

1. Classify ODEs.

- ↳ What is the order?
- ↳ Is it linear?
- ↳ Is it autonomous?
- ↳ If linear, is it homogeneous?

Examples

Teschl 1.3 and 1.4
 Quiz 1: Problems 1, 2, 3

2. Find an ODE w/ given soln

e.g. $y = Cx + C^3$
 $y' = C$
 $\Rightarrow y = y'x + (y')^3$

Ex.

Tenenbaum Exercise 4,
 Problems 6-17

3. Solve 1st order ODEs

- autonomous
- separable
- linear coefficients
- homogeneous coefficients
- exact differential
- integrating factor for linear differential 1st order

Ex.

Tenenbaum
 ↳ Exercise 6, problems 1-21
 ↳ Exercise 7, problems 2-15
 ↳ Exercise 8, problems 1-14
 ↳ Exercise 9, problems 4-11
 ↳ Exercise 11, problems 11-18

I will probably choose 2-4 problems of this type.

4. Picard iterates

Ex.

Tenenbaum Exercise 57, problems 1-5

5. Word problem interpreting ODE

- e.g. A capacitor behaves according to an ODE. What behavior do you get as $t \rightarrow \infty$
- e.g. You have a bank account that compounds interest based on a complicated formula. How much money do you have on day 100?

6. Proof.

Will be a simple application of a theorem or definition we

Covered in class.

e.g. Prove that the Manhattan norm $\|x\|_1 := \sum_{i=1}^n |x_i|$, $x \in \mathbb{R}^n$ is a norm.

e.g. Use the Banach fixed pt theorem to prove that if $K(x) = 1000 + \frac{x}{2}$, $\lim_{n \rightarrow \infty} K^n(x) = 1000 \quad \forall x \in \mathbb{R}$.

e.g. Prove that if the triangle inequality $\|x+y\| \leq \|x\| + \|y\|$ holds, then so does the inverse triangle inequality $|\|x\| - \|y\|| \leq \|x-y\|$.