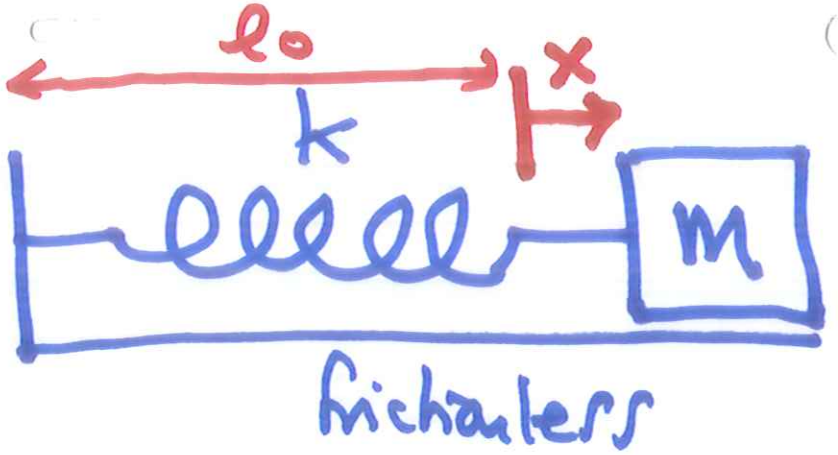
NYU Physics I 2017-10-17.

- Exam 3 scope
  - PS 5, 6
  - Oct 5 - today inclusive
  - bouncing.
- Reading.
  - simple harmonic oscillator
  - Hooke's law!
- LIGO event.
- Questions.
- Harmonic oscillators.



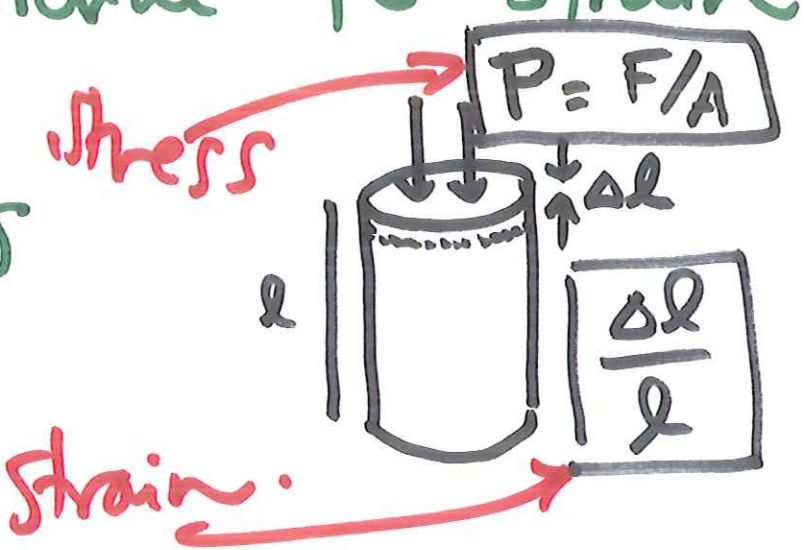
mass m

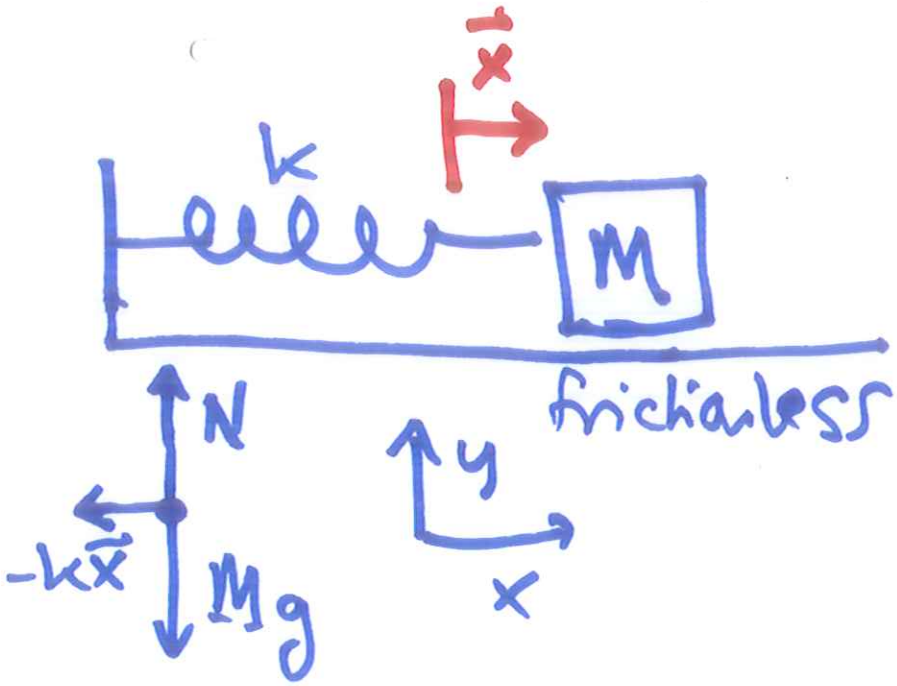
spring constant k

Hooke's Law $\vec{F} = -k\vec{x}$

"stress is proportional to strain"*

* for small strains





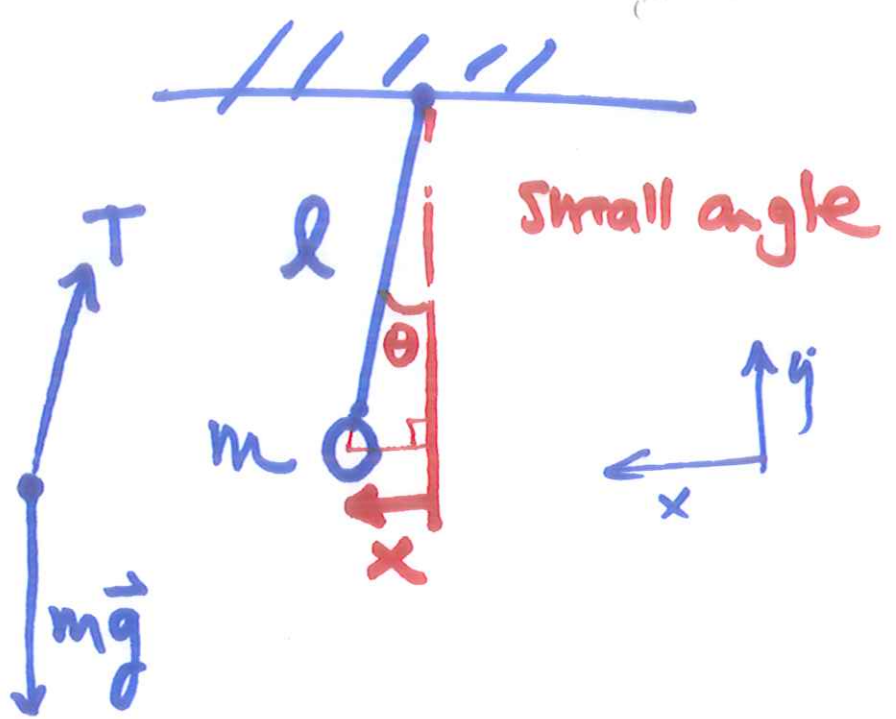
(x:) $-k\vec{x} = ma_x$

$v_x = \frac{dx}{dt}$ $a_x = \frac{dv_x}{dt} \equiv \frac{d^2x}{dt^2}$

$$m\frac{d^2x}{dt^2} + kx = 0$$

$x(t)$

$$\boxed{\frac{d^2x}{dt^2} + \frac{k}{m}x = 0}$$



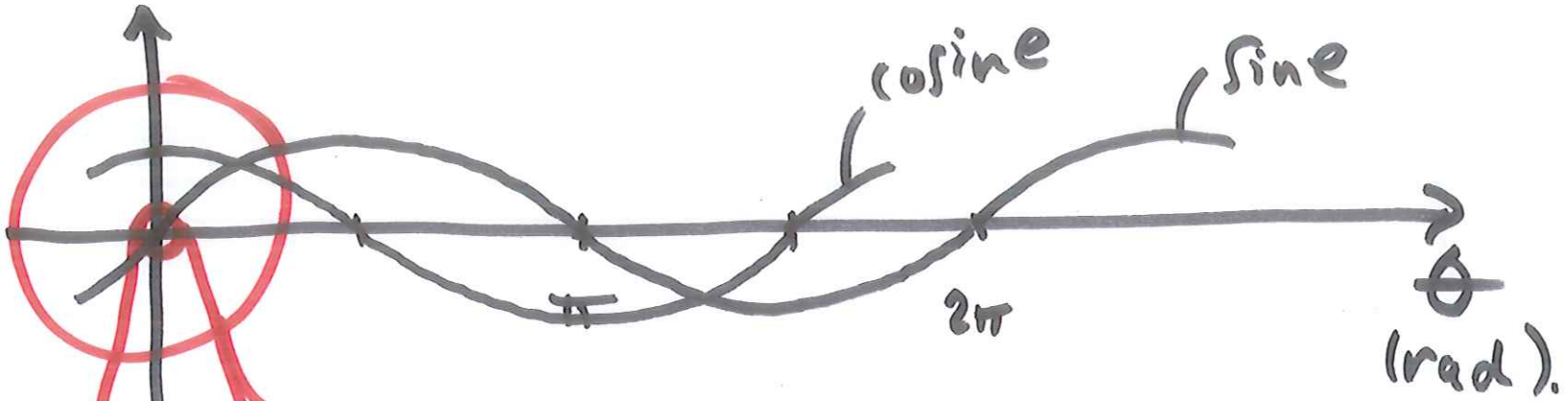
(x:) $-T\sin\theta = ma_x$

small-angle approx.

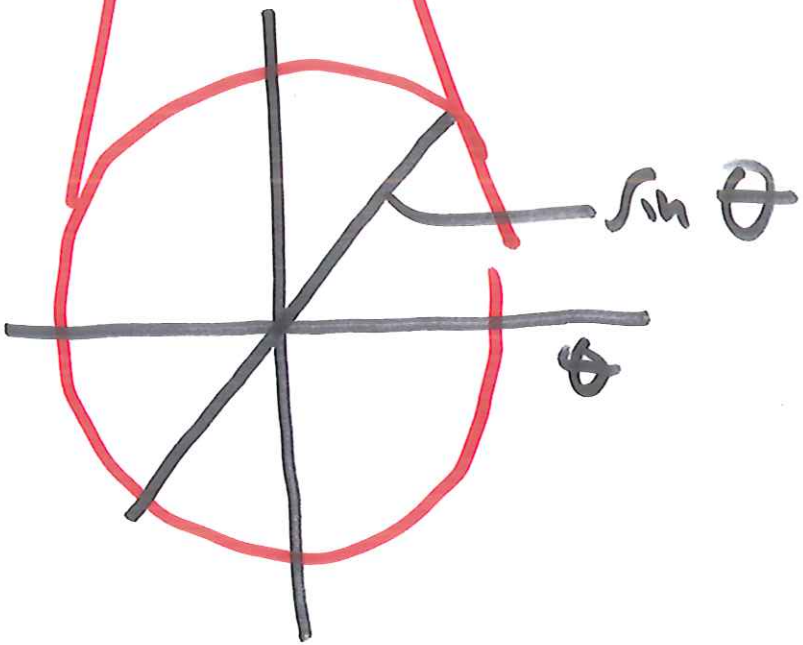
$-T\frac{x}{l} = m\frac{d^2x}{dt^2}$

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

$$\boxed{\frac{d^2x}{dt^2} + \frac{g}{l}x = 0}$$



$$\frac{d\sin\theta}{d\theta} = \cos\theta \qquad \frac{d\cos\theta}{d\theta} = -\sin\theta$$



$$\lim_{\theta \to 0} \sin\theta = \theta - \frac{\theta^3}{3!} + \frac{\theta^5}{5!} \cdots$$

$$\lim_{\theta \to 0} \cos\theta = 1 - \frac{\theta^2}{2!} + \frac{\theta^4}{4!} \cdots$$