

(Q)

Equation :

$$b\dot{\Theta} + mgl\sin\Theta = \Gamma$$

To reduce to:

$$\Theta' = \gamma - \sin\Theta$$

$$\Rightarrow \frac{b}{mgl} \dot{\Theta} + \sin\Theta = \frac{\Gamma}{mgl}$$

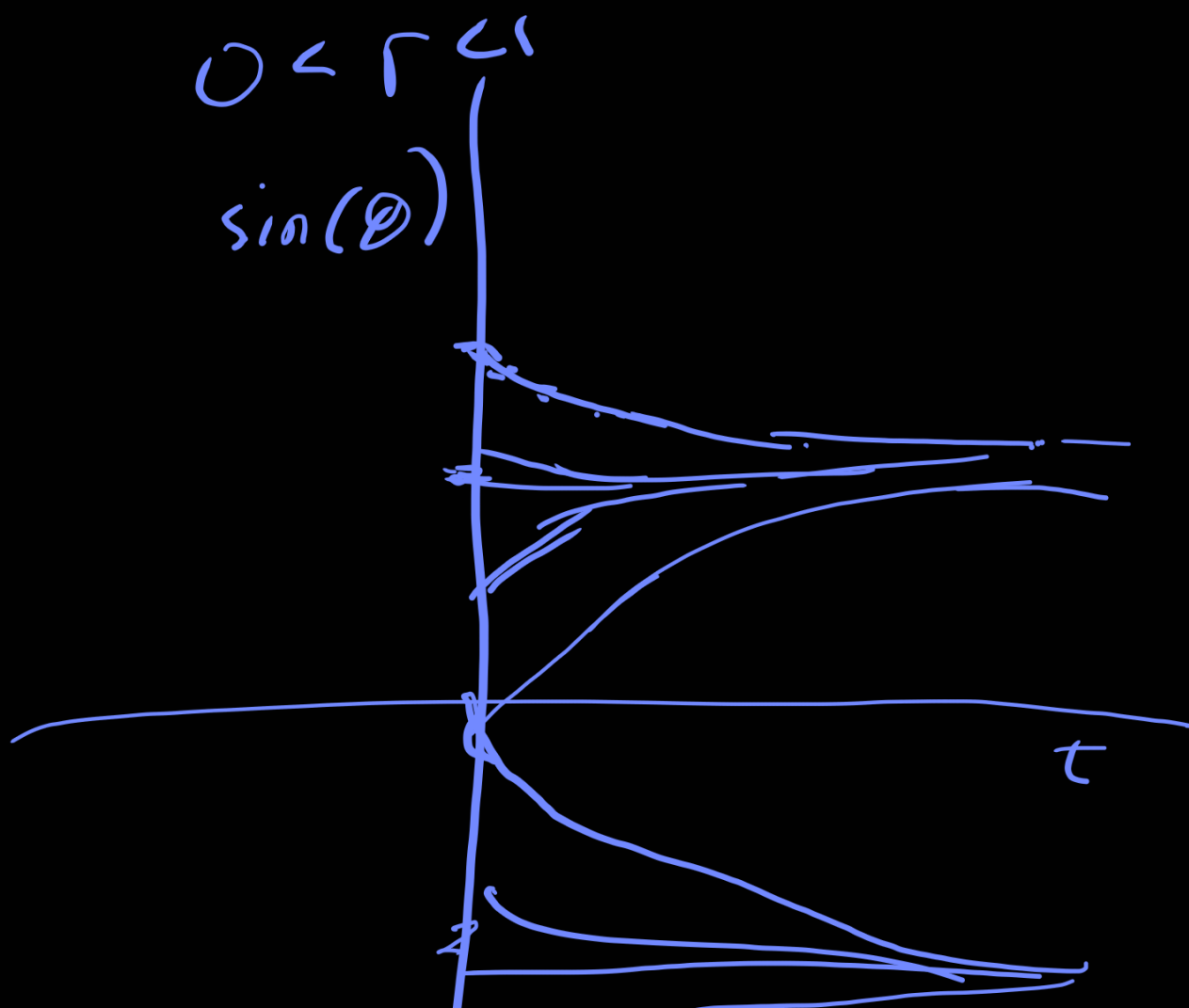
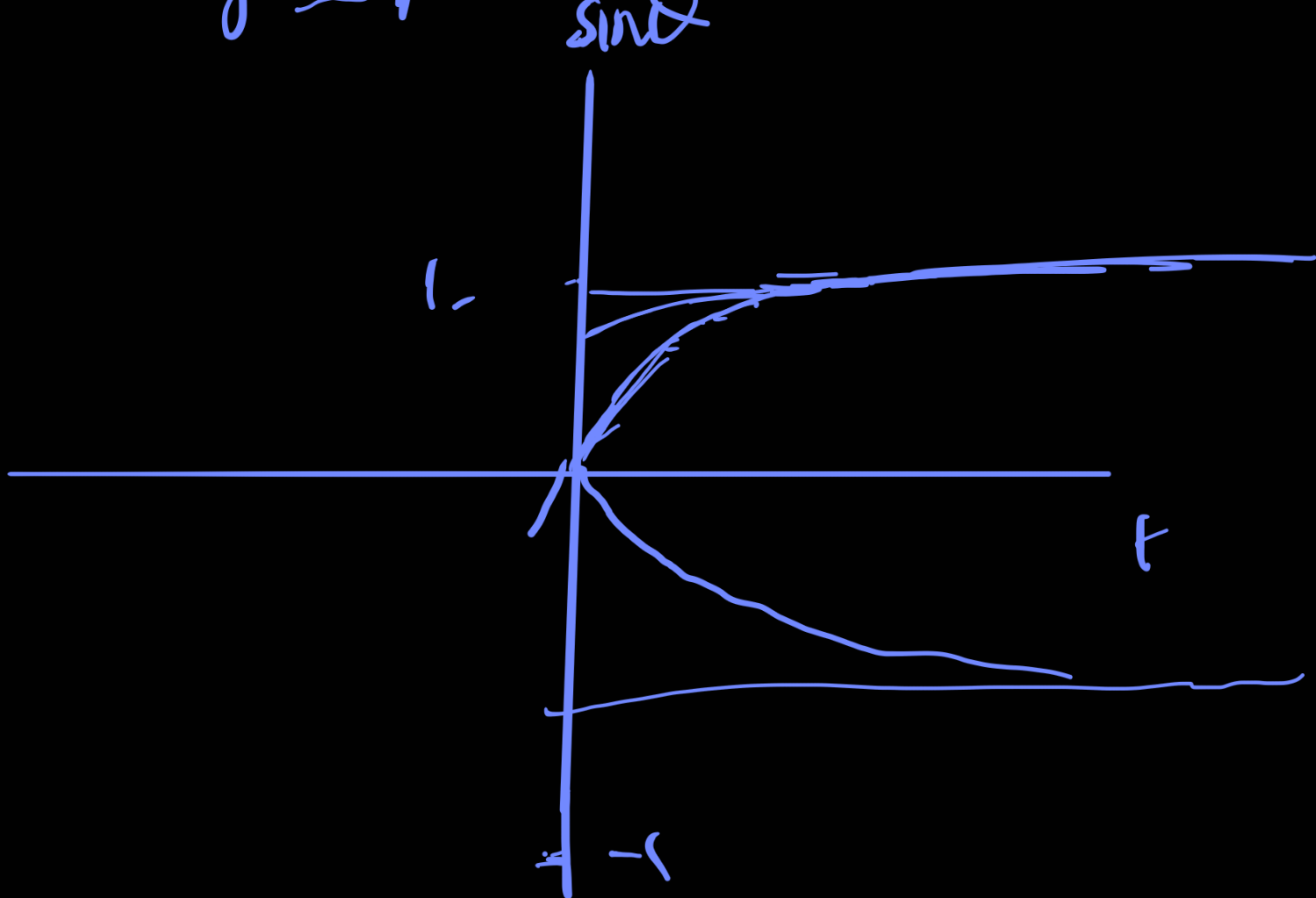
$$\frac{b}{mgl} \frac{d\Theta}{dt} = \frac{\Gamma}{mgl} - \sin\Theta$$

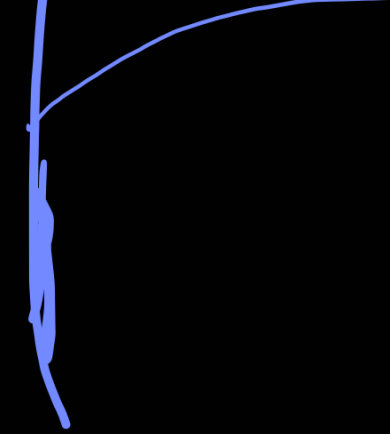
Take: $z = \frac{mgl}{b}t$, $\gamma = \frac{\Gamma}{mgl}$

$$\Rightarrow \frac{d\Theta}{dz} = \gamma - \sin\Theta$$

(b)

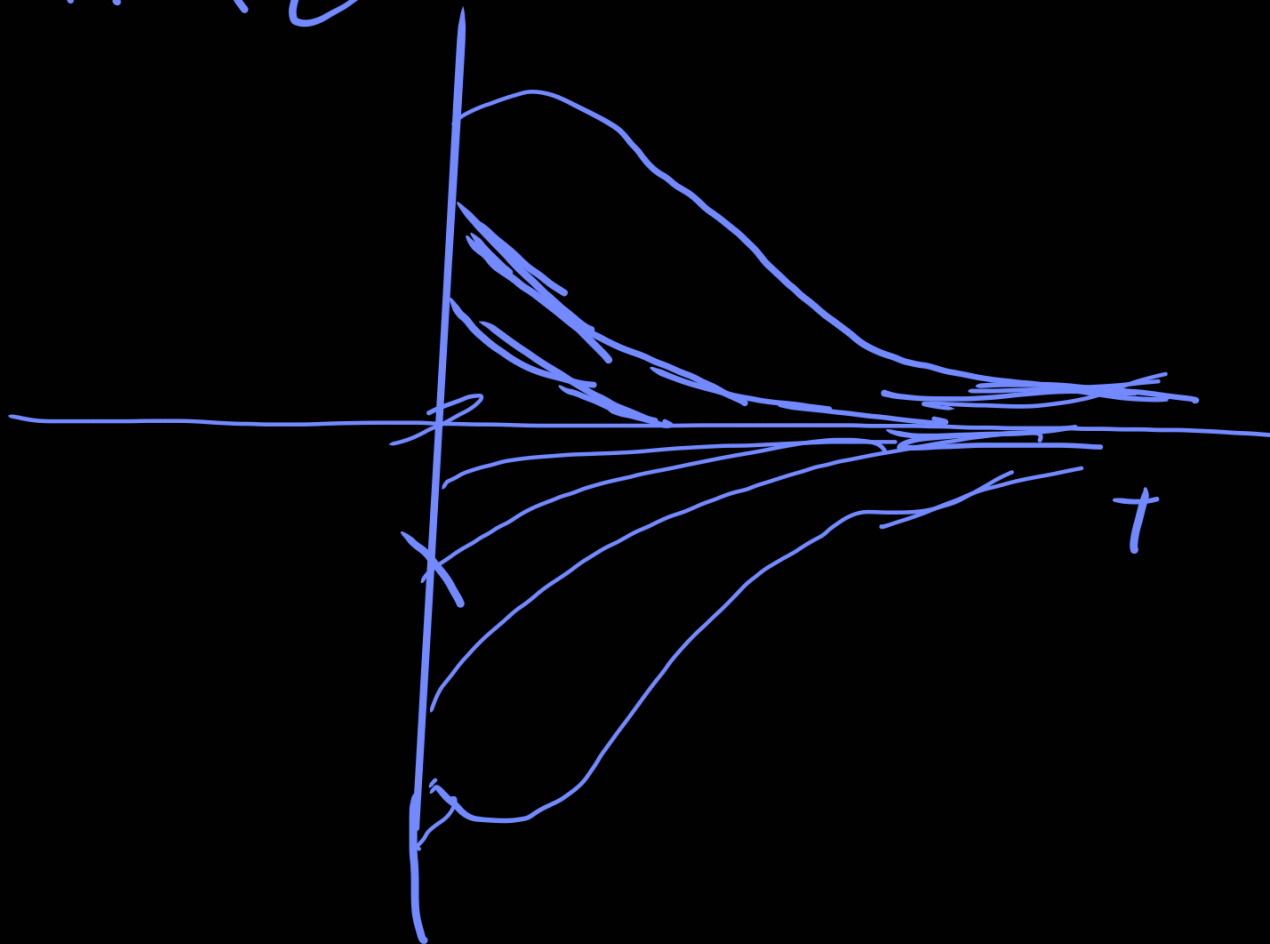
$x \approx 1$ and





$$y < 1$$

$$\sin(\theta)$$

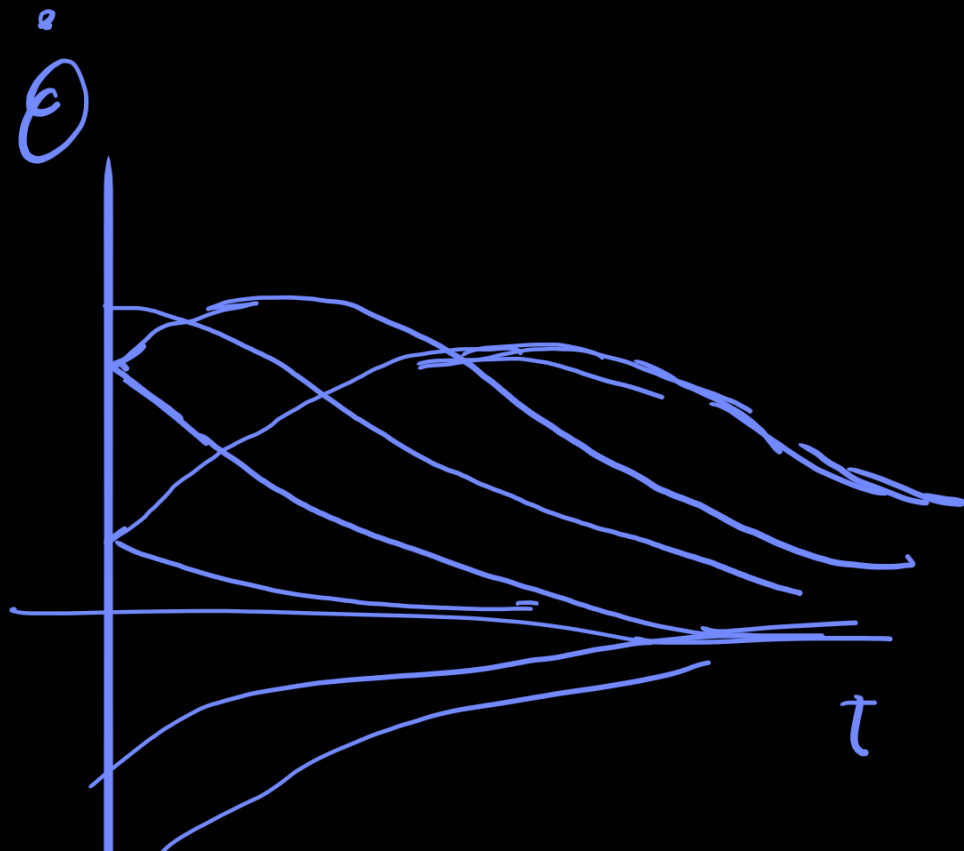


c) Torque due to gravity
is proportional to $\sin \theta$

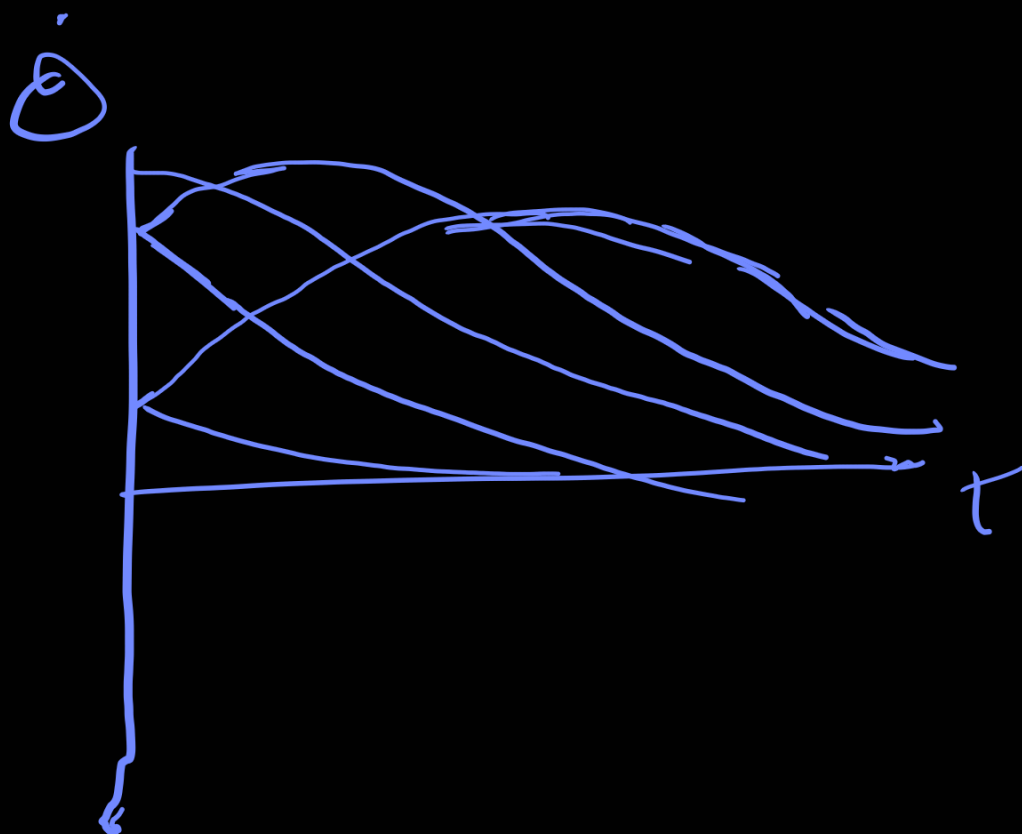
d)

For $\dot{\theta}$ vs t

$$l > r > 0$$



$$\gamma \approx 1$$



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