

Math 220 Midterm 1 – September 30, 2015

Name: \_\_\_\_\_ UIN: \_\_\_\_\_

Problem session day: \_\_\_\_\_ Problem session time: \_\_\_\_\_

**Instructions:**

- During the exam, you may **not** use your books, notes, reference materials, or **any electronic devices**, including calculators and cell phones. Violating this rule will result in expulsion from the exam and a score of zero (0)!
  - **No form of reproduction or provision of this exam**, or any part thereof, including, but not limited to, copying for personal use, sharing with current or prospective students, or posting on the Internet in open access or restricted selective spaces **is permitted without the written permission of the course coordinator**, Prof. Alexey Cheskidov, Math 220, Fall 2015.
  - You are required to show your work on each problem on this exam. **Mysterious or unsupported answers will not receive full credit.** A correct answer, unsupported by calculations, explanations, and/or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations will receive partial credit.
  - Write your solutions in the exam booklets provided. At the end of the exam, you **must return this problem sheet together with your exam booklet.**
- 

**Scores:**

1. \_\_\_\_\_/4 points
2. \_\_\_\_\_/4 points
3. \_\_\_\_\_/4 points
4. \_\_\_\_\_/3 points
5. \_\_\_\_\_/5 points

**Total:** \_\_\_\_\_/20 points

---

1. **(4 points)** Find the general solution of the differential equation:

$$x(y^2 + 1) dx + e^x dy = 0$$

2. **(4 points)** Solve the initial value problem

$$y'' + 8y' - 9y = 0, \quad y(0) = 3, \quad y'(0) = -7.$$

3. **(4 points)** Solve the equation

$$(2xy^3 + 1) dx + (3x^2y^2 - y^{-1}) dy = 0.$$

4. **(3 points)** Use Euler's method with  $h = 1$  in order to approximate the solution to the initial value problem:

$$y' = y^2 - x, \quad y(0) = 0$$

at  $x = 2$ .

5. **(5 points)** A nitric acid solution flows at a constant rate of 5L/min into a large tank that initially held 200L of a 0.5% nitric acid solution. The solution inside the tank is kept well stirred and flows out of the tank at a rate of 10L/min. If the solution entering the tank is 10% nitric acid, determine the volume of nitric acid in the tank after  $t$  minutes.