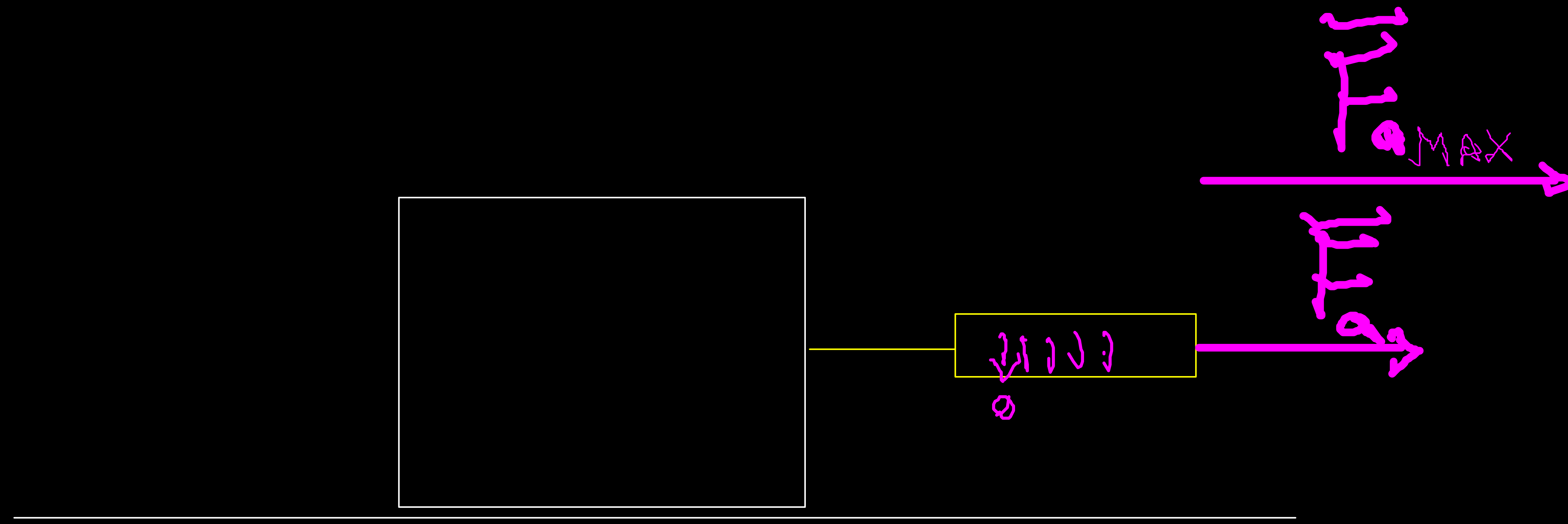
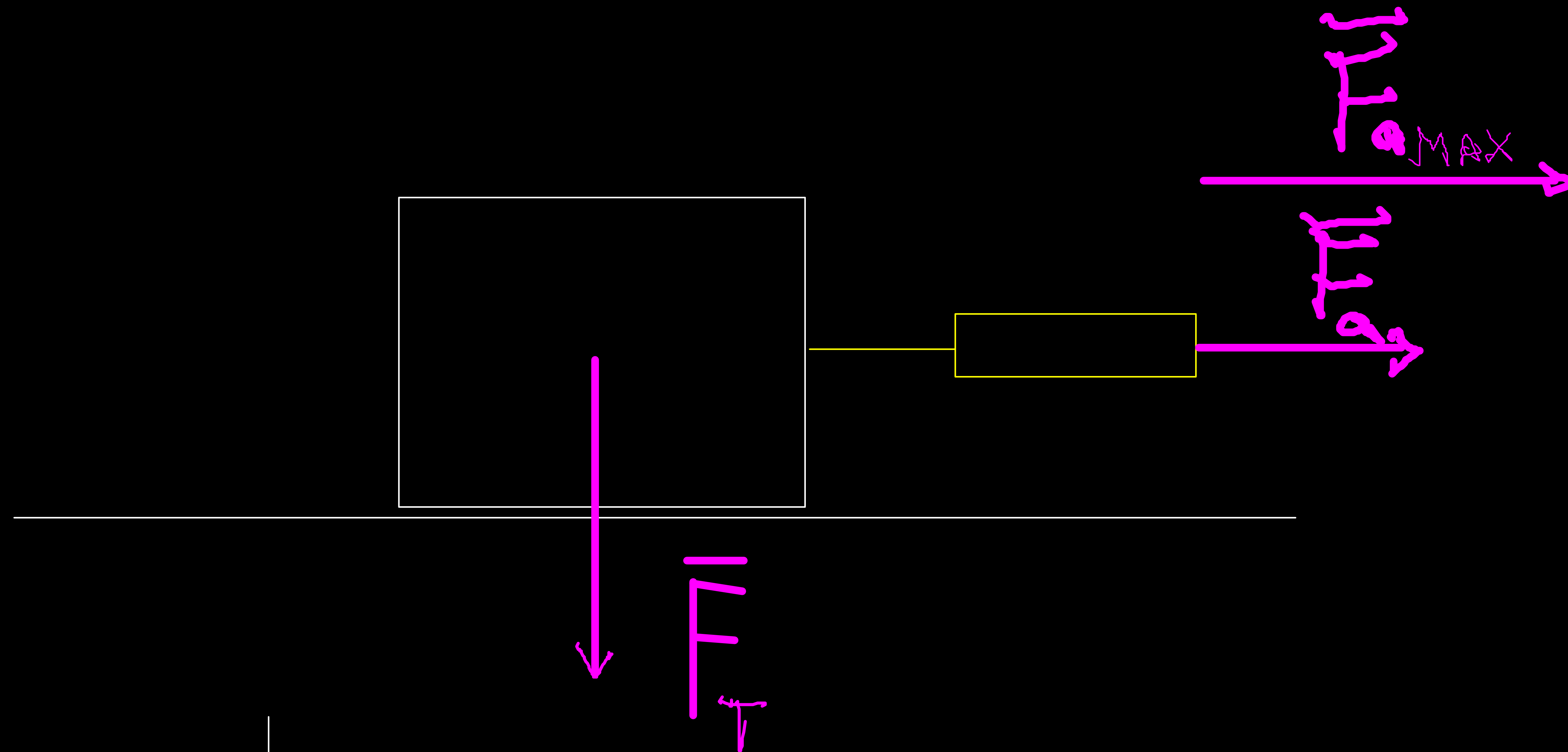
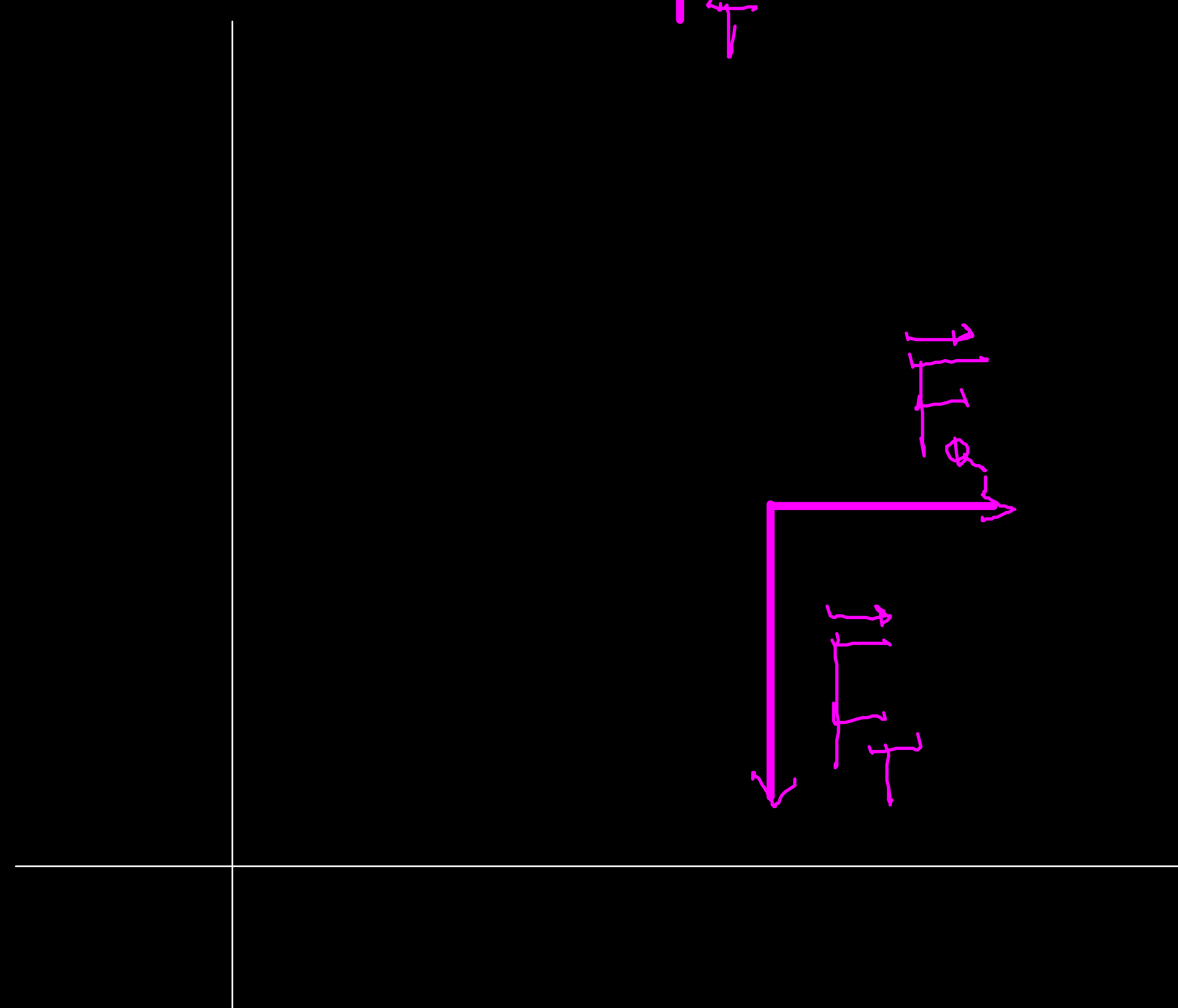
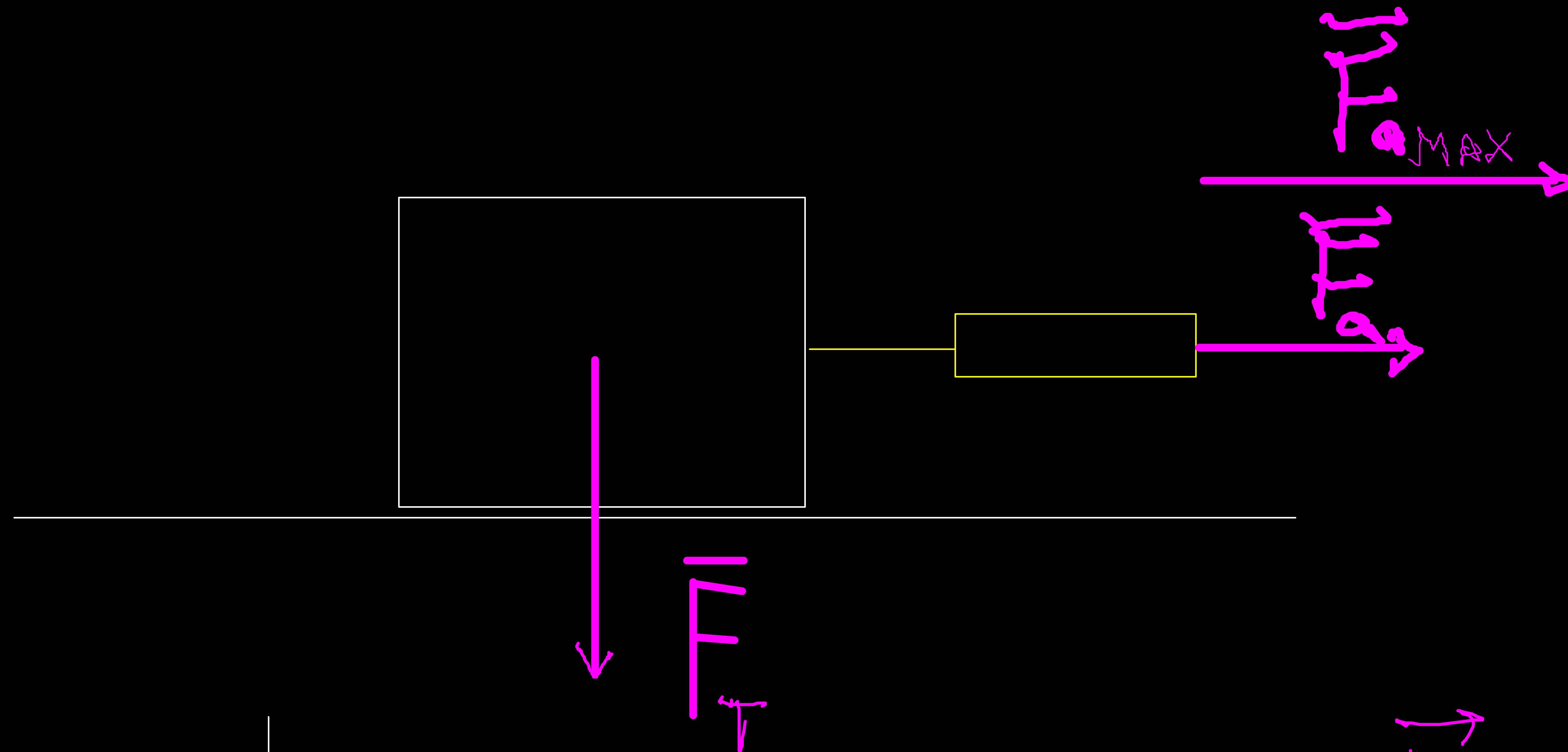
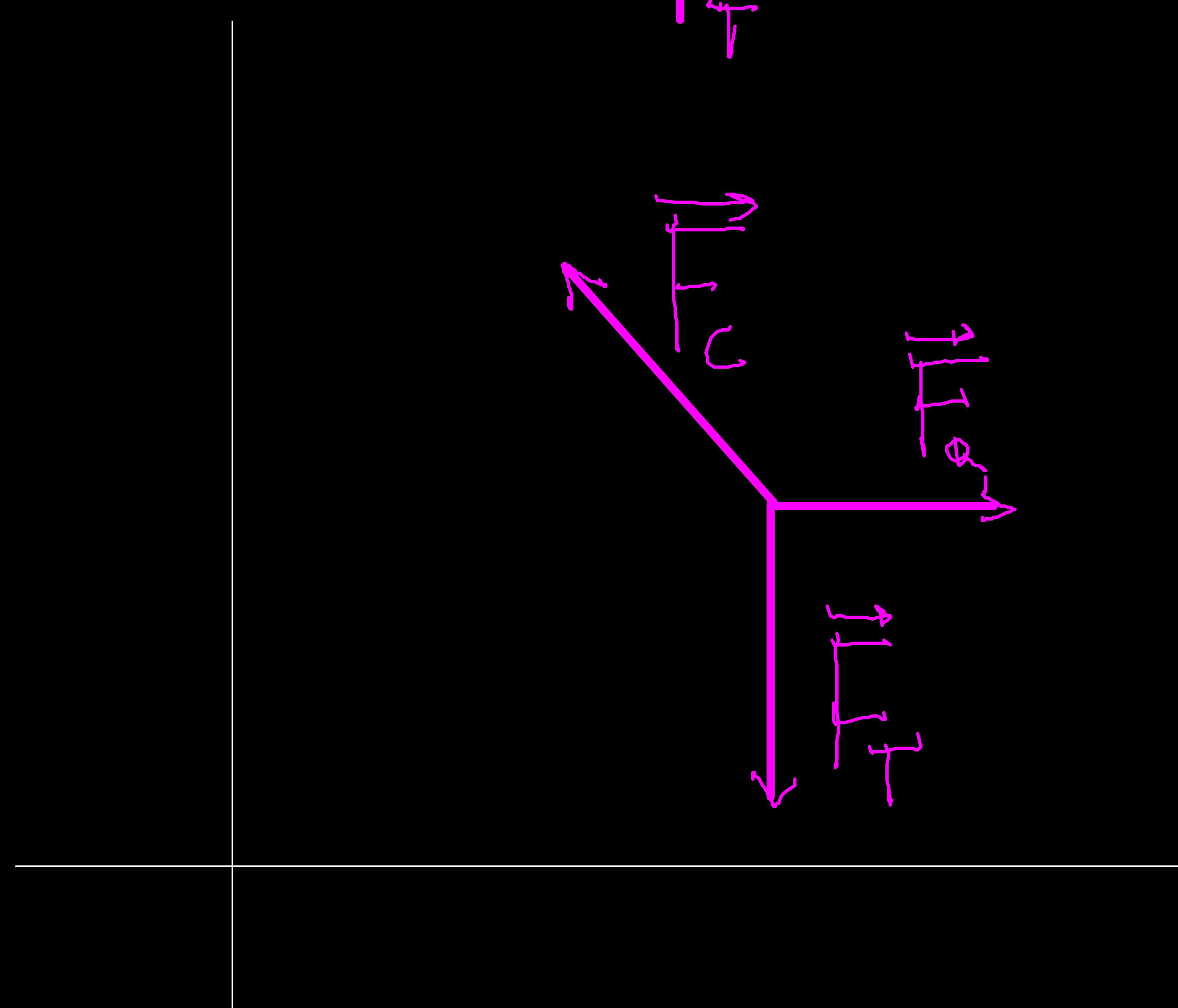


$\vec{F}_{a\,MAX}$
$\vec{F}_a$
0

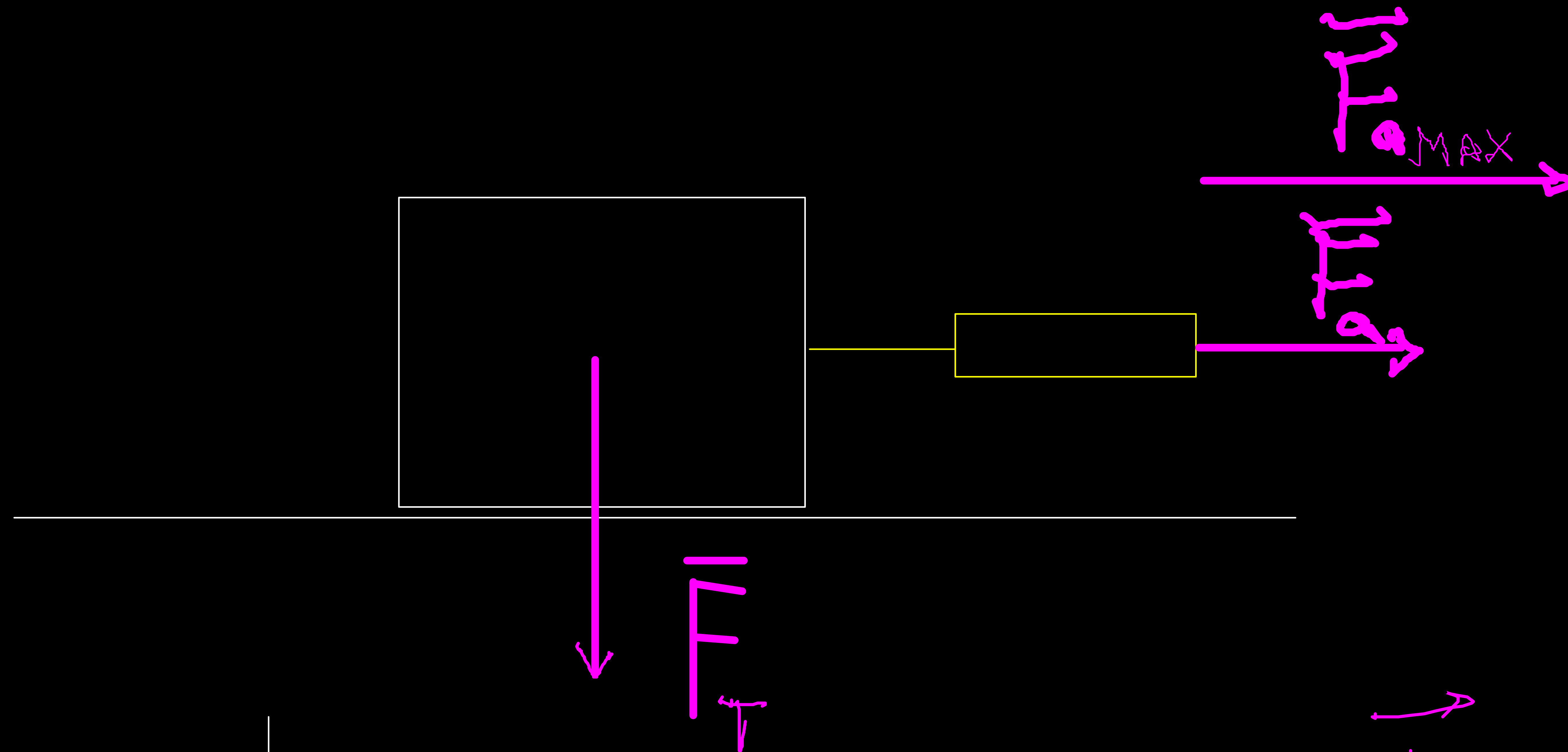

$\vec{F}_{a\,MAX}$
$\vec{F}_a$
$\vec{F}_T$

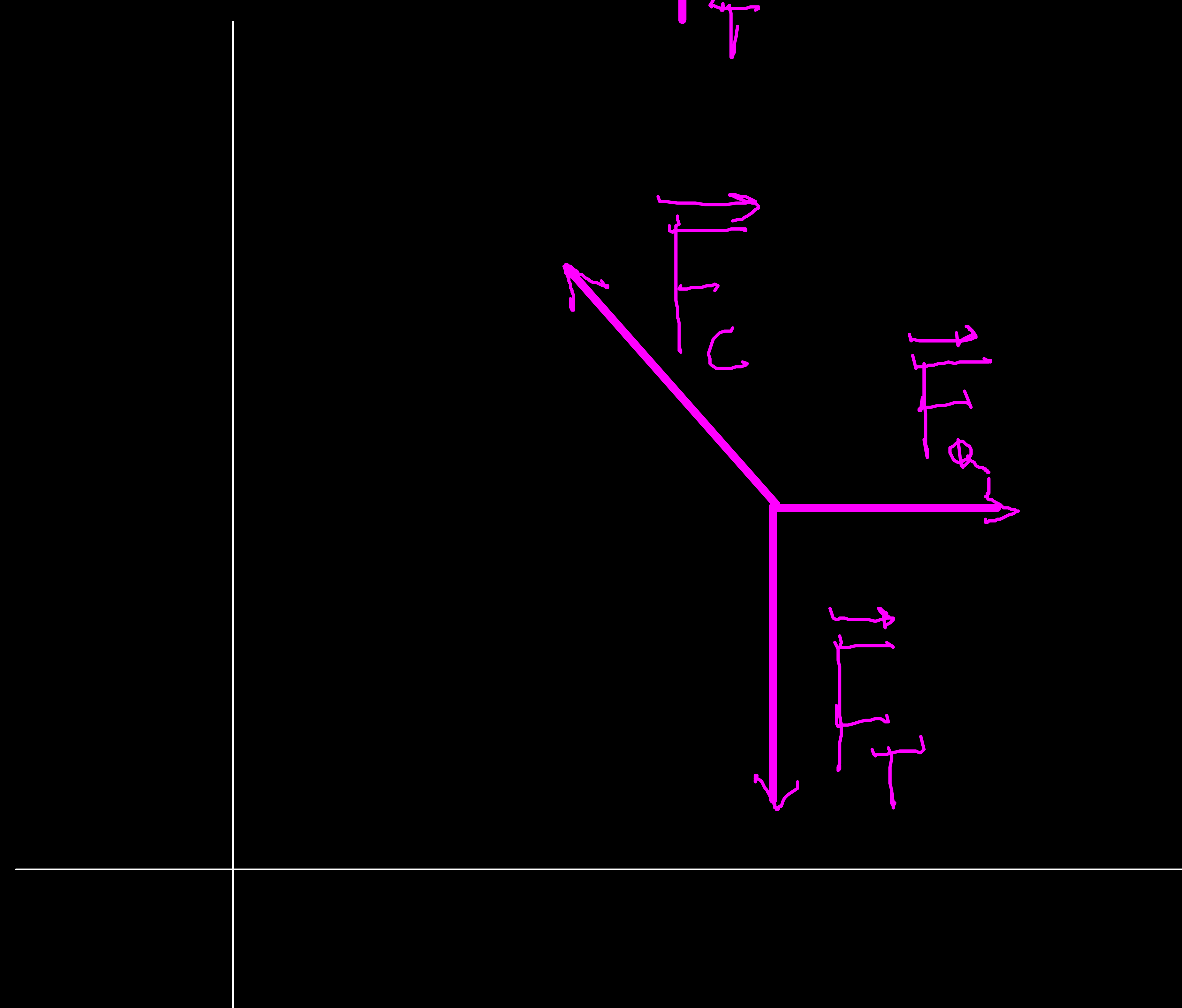

$\vec{F}_a$
$\vec{F}_T$





$\vec{F}_c$ tc $\sum \vec{F} = 0$

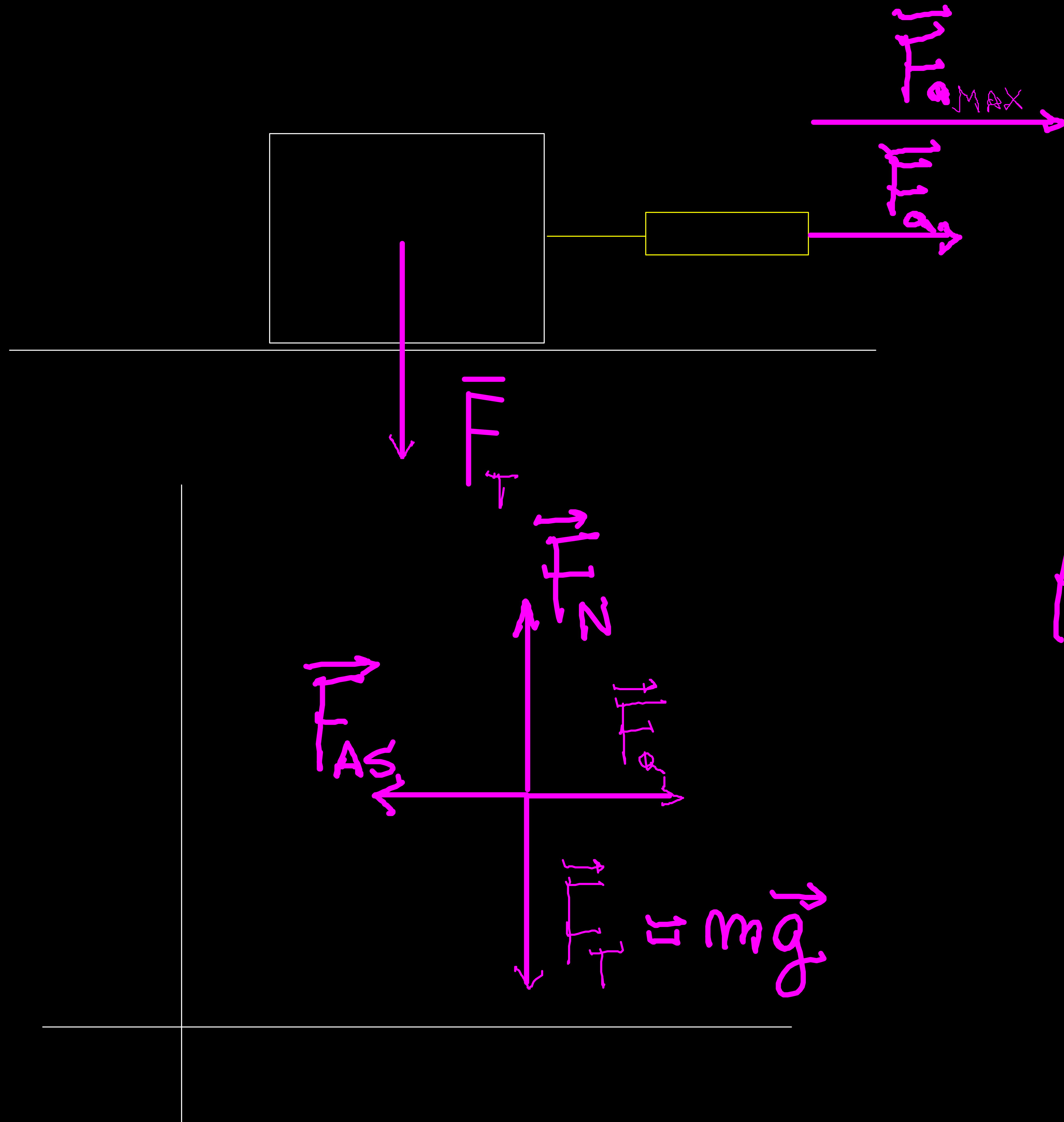




$$\vec{F}_C = \vec{F}_{as} + \vec{F}_N$$

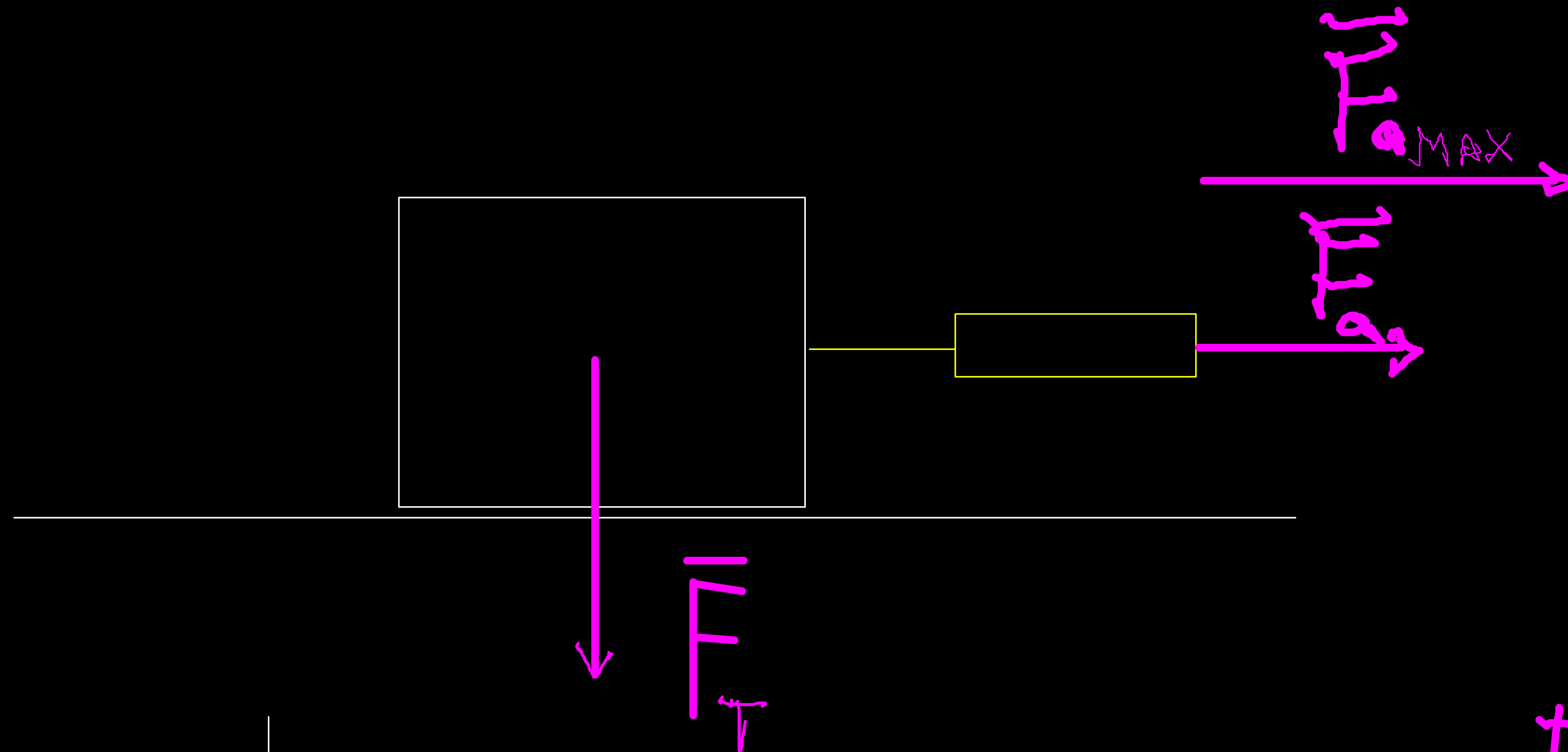
$//$ $\quad\quad\quad$ $\perp$

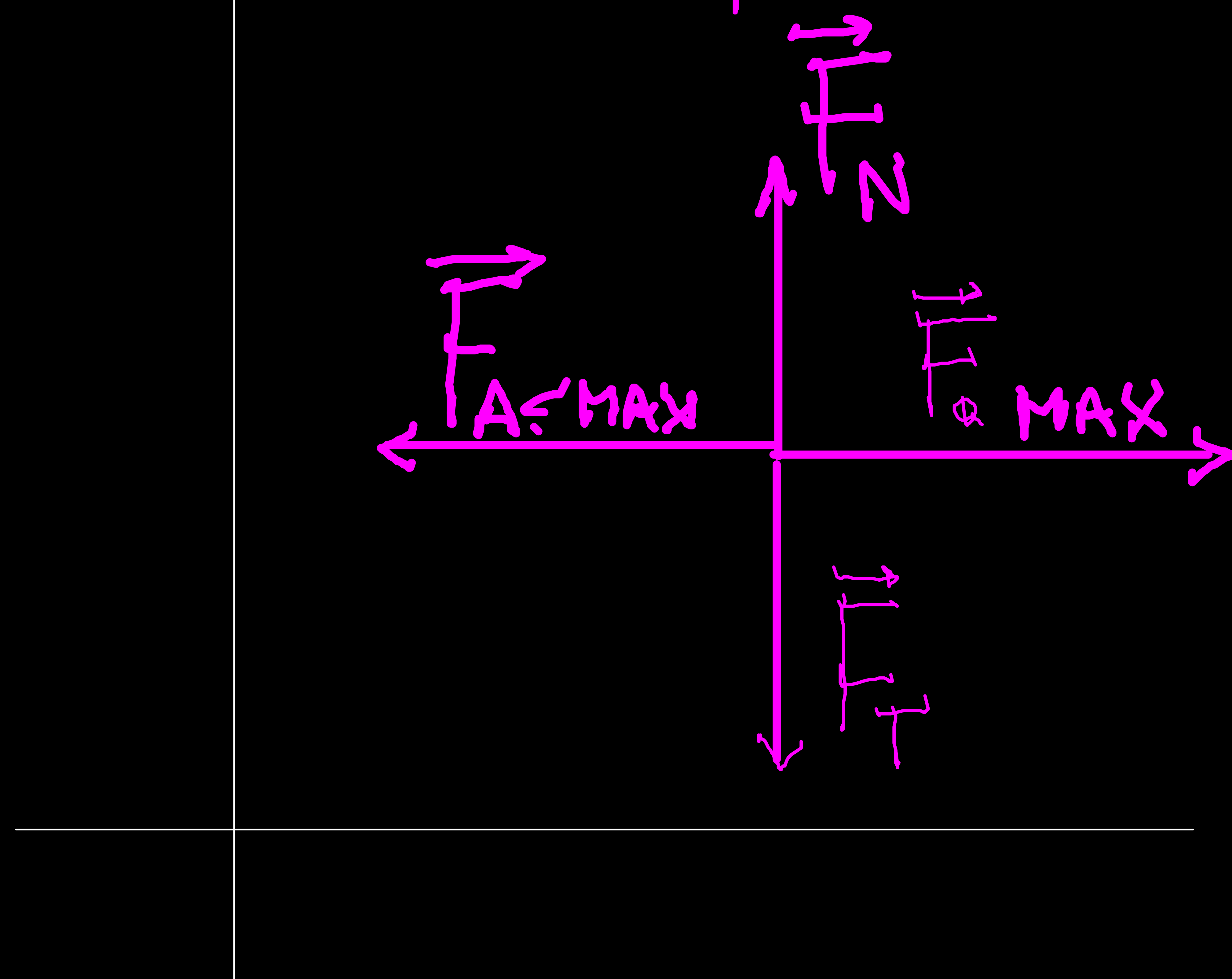
alla sup.



$$F_{AS} = F_a$$

$$F_N = mg$$



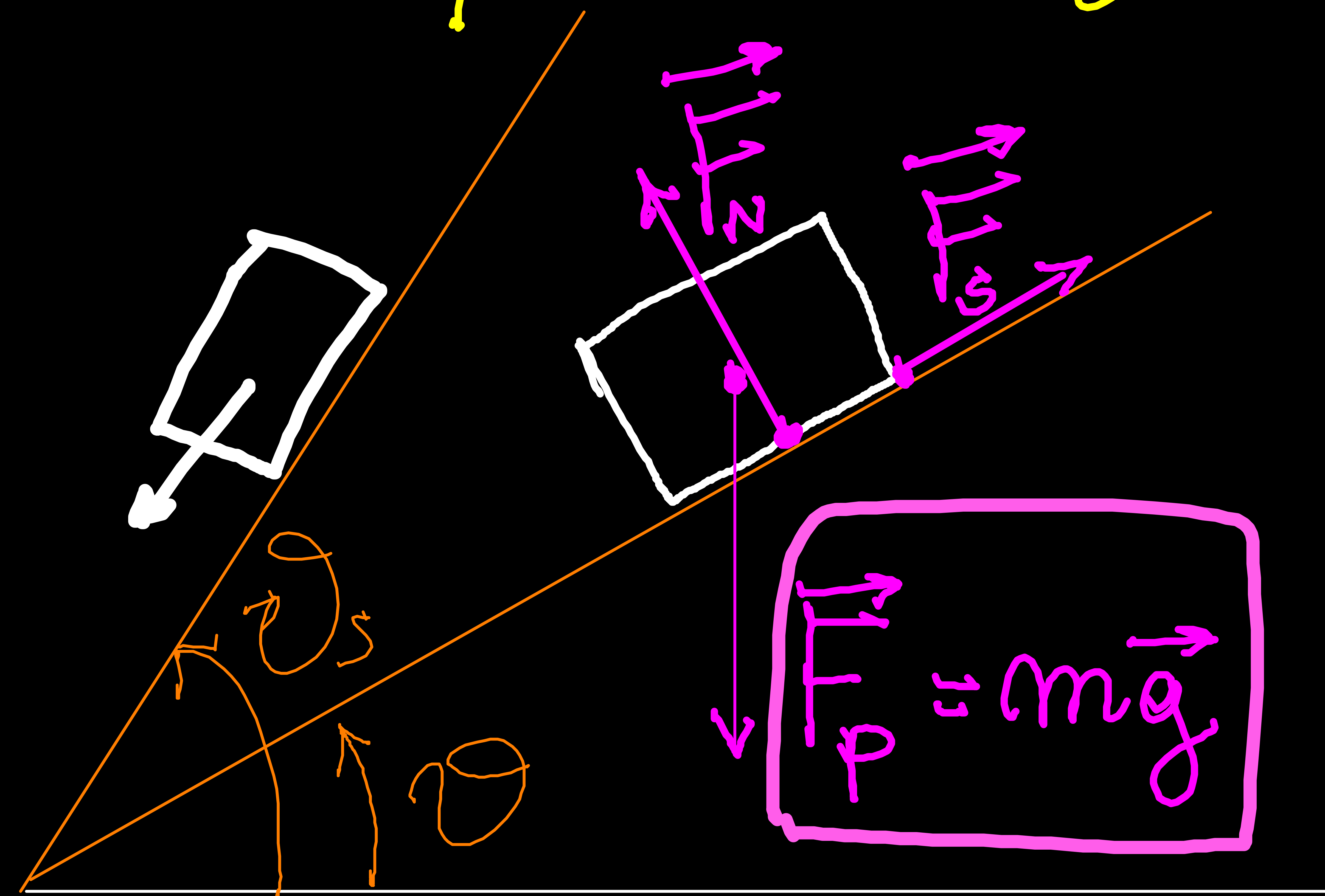


$$F_{As} = F_a \leq F_{As\,MAX}$$

$$\rightarrow F_{As\,MAX} = \mu_s F_N$$

$$\rightarrow F_{As} \leq \mu_s F_N$$

Es. 6.3 μ_s angolo critico

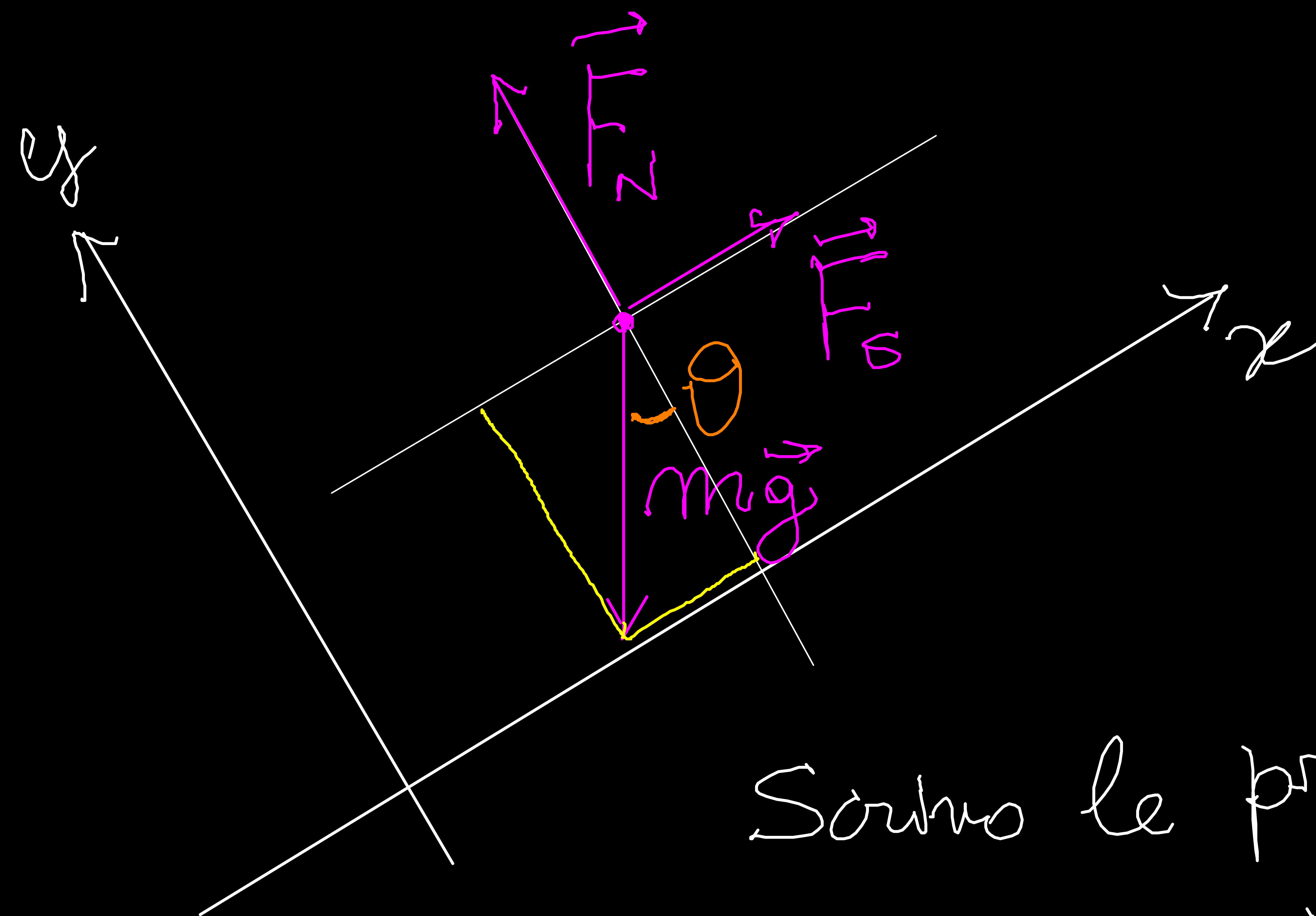


$\boxed{\vec{F}_p = m\vec{g}}$

$\vec{v} = 0$

$\Rightarrow \vec{a} = 0$

$\sum \vec{F} = 0$

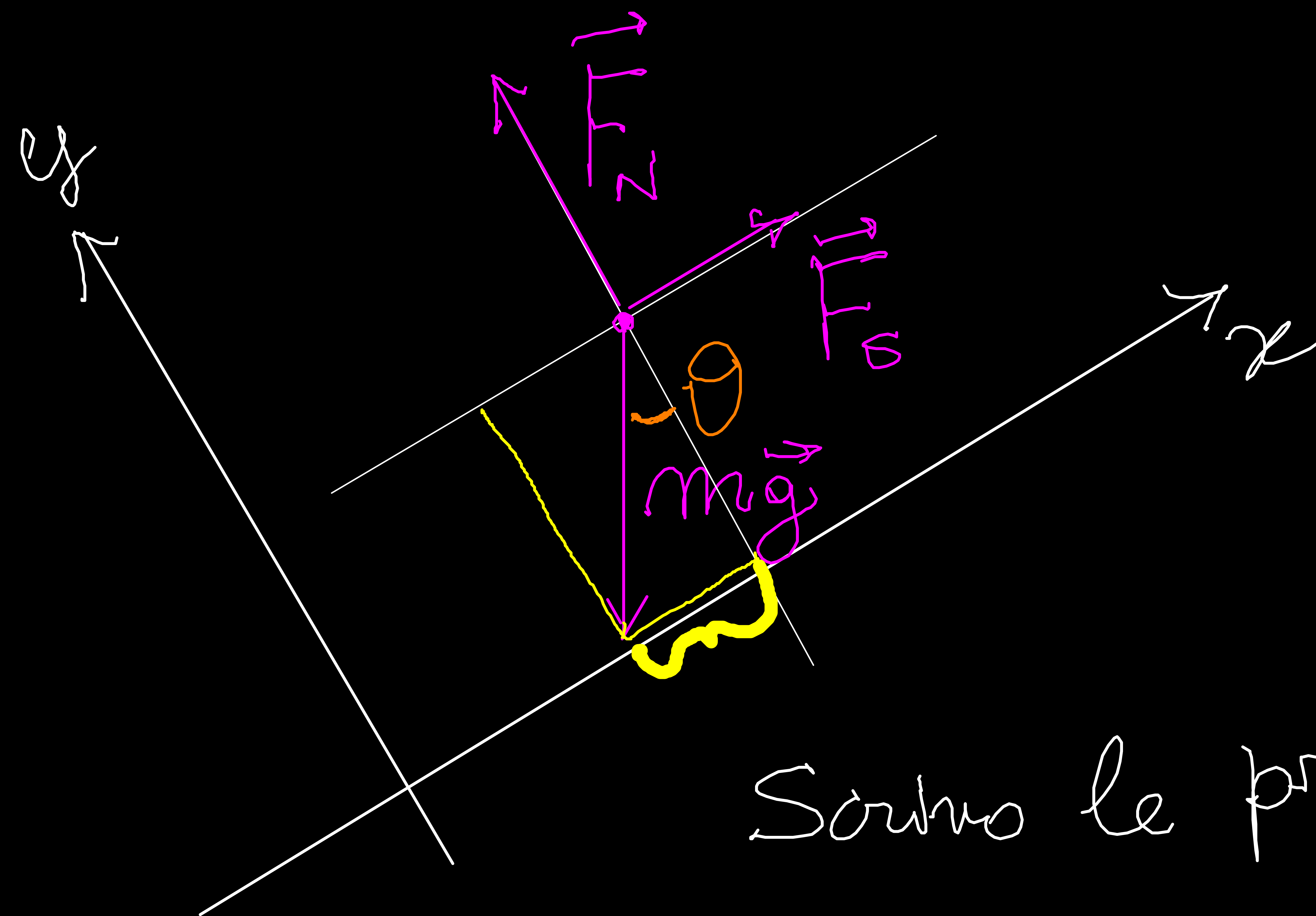


$$\vec{F}_p + \vec{F}_s + \vec{F}_N = 0$$

Scrivo le proiezioni Newton

lungo x $\quad F_{px} + F_{sx} + 0 = 0$

lungo y $\quad F_{py} + 0 + F_{Ny} = 0$



$$\vec{F}_P + \vec{F}_S + \vec{F}_N = 0$$

Scrivo le proiezioni Newton

lungo x $\quad -mg\,\text{sen}\,\theta + F_S = 0$

lungo y $\quad -mg\cos\theta + F_N = 0$

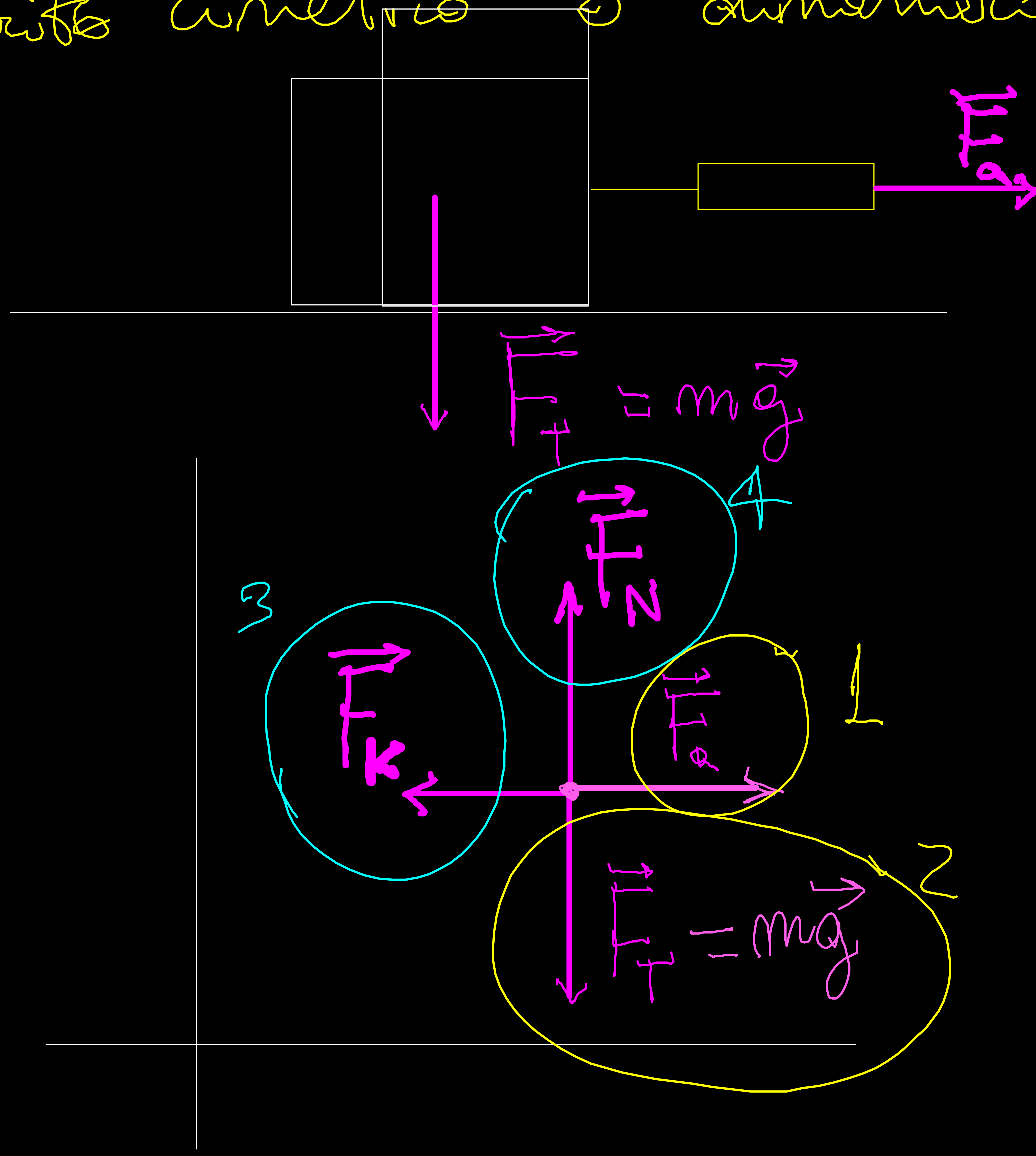
$$\rightarrow \begin{cases} F_S = mg\,\mathrm{sen}\,\vartheta \\ F_N = mg\cos\vartheta \end{cases}$$

per $F_S = F_{S\,MAX} = \mu_S F_N$

ad un angolo ϑ_S

$$\vartheta_S \quad \begin{cases} \mu_S F_N = mg\,\mathrm{sen}\,\vartheta_S \\ F_N = mg\cos\vartheta_S \end{cases} \rightarrow \mu_S = \mathrm{tg}\,\vartheta_S$$

Attrito cinetico o dinamico



$\boxed{\vec{v} \neq 0}$

$\vec{a} \neq 0$

Caso iniziale/limite semplificato $\vec{v} = cost$

$\vec{F}_a$ t.c. $\vec{v} = cost$

$\Rightarrow \vec{a} = 0$

$\sum \vec{F} = 0$

Se raddoppio m

moduli

$$F_K = \mu_K F_N$$

1) F_K o μ_K dipende natura e condizioni due superfici a contatto

2) " " " indipendente velocità (a basse velocità)

3) " " " indipendente dall'area della sup. cont.

Esperienza del parallelepipedo

4) valori di μ_K : $0.1 < \mu_K < 1$; casi partic. $\begin{cases} \mu_K < 0.1 \\ \mu_K > 1 \end{cases}$

5) $\boxed{\mu_S > \mu_K}$

Forze di attrito dovute ai fluidi

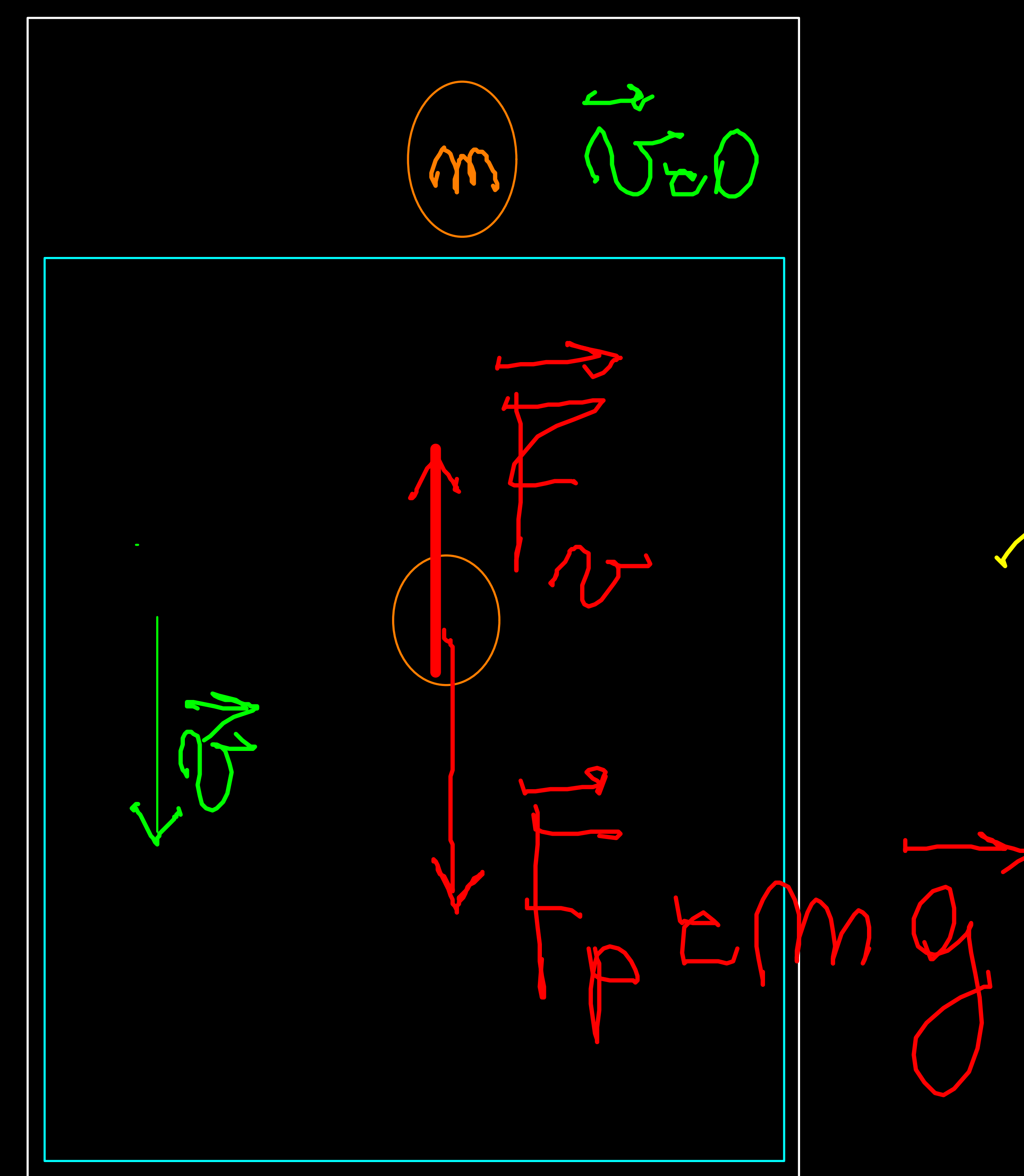
fluido tipo aria, acqua, olio $\boxed{\vec{v}}$

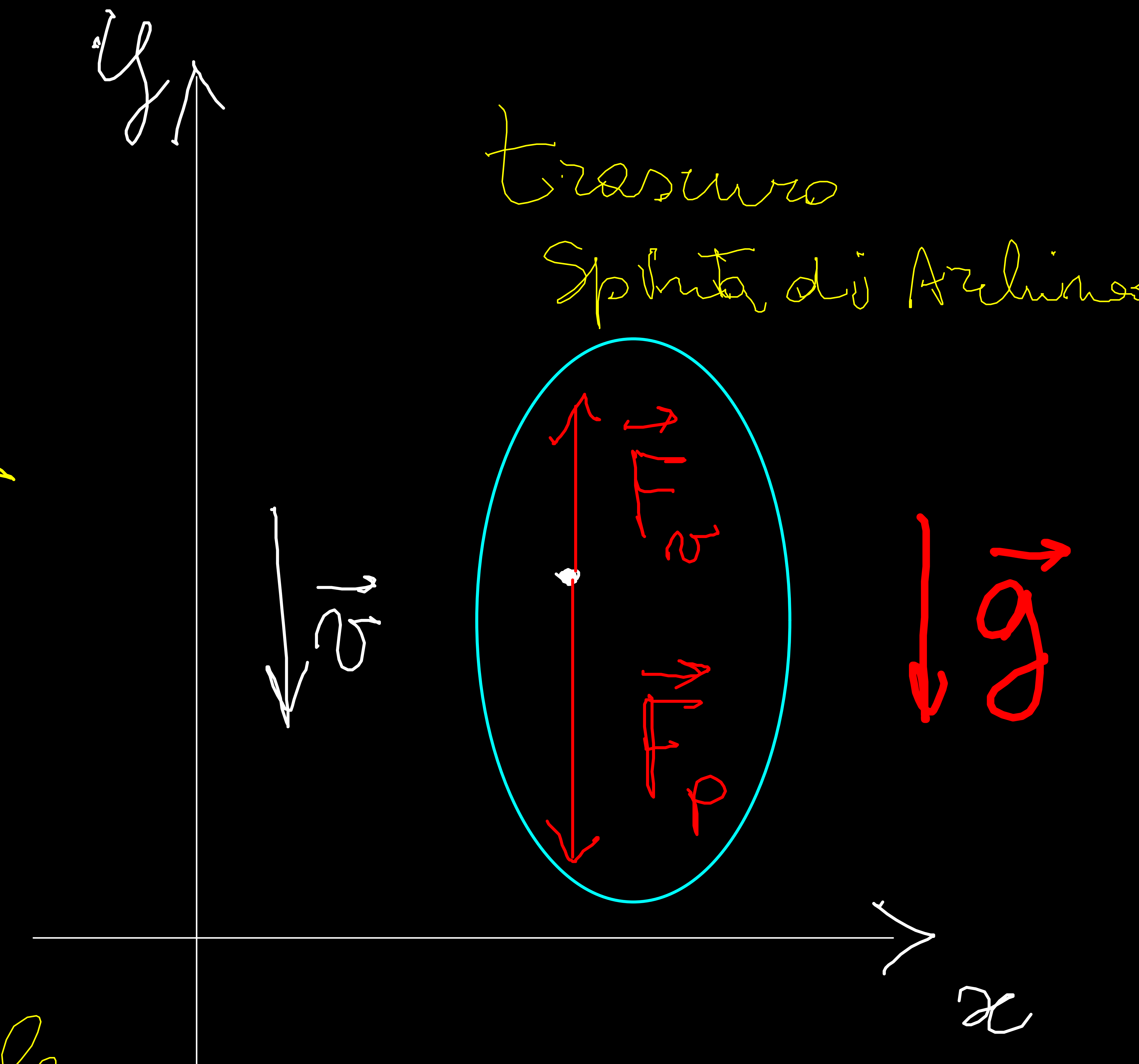
forza viscosa o resistenza viscosa

o forza frenante

dipende forma del corpo,

In prima approx $\vec{F}_v = -b\vec{v}$





Sistema rif. inerziale

$$\sum \vec{F} = m\vec{a}$$

$$\vec{F}_v + \vec{F}_p = m\vec{a}$$

eq. moto

lo proiettile lungo y

$$F_{vy} + F_{py} = m a_y \quad \text{eq. scalare}$$

$$\underbrace{-b v_y}_{\substack{\text{positiva} \\ \text{quando il corpo} \\ \text{scende}}} \underbrace{- mg}_{\text{negativa}} = m a$$

corretta perché negativa se il corpo sale lo proietto lungo y

$$F_{v\,y} + F_{p\,y} = m\, a_y \qquad \text{eq. scalare}$$

$$-b v_y - mg = m\, a_y \qquad /m$$

$$-\frac{b}{m} v_y - g = \frac{d v_y}{dt} \qquad \text{eq. diff}$$

$v_y(t)$

incognita

$$\frac{dv_y}{dt} = -g\left(\frac{b}{mg}v_y + 1\right)$$

$$\int \frac{dv_y}{\left(1 + \frac{b}{mg}v_y\right)} = \int -g\,dt$$

guardo app.

$$\frac{1}{\frac{b}{mg}} \ln\left(1 + \frac{b}{mg}v_y\right) =$$

$$\int \frac{dx}{a+b'x} = \frac{1}{b'}\ln(a+b'x)$$

$$\frac{dv_y}{dt} = -g\left(\frac{b}{mg}v_y + 1\right)$$

$$\int_{v_0=0}^{v_y(t)} \frac{dv_y}{\left(1 + \frac{b}{mg}v_y\right)} = \int_{t=0}^{t} -g\,dt$$

$$\left[\frac{1}{\frac{b}{mg}}\ln\left(1 + \frac{b}{mg}v_y\right)\right]_{v=0}^{v(t)} = \Big[-gt\Big]_0^t$$

$$\frac{dv_y}{dt} = -g\left(\frac{b}{mg} v_y + 1\right)$$

$$\int \frac{dv_y}{\left(1 + \frac{b}{mg} v_y\right)} = \int -g \, dt$$

$$e^{\left[\ln\left(1 + \frac{b}{mg} v_y(t)\right)\right]} = e^{\left[-\frac{b}{m} t\right]}$$

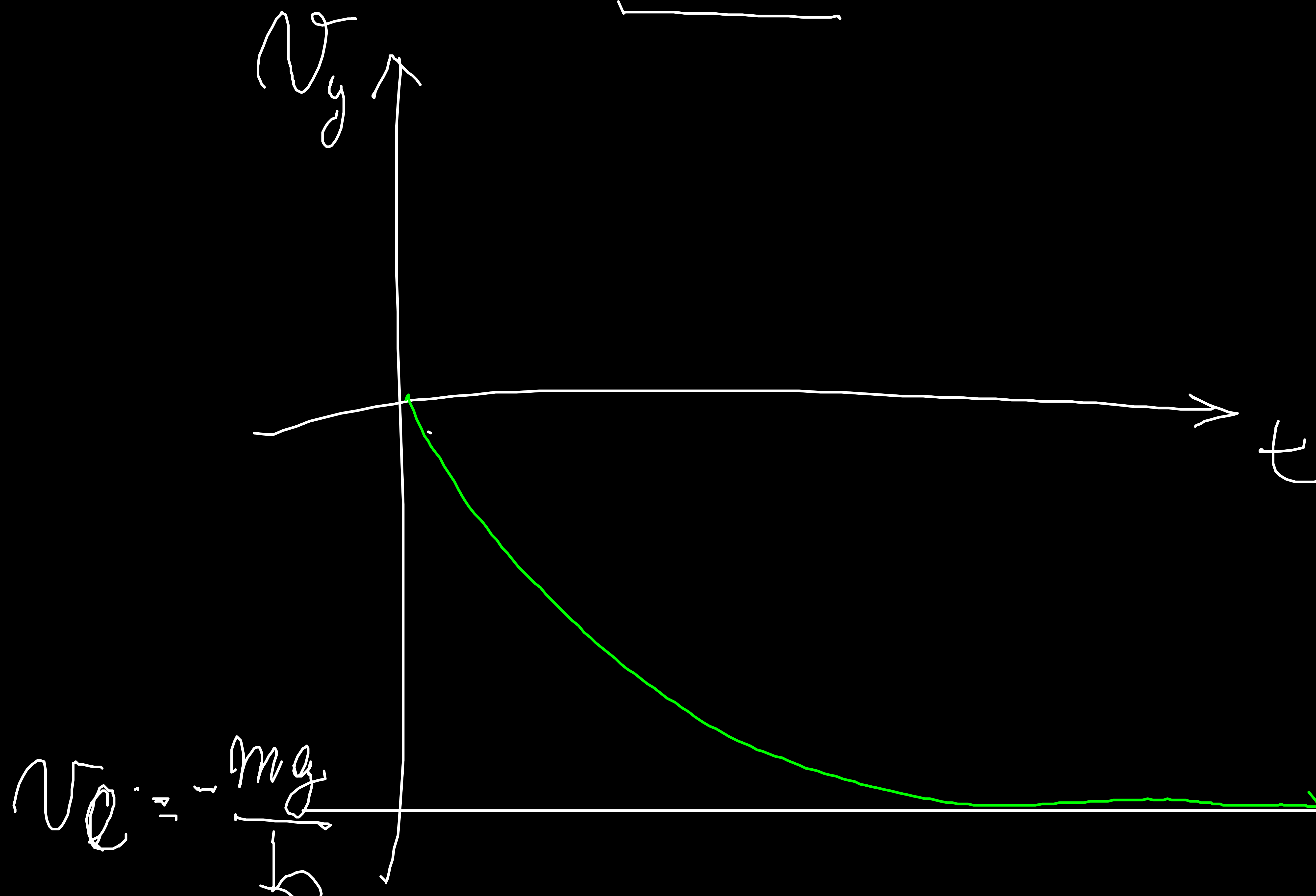
$$\frac{dv_y}{dt} = -g\left(\frac{b}{mg}v_y + 1\right)$$

$$\int \frac{dv_y}{\left(1 + \frac{b}{mg}v_y\right)} = \int -g\,dt$$

$$1 + \frac{b}{mg}v_y(t) = e^{\left[-\frac{b}{m}t\right]}$$

$$\uparrow$$

$$v_y = \frac{mg}{b}\left[e^{-\frac{b}{m}t} - 1\right]$$



$$\frac{dv_y}{dt} = -g\left(\frac{b}{mg}v_y + 1\right)$$

$$\int \frac{dv_y}{\left(1 + \frac{b}{mg}v_y\right)} = \int -g\,dt$$