ODE

- (I) Linear : (classic eigenvalue argument)
- (II) Non-linear
  - Existence of periodic solutions
    - First integral
    - Bendixson's criterion
    - Tranforming to polar coordinates
  - Classification / Stability of solutions
    - Linearization (I) → the classification can be carried on to the non-linear equation through theorem 3.1. (that's for attractors.)
    - First integral
    - Lyapunov function
    - As for a saddle in the linearized, we can conclude it's unstable for non-linear equation.
    - As for a centre in linearized, we use either polar coordinates or Morse lemma to try to show that the point is a centre for the non-linear equation.
    - If of the form $\dot{x} = Ax + B(t)x + f(t,x)$; under the hypotheses of thm 7.3 we conclude instability.