

Two equal masses. Symmetric displacement from center of mass. Restoring force comes from spring.

The spring is stretched by distance  $2x$ .

Restoring force on right mass is

$$F = -k(2x)$$

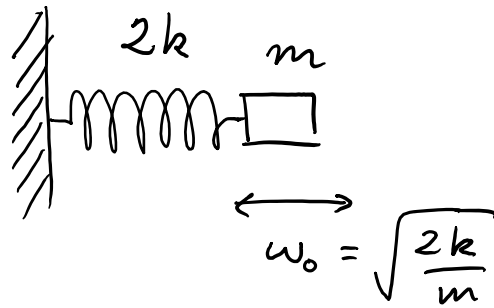
$$m \frac{d^2x}{dt^2} = -2kx$$

Let  $x = x_0 \sin \omega_0 t$

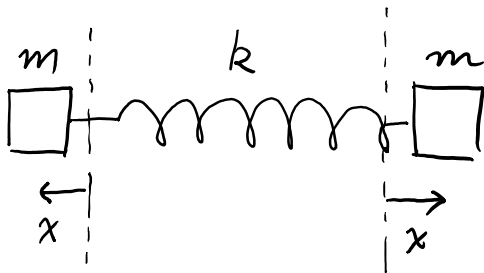
Then  $m\omega_0^2 = -2k$

$$\omega_0 = \sqrt{\frac{2k}{m}}$$

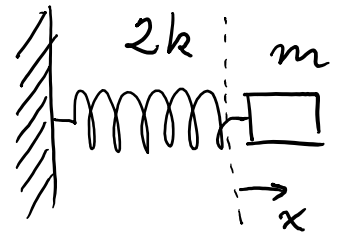
The dynamics of right mass is equivalent to a single mass attached to a wall.



System 1



System 2



- Both systems have two degrees of freedom,  $x$  and  $\frac{dx}{dt}$ , that contribute quadratically to the systems total energy.
- Both systems oscillate at the same freq,  $\omega_0$
- In the quantum limit, both systems have the same energy level structure

$$E_n = (n + \frac{1}{2}) \hbar \omega_0$$