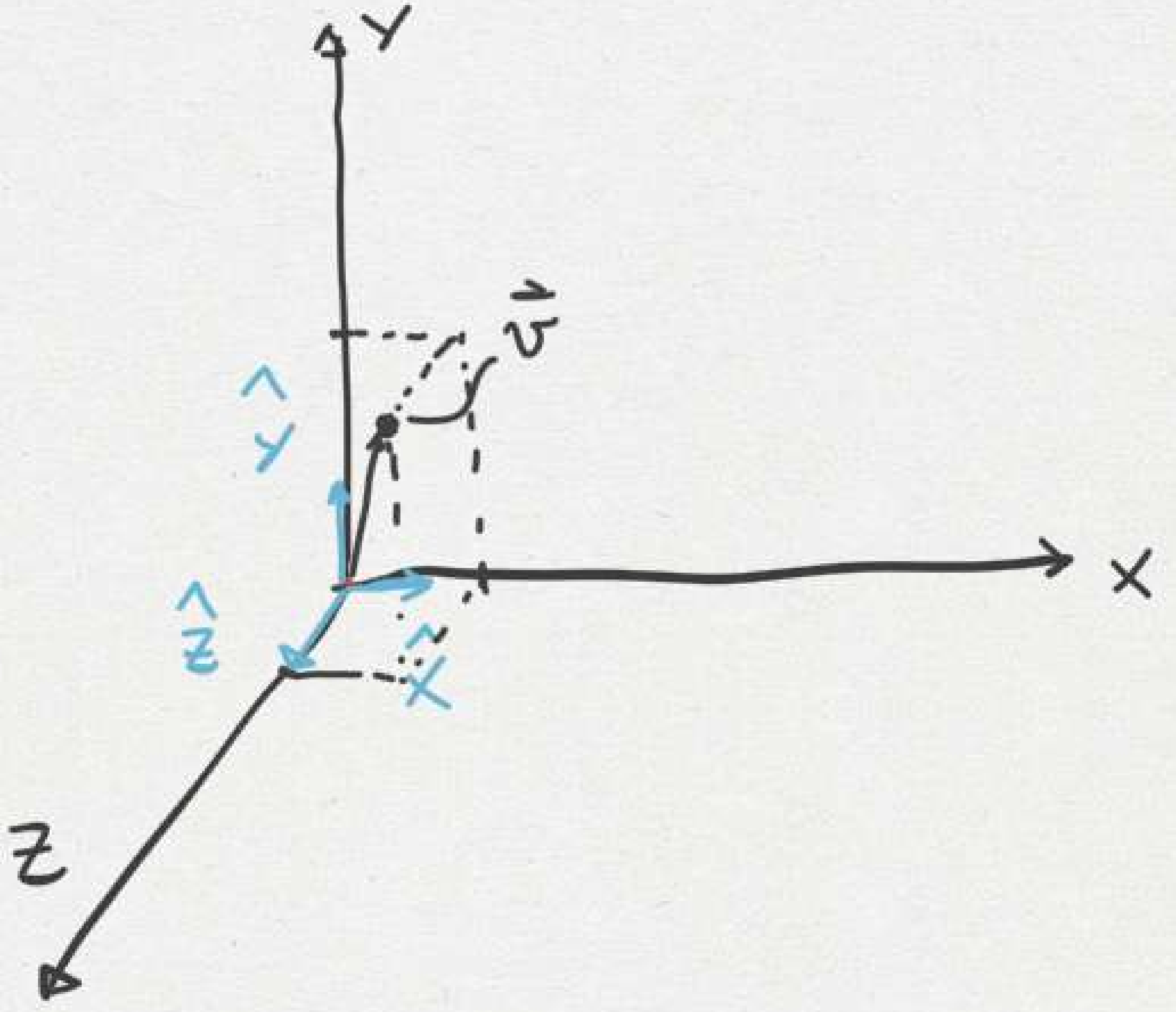






6) $\vec{x} \times \vec{y} = \vec{w} = (x_2 y_3 - x_3 y_2,\ x_3 y_2 - x_2 y_3,\ x_1 y_2 - x_2 y_1)$

$|\vec{x} \times \vec{y}| = |\vec{w}| = x y \sin\theta$



$\vec{v} = (2,3,1) = \boxed{2\hat{x} + 3\hat{y} + 1\hat{z}}$

$\hat{x} = (1,0,0)$

$\hat{y} = (0,1,0)$

$\hat{z} = (0,0,1)$

$\hat{x} \cdot \hat{y} = 1\cdot 0 + 0 \cdot 1 + 0 \cdot 0 = 0$

$\vec{v} = (v_x, v_y, v_z)$

$\vec{v} \cdot \hat{y} = (v_x \hat{x} + v_y \hat{y} + v_z \hat{z}) \cdot \hat{y} = v_x \overset{0}{\overset{\parallel}{(\hat{x} \cdot \hat{y})}} + v_y\, \hat{y} \cdot \hat{y} + v_z \overset{0}{\overset{\parallel}{(\hat{z} \cdot \hat{y})}} =$

$= v_y$

1) QUAL È L'ANGOLO COMPRESO TRA $\vec{v} = 3\hat{x} + 3\hat{y}$ e $\vec{w} = 2\hat{x} + \hat{y}$ *

2) QUAL È IL MODULO DI $\vec{v} = \hat{x} + 4\hat{y} - 2\sqrt{2}\,\hat{z}$? E L'ESPRESSIONE DI $\hat{v}$?

3) dato $\vec{v} = v_x \hat{x} + v_y \hat{y}$ con $v = 4$, se $\vec{v}$ forma un angolo di $\frac{\pi}{3}$ con $\hat{x}$, quanto valgono v_x e v_y ? *

4) $\vec{A} = (1,2,0)$, $\vec{B} = (6,3,0)$ *

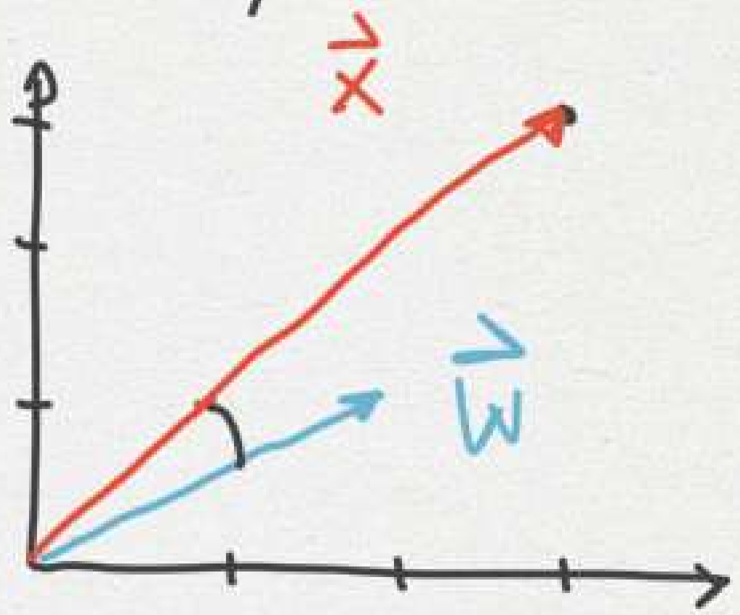
a) determinare $\vec{v}$ che congiunge $\vec{A}$ a $\vec{B}$

b) calcolare la distanza tra $\vec{A}$ e $\vec{B}$

c) determinare i versori $\vec{A} \to \vec{B}$ e $\vec{B} \to \vec{A}$

* DISEGNATE!

1) $\theta = 18.49°$, $\theta = 0.32$ rad



$$\vec{x}\cdot\vec{w} = x\,w\cos\theta = 9$$

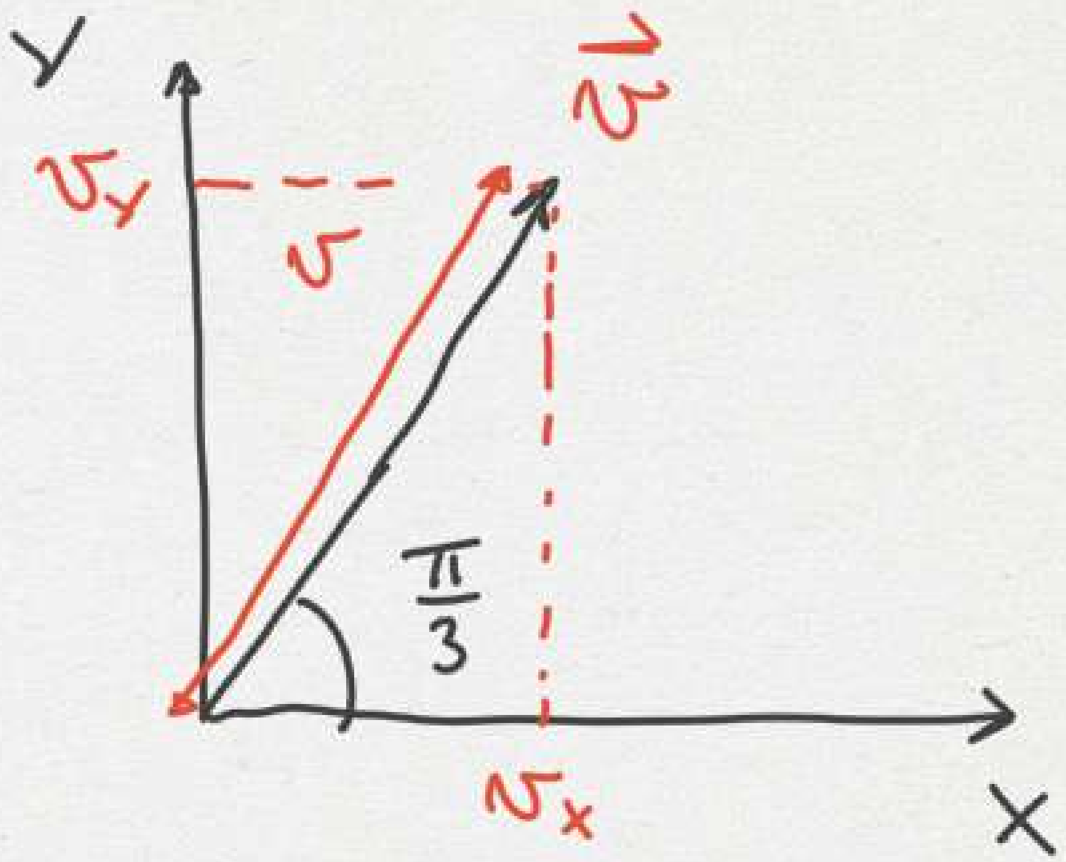
$$\parallel$$

$$x_1 w_1 + x_2 w_2 = 3\cdot 2 + 3\cdot 1 = 6 + 3 = 9 = x\,w\cos\theta \Rightarrow$$

$$\cos\theta = \frac{9}{x\,w} = \frac{9}{3\sqrt{2}\sqrt{5}}$$

2) $\vec{v} = \hat{x} + 4\hat{y} - 2\sqrt{2}\,\hat{z}$, $v = 5$, $\hat{v} = \frac{\vec{v}}{v} = \frac{1}{5}\left(1, 4, -2\sqrt{2}\right)$

3) $v = 4$, $\frac{\pi}{3}$ con $\hat{x}$



$$v_x = v\cos\theta$$

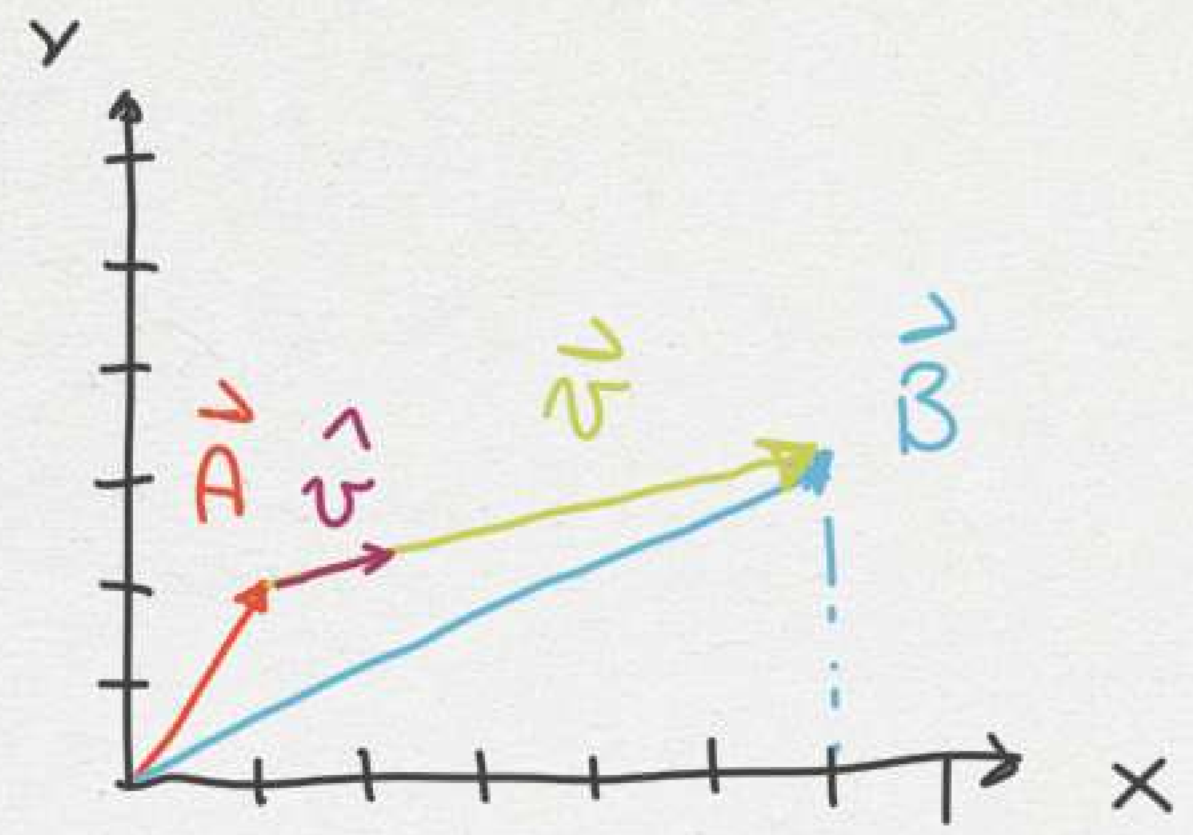
$$v_y = v\sin\theta$$

4) $\vec{A} = (1,2,0)$, $\vec{B} = (6,3,0)$

a) $\vec{v} : \vec{A} + \vec{v} = \vec{B}$

b) $v = |\vec{v}|$

c) versori $\boxed{\vec{A} \to \vec{B} \text{ e } \vec{B} \to \vec{A}}$



a) $\vec{A} + \vec{v} = \vec{B} \Rightarrow \vec{v} = \vec{B} - \vec{A} = (5,1,0)$

b) $\sqrt{25+1} = \sqrt{26}$

c) $\hat{v}_{A \to B} = \dfrac{\vec{v}}{v} = \dfrac{1}{\sqrt{26}}(5,1,0)$

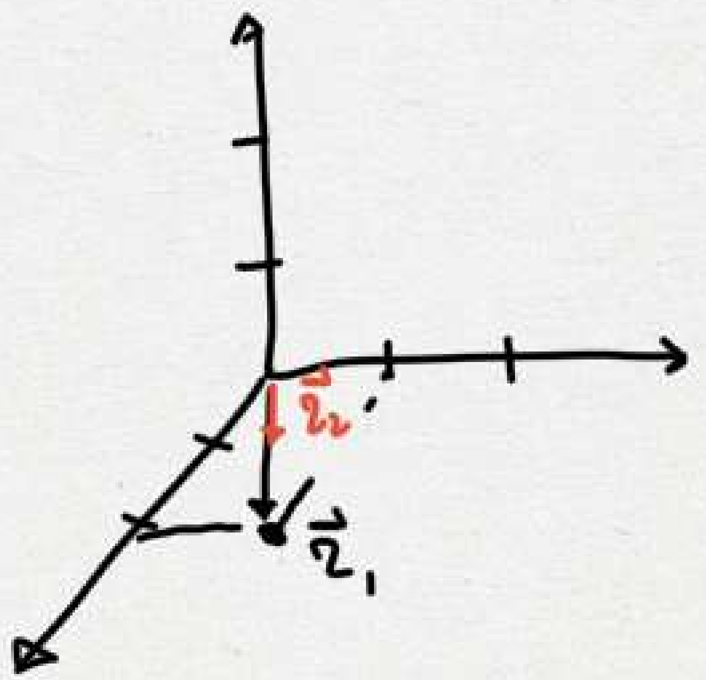
$\vec{w} : \vec{B} + \vec{w} = \vec{A} \Rightarrow \vec{w} = \vec{A} - \vec{B} = -(\vec{B} - \vec{A}) = -\vec{v}$

$\Rightarrow w = v$, $\hat{v}_{B \to A} = - \hat{v}_{A \to B}$

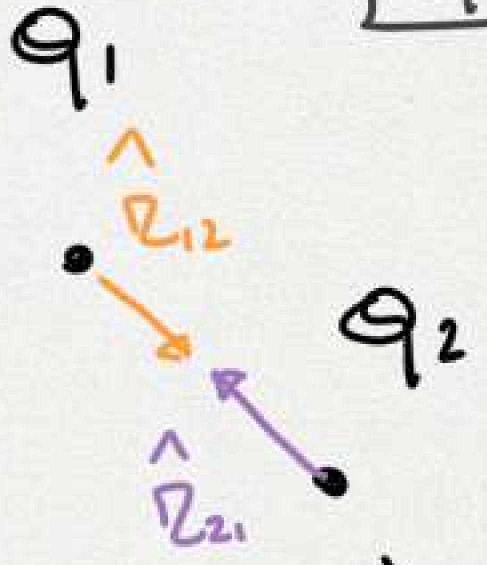
ESERCIZIO 0

$q_1 = 10^{-9}\,C$, $q_2 = -2\cdot 10^{-9}\,C$, $\vec{r}_1 = (1,0,2)$ e $\vec{r}_2 = (0,-1,0)$

1) $\vec{F}_{21} = ?$ 2) $F_{21} = |\vec{F}_{21}|$



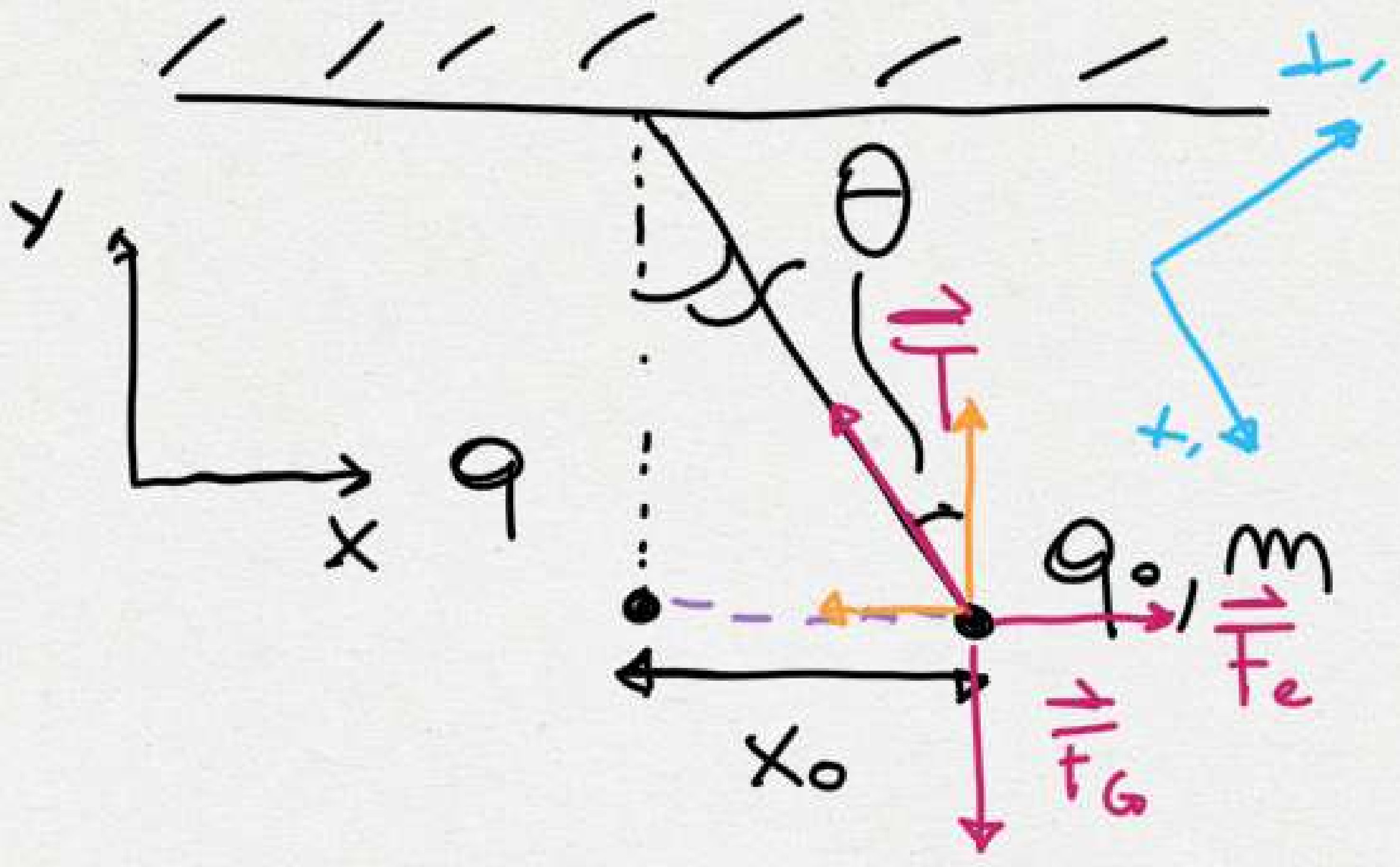
$$\vec{F}_{21} = \underbrace{\frac{q_1 q_2}{4\pi \varepsilon_0}}_{} \underbrace{\frac{\hat{r}_{21}}{r_{21}^2}}_{}$$



$$\vec{r}_2 + \vec{r}_{21} = \vec{r}_1 \Rightarrow \vec{r}_{21} = \vec{r}_1 - \vec{r}_2 = (1,1,2)$$

$$r_{21} = \sqrt{6}, \quad \hat{r}_{21} = \frac{\vec{r}_{21}}{r_{21}} = \frac{1}{\sqrt{6}}(1,1,2) \Rightarrow \vec{F}_{21} = \frac{q_1 q_2}{4\pi\varepsilon_0} \frac{1}{6} \frac{1}{\sqrt{6}} (1,1,2)$$

$$\underline{\vec{F}_{12} = -\vec{F}_{21}}$$



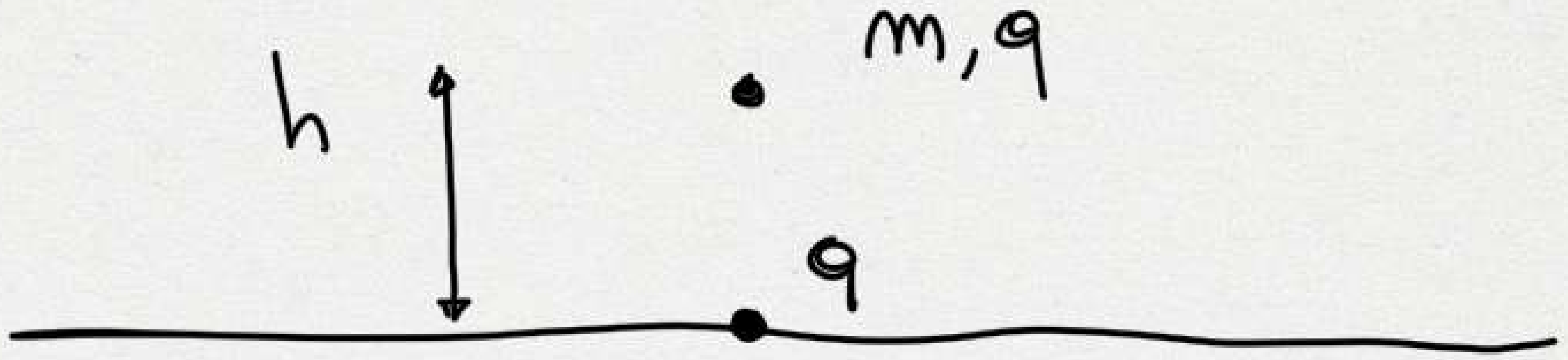
scrivere $\theta = \theta(x_0)$

$$\vec{F}_{TOT} = 0 = \vec{T} + \vec{F}_e + \vec{F}_G$$

$$\vec{T} = (T_x, T_y), \quad \vec{F}_e = (F_e, 0), \quad \vec{F}_G = (0, -mg)$$

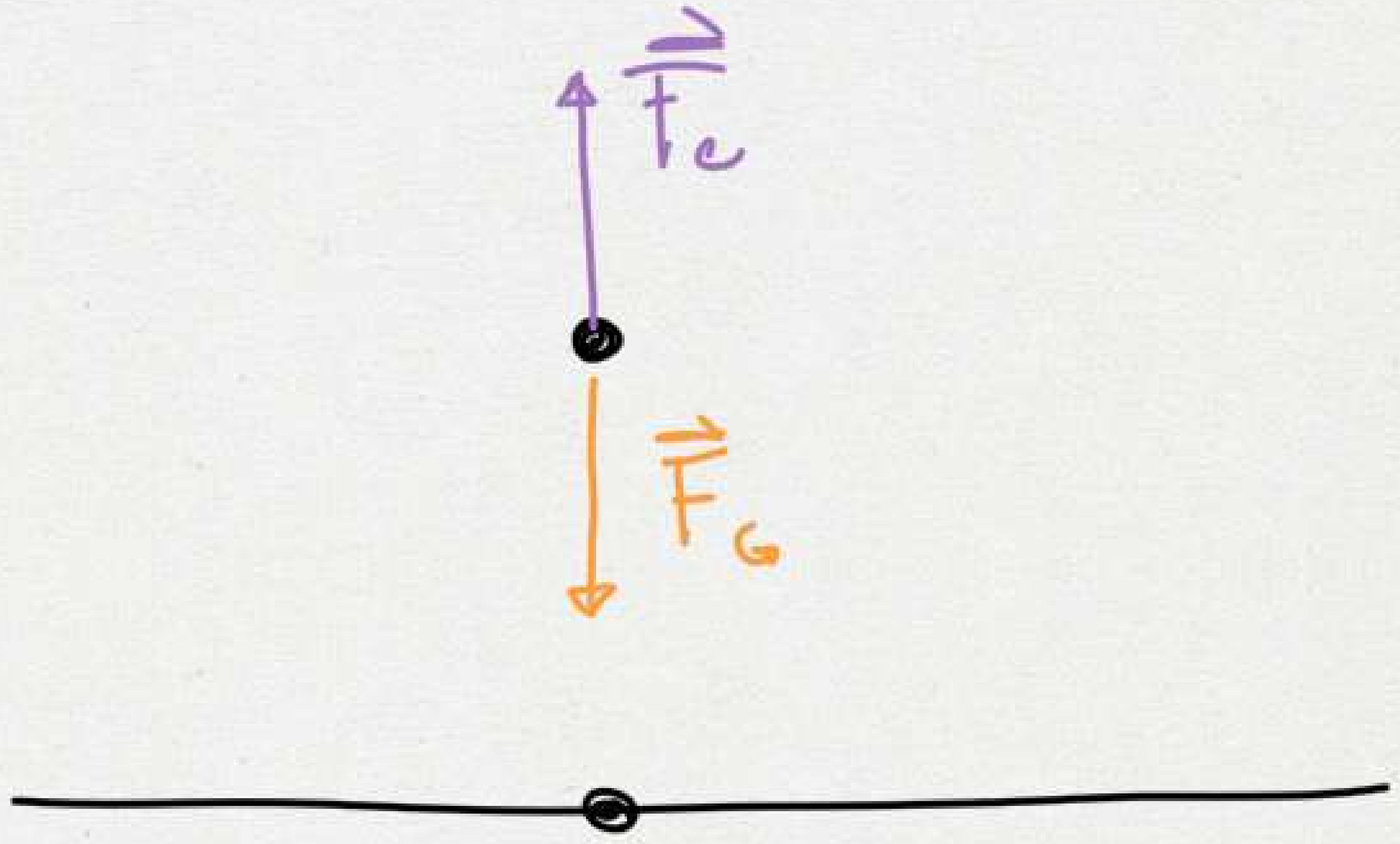
$$\begin{cases} T_x + F_e = 0 \\ T_y - mg = 0 \end{cases} \Rightarrow \begin{cases} -T\sin\theta + F_e = 0 & \Rightarrow T = \dfrac{F_e}{\sin\theta} \\ T\cos\theta - mg = 0 & \Rightarrow \dfrac{F_e}{tg\,\theta} = mg \Rightarrow \boxed{tg\,\theta = \dfrac{F_e}{mg}} \end{cases}$$

$$F_e = \frac{q q_0}{4\pi\varepsilon_0} \frac{1}{x_0^2}$$



il sistema è in equilibrio

1) scrivere la relazione che lega m e q
2) $h = 10^{-2}\,m$, $m = 3 \cdot 10^{-3}\,g$, $q = ?$
3) Quante cariche elementari "spostate" ci sono?



$$mg = F_e = \frac{q^2}{4\pi\varepsilon_0}\frac{1}{h^2}$$

ESERCIZI 3 E 4