- **KINEMATICS:**
  - $a(t) = a$
    - a = constant acceleration
    - a(t) = acceleration at time "t"
  - $v(t) = v(0) + at$
    - v(t) = velocity at time "t"
    - v(0) = velocity at time "0"
  - $x(t) = x(0) + v(0)t + \frac{1}{2}at^2$
    - x(t) = position at time "t"
    - x(0) = position at time "0"
  - $v_f = v_i + a\Delta t$
    - v_f = final velocity
    - v_i = initial velocity
    - Δt = change in time
  - $v_f^2 = v_i^2 + 2a\Delta x$
    - Δx = change in position
- **FRICTION:**
  - $F = ma$
    - m = mass
  - $f_s = \mu_s F_N$
    - f_s = static friction
    - μ_s = coefficient of static friction
  - $f_k = \mu_k F_N$
    - f_k = kinetic friction
    - μ_k = coefficient of kinetic friction
  - $F_g = mg$
    - g = acceleration due to gravity
  - ΣF_x
    - Net force equation for the "x" direction
  - ΣF_y
    - Net force equation for the "y" direction
- **CIRCULAR MOTION:**
  - $\alpha(t) = \alpha$
    - α = constant angular acceleration
    - $\alpha(t)$ = angular acceleration at time "t"
  - $\omega(t) = \omega(0) + \alpha(t)$
    - $\omega(t)$ = angular velocity at time "t"
    - $\omega(0)$ = angular velocity at time "0"
  - $\theta(t) = \theta(0) + \omega(0)t + \frac{1}{2}\alpha t^2$
    - $\theta(t)$ = angular position at time "t"
    - $\theta(0)$ = angular position at time "0"
  - $\omega = \frac{2\pi}{T}$
    - T = time period
  - $f = \frac{1}{T}$
    - f = frequency
  - $v = \omega R$
    - R = radius
  - $s = R\theta$
    - s = arc length
  - $\vec{a} = \omega v(-\hat{r})$
    - $\vec{a}$ = centripetal acceleration
    - $-\hat{r}$ = radial direction
  - $F_c = \frac{mv^2}{R}$
    - F_c = centripetal force
  - $\vec{a} = \omega^2 R$
  - $\vec{r}(t) = (R, \theta(t))$
    - R = radial position
    - $\theta(t)$ = angular position
- **PROJECTILE MOTION:**
  - $t^* = \frac{v_0}{g}\sin(\theta)$
    - t* = time when projectile reaches max Δy
  - $x^* = \frac{{v_0}^2}{2g}\sin(2\theta)$
    - x* = x displacement at time "t*"
  - $y^* = \frac{{v_0}^2}{2g}\sin(\theta)^2$
    - y* = y displacement at time "t*"
  - $v_x(t) = v_0\cos(\theta)$
    - $v_x(t)$ = horizontal velocity at time "t"
  - $v_y(t) = v_0\sin(\theta)$ - gt
    - $v_y(t)$ = vertical velocity at time "t"
- **CONNECTED OBJECTS:**
  - Draw Net Force Equations
    - Apply formulas as necessary
    - Everything here is case-by-case
- **DRAG:**
  - $F_{drag} = c_1 R v + c_2 R^2 v^2$
    - F_{drag} = Force of drag
    - c_1 = strong function of temperature
    - c_2 = strong function of density
    - R = radius of object
  - $v_c = \frac{c_1}{c_2 R}$
    - v_c = regime crossover velocity
  - $v_T = c_1 R v_T + c_2 R^2 {v_T}^2 = mg$
    - v_T = Terminal velocity
  - Regime 1: $\frac{mg}{c_1 R} \propto R^2$
  - Regime 2: $\sqrt{\frac{mg}{c_2 R^2}} \propto \sqrt{R}$
  - ${F_D}^{Viscous} = 6\pi\eta R v$
    - η = Dynamic Viscosity
  - ${F_D}^{Pressure} = \frac{\pi}{2} c \varrho R^2 v^2$
    - ϱ = fluid density
    - c = drag coefficient
  - $R_e = \frac{\varrho R v}{\eta}$
    - R_e = Reynold's number
  - $F_D = \frac{1}{2} c\, \varrho A v^2$
    - A = Cross sectional area