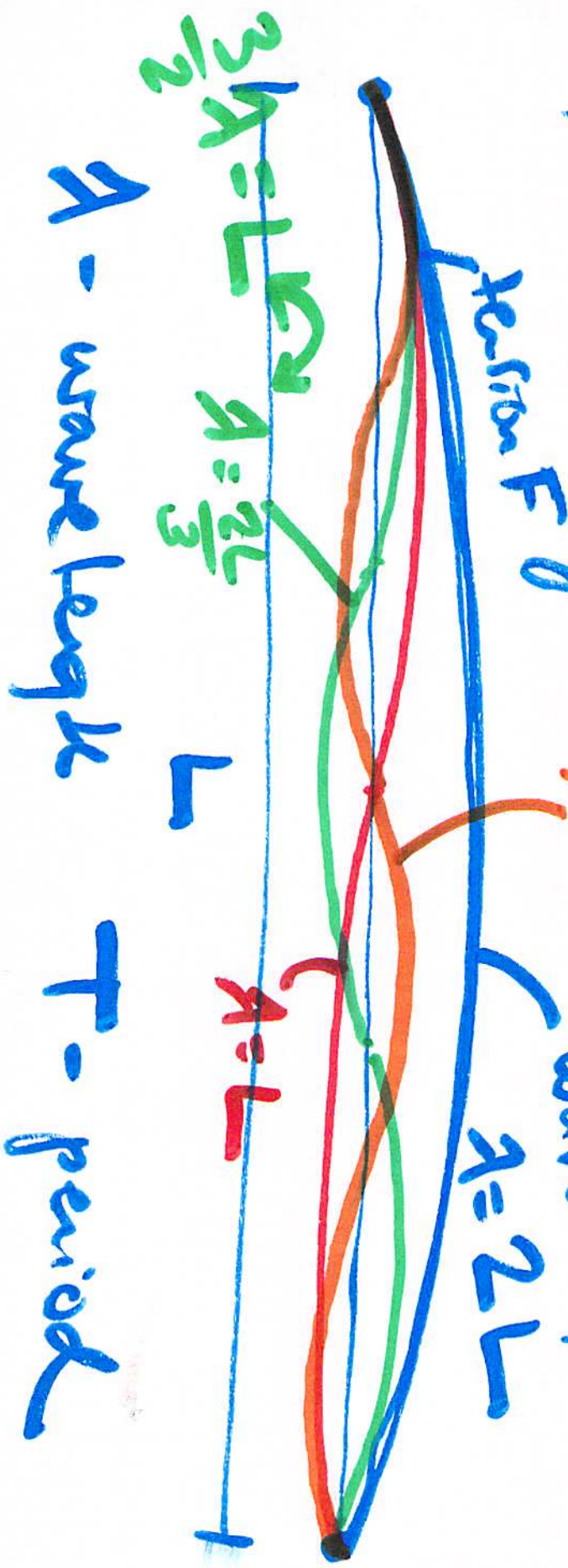


$$T = \frac{\text{time}}{\text{cycle}}$$

$$f = \frac{\text{cycle}}{\text{time}} = \frac{1}{T}$$

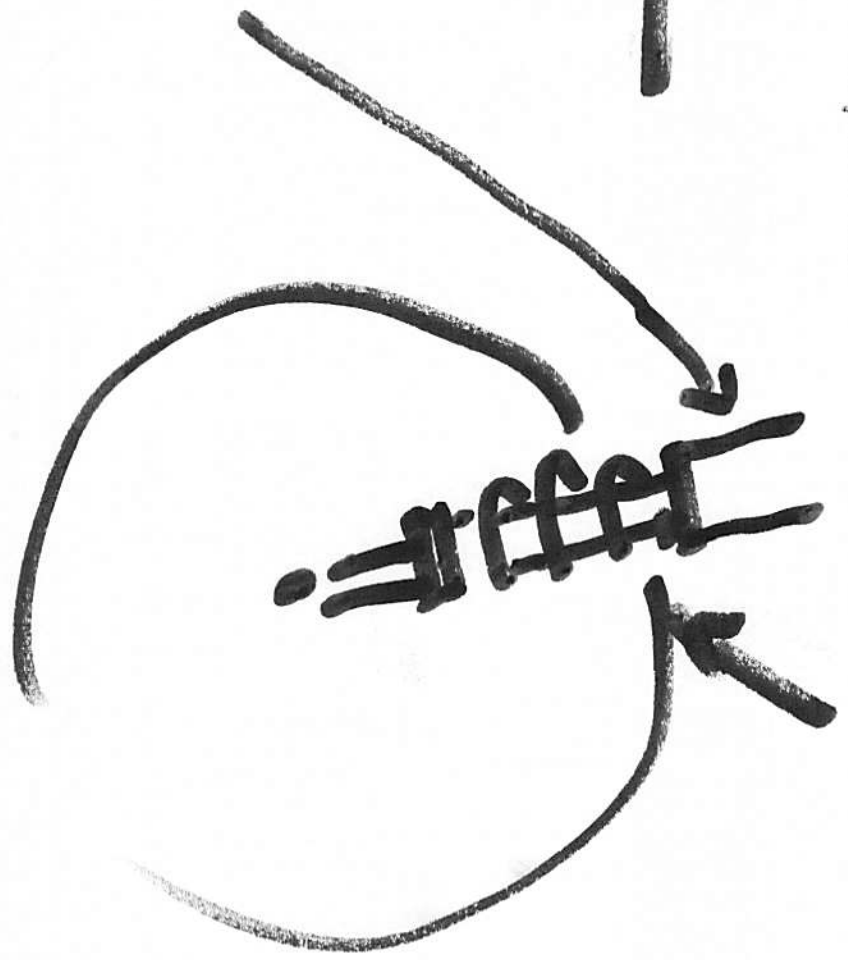
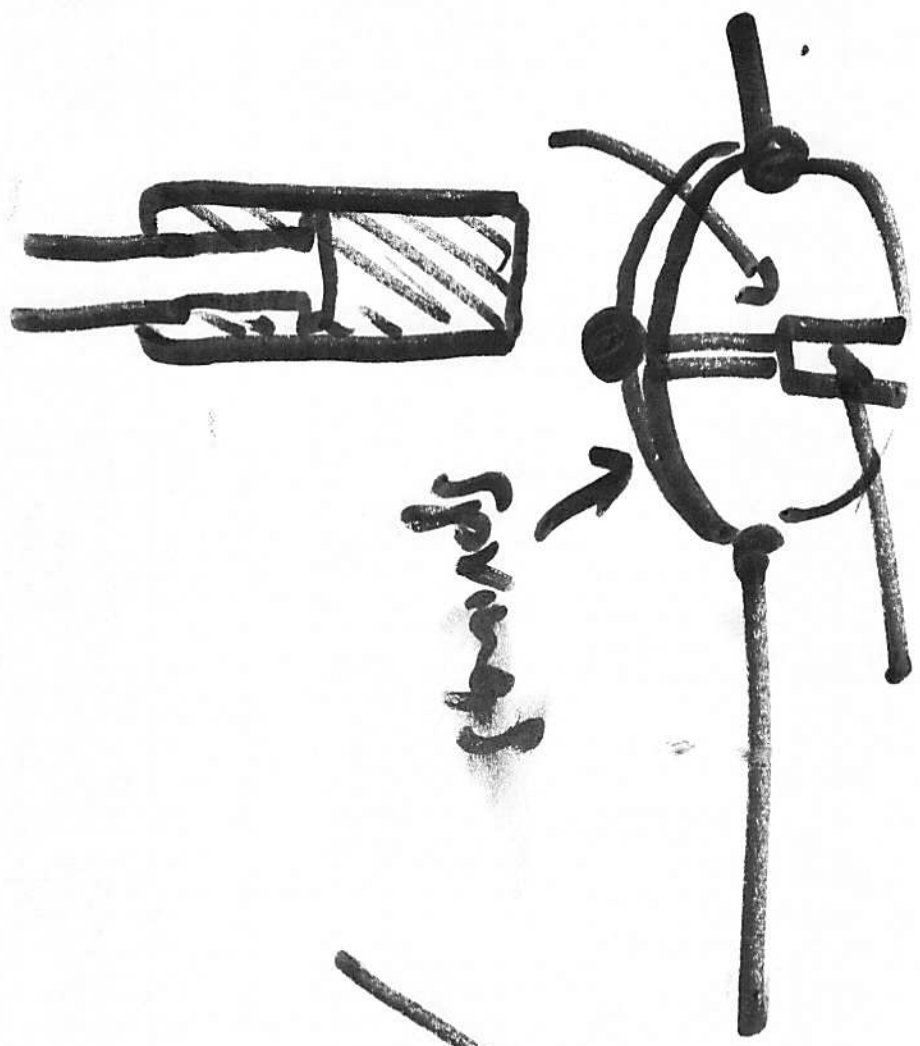
Piano string: $f = \frac{v}{\lambda}$ wave length



$$\frac{\lambda}{T} = C_s - \text{speed of } \text{str} \text{ wave}$$

$$C_s = \sqrt{\frac{FL}{M}}$$

Water-M-F-Oil



recall

$$m \frac{d^2 x}{dt^2} = -kx$$

$$ma = -kx = F_{\text{spring}}$$

$$\left\{ m \frac{d^2 x}{dt^2} = -kx - \beta \frac{dx}{dt} \right\} \left. \begin{array}{l} \text{general} \\ \text{2nd order} \\ \text{homogeneous} \end{array} \right\}$$

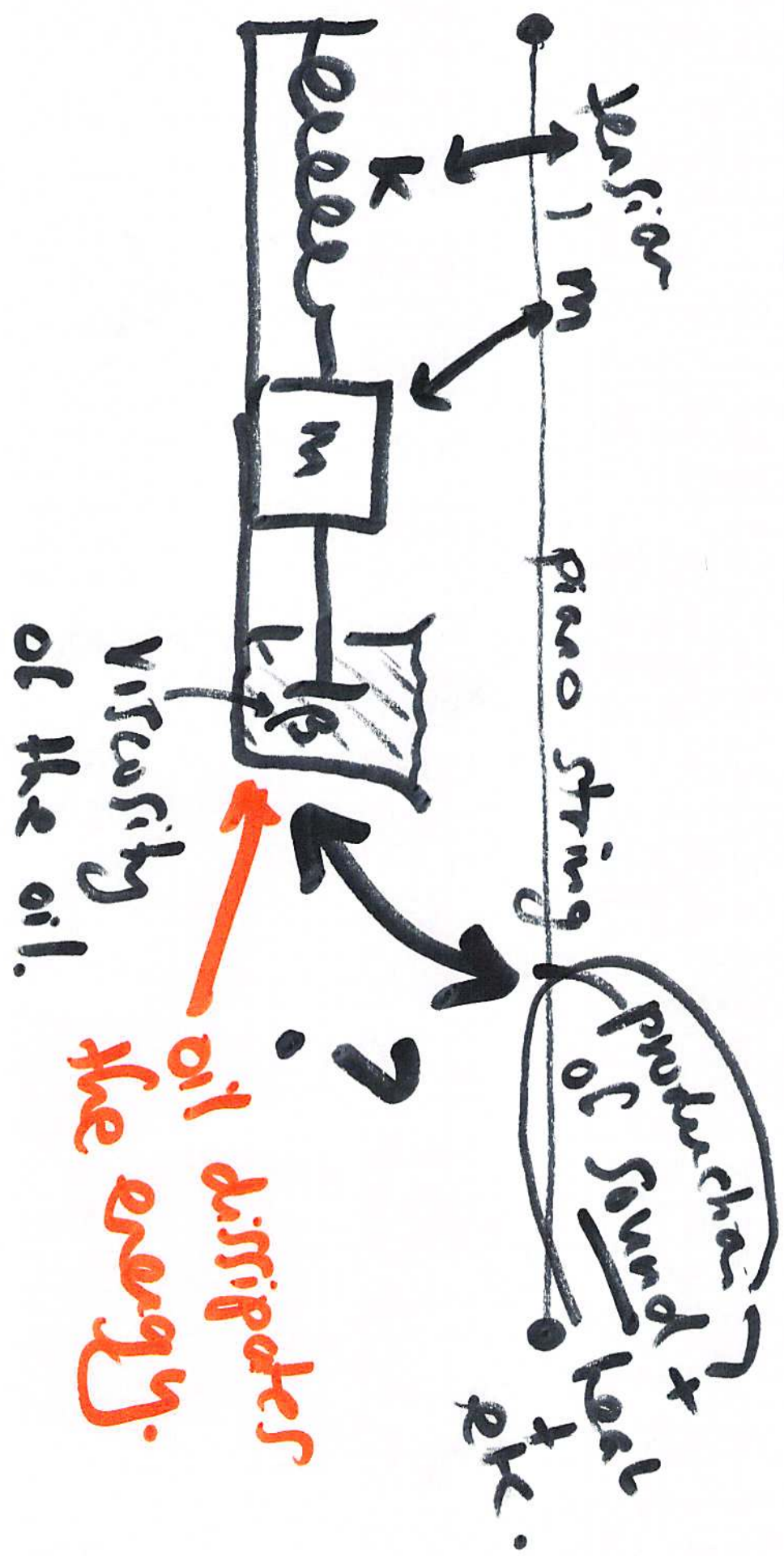
$ma = \underbrace{-kx}_{\text{Spring force}} - \underbrace{\beta v}_{\text{damping force}}$

linear diff. eq.

all solutions are $X = A e^{\alpha t}$

$$e^{i\pi} = -1$$

$$e^{i\theta} = \cos \theta + i \sin \theta$$



$$ma = F_{net} = -kx - b v$$

$\frac{F_{net}}{length}$ $\frac{F_{net}}{speed}$