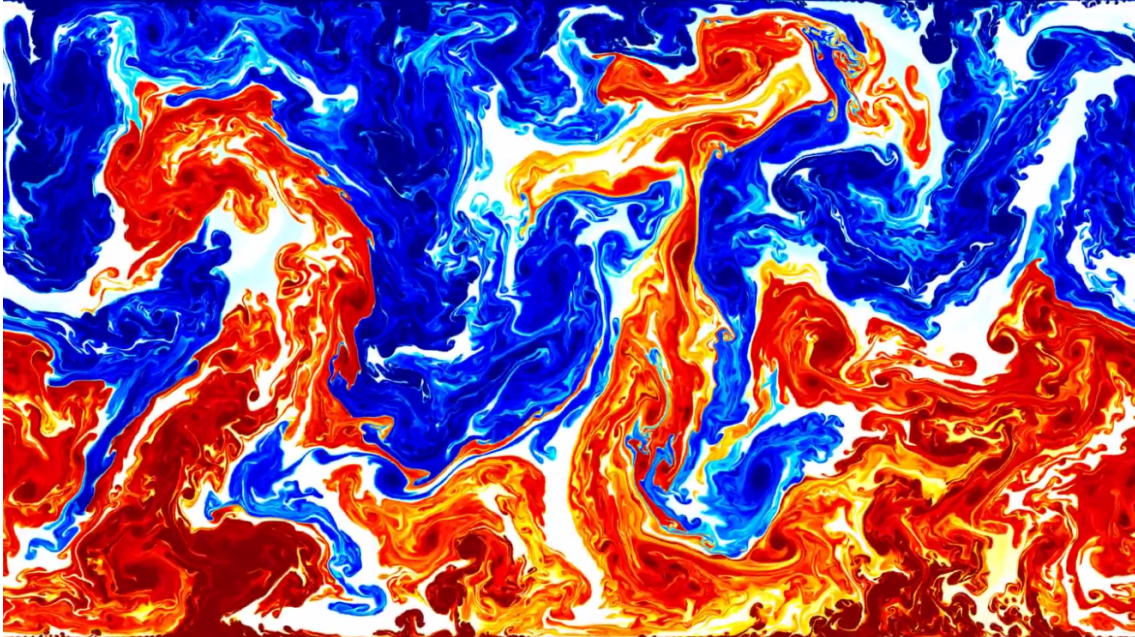# Midterm 01

Math 33b $\mathscr{U}CLA$ (Summer 2021)

Assigned: August 25, 2021.

Instructions/Admonishment

1. **SHOW ALL WORK**

2. Duration: 24 Hours.

3. The following is my own work, without the aid of electronic calculating devices or any other person.
   Signature: _____

Problem 1 *Solution to Linear ODEs* .

Find the particular solution of the equation $y'' + 4y' + 3y = 56 \sin 2x$ by

(i) the method of undetermined coefficients,

(ii) the method of variation of parameters (**feel free to use the formula or to show some key steps of the calculation process**)

Problem 2 *Nonhomogeneous Equation.*

Consider the equation $y'' - 9y = \cos x$.

(i) If $y_p = -\frac{1}{10}\cos x$ is particular solution, what is the particular solution of the equation $y'' - 9y = 12\cos x$? (**do not use the UC or variation of parameters method to justify your answer**).

(ii) Using (i) find the general solution of the equation $y'' - 9y = 12\cos x$.

Problem 3 *Autonmous equation* .

Consider $\dfrac{dy}{dt} = e^y - 2$, with $-\infty < y < +\infty$. This equation has one stable equilibrium point. Select one of the the following answers and **justify your response**.

  (i) the stable equilibrium point being $y = \ln 2$

 (ii) the stable equilibrium point being $y = 0$

(iii) the equilibrium point is unstable.

(iv) there are no equilibrium points.

Problem 4 *Mass/Spring ODE* .

In an experiment, a 2-Kg mass is suspended from a spring. The displacement of the spring-mass equilibrium from the spring equilibrium is measured to be 50 cm. The mass is then displaced 12 cm downward from its spring-mass equilibrium and released from rest.

(i) Sketch the setup of the experiment showing the positive direction of the orientation of the displacement.

(ii) Set up (but do not solve) the initial value problem that models this experiment. Assume no damping is present.