

## 1 Coupled Oscillations: Three Masses

*None* Consider a system of three unequal masses in a row between two fixed walls. The walls and masses are all connected by unequal springs.

- (a) Sketch and label a diagram for the system
- (b) Write a system of coupled ODEs that represents the motion of this system.
- (c) Rearrange your system of ODEs to find a matrix ODE.
- (d) Impose an appropriate Ansatz for the normal modes of this system to obtain an algebraic matrix equation.
- (e) Find the eigenvectors and eigenvalues of this matrix equation in the special case that the system is symmetric around the central mass and all the masses are the same.
- (f) *Sensemaking*: Explain briefly what these eigenvectors tell you about the normal modes of the system and why you might expect these normal modes based on the symmetries of the system.
- (g) Find the general solution for the motion of the (unforced) system in the special case that the system is symmetric around the central mass and all the masses are the same.