* REVIEW *

Chapter 1 : Ways to solve 1st order ODE

1) Integrate $y' = f(x)$
2) separation $y' = f(x)\,g(y)$
3) integrating factor $y' + P(x)y = Q(x)$
   $\rho(x) = \exp\left(\int P(x)\,dx\right)$

application :

- Toricelli's law
  $A(y)\frac{dy}{dt} = -k\sqrt{y}$ wher $k = a\sqrt{2g}$
- Mixture problem
  $\frac{dx}{dt} = c_i r_i - r_o \frac{x}{V}$

Chapter 2 :

- Equilibrium soln & stability - phase line diagram
- application : -- population model ~ exponential growth $p' = kp$
  ~ logistic growth $p' = k(M-p)p$

-- acceleration / velocity : $mv' = -mg + F_R$

Chapter 3 :

- Linear eqn with constant coeffs ~ multiple roots ? ~ characteristic eqn
- Particular & Complementary soln for non-homogeneous eqn
- also linear independence using Wronskian
- Mass & spring : $mx'' + cx' + kx = f(t)$
  - undamped ($c = 0$)
    natural frequency $\omega_0 = \sqrt{\frac{k}{m}}$
    resonance when forced w/ natural frequency
  - damped case ($c \neq 0$)
    overdamped case : 2 real roots ($c^2 > 4km$)
    critically damped : 1 real roots ($c^2 = 4km$)
    underdamped case : 2 complex roots ($c^2 < 4km$)

Chapter 5 : Systems of ODEs

- Eigenvalue method
- Fundamental matrix solution & e^{At}
  Generalized eigenvector

application :

- mass & spring system
- mixture problem

Chapter 6 : Phase plane analysis

- Linear analysis of equilibrium soln (Jacobian)

Chapter 7 : Laplace transform

- How to solve ode using LT
- Properties : Convolution
  Translation $\mathcal{L}\{H(t-a)\,f(t-a)\} = e^{-as}F(s)$
  $\mathcal{L}\{e^{at}f(t)\} = F(s-a)$

  Partial fraction

Chapter 9 : Fourier Series

- definition of FS
- odd extension , fourier sine series
  even extension , Fourier cosine series
- PDE : separation of variables .