# Simple Harmonic Motion

- Simple harmonic motion is a motion that repeats with time: $x(t) = A\cos(\omega t + \phi)$

  - A: **Amplitude**, maximum displacement from center/equilibrium

  - $\omega$: **angular frequency**, related to how often motion repeats ($\omega = 2\pi f = 2\pi/T$)

  - $\varphi$: **phase constant**, needed to describe initial position if not at maximum (shift in cosine function)

- Also: $v(t) = -A\omega\sin(\omega t + \phi)$
  $a(t) = -A\omega^2\cos(\omega t + \phi)$

# SHM and Hooke's Law

- Simple harmonic motion is the result any time you have an acceleration proportional to displacement (and opposite)

- First example: Hooke's Law $\omega = \sqrt{\dfrac{k}{m}}$

Important: this will come out in radians

# Finding SHM Parameters

- Angular frequency depends on system under consideration (k & m for Hooke's Law)

- Get A and φ from knowing x & v at a particular time (usually t = 0)

  - Today's HW: can use a bit of common sense to avoid solving equations