- Existence :

  Any solution which satisfies the governing equation, initial condition and boundary conditions is a solution for that problem.

  Algebraic equation → number

  Differential equation → function

- Uniqueness :

  First, we assume two solutions, and then prove that the two are the same.

- Physically realizable :

  Physical constraint, casaul effect.

  Response occurs after the excitation.

  Examples:

  Case 1: No real solution

  $$\dot{y}^2 + 3 = 0$$

  Case 2: One trivial solution $y(t) = 0$.

  $$\dot{y}^2 + y^2 = 0$$

  Case 3: One solution

  $$\dot{y} + 3y = 0, y(0) = 1$$

  Check the solution ?

- Solution group, undetermined coefficient

- Complete solution=complementary solution(homo. + parti.)

- Singular solution $(y = cx + 2c^2)$ with $y(1) = -1/8$

  $$y = xy' + 2(y')^2$$

  $$y(x) = -x^2/8$$

  Nonunique solution