Tips for Force Problems (with many objects)

- Draw a free body diagram for each object
  - Define your “object”!
  - You can make anything you want an “object” by drawing a box around it, as long as it all has the same acceleration
  - All forces crossing the boundary of the box go into Newton’s 2nd Law
  - All forces between things inside the box are ignored

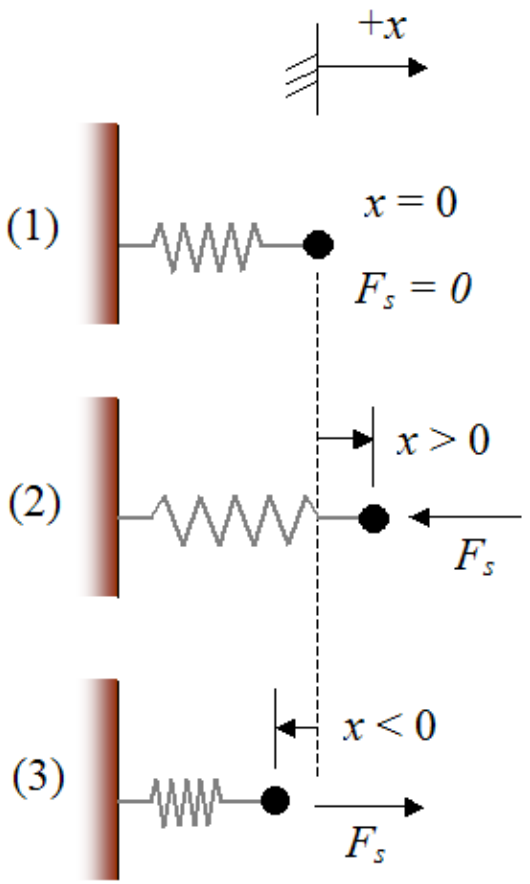
Solving for Forces in Free-Body Diagrams

- Frequently you know the angle of forces in diagrams, but not their magnitude
- Can still express each force in components, with unknown magnitudes
  - Solve for unknowns using Newton's 2nd in each component

Notation Reminders

- Full vector: $\vec{F} = F_x \hat{i} + F_y \hat{j}$
- Magnitude: $F = \sqrt{F_x^2 + F_y^2}$
- Component: $F_x = F \cos(\theta)$

Hooke's Law



- Force proportional to stretch/compression from equilibrium and in opposite direction

$$F_{s,x} = -kx$$

- Spring constant depends on spring properties
  - Units: force/length

Warnings for Spring Problem!

- For helicopter problem with spring:
  - “Stretch” is compared to equilibrium *with mass attached* at rest
  - Stretch measured with downward positive
  - Acceleration measured with up positive