

UBC ID #: _____ NAME (print): _____

Signature: _____



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

IRVING K. BARBER SCHOOL
OF ARTS AND SCIENCES
UBC OKANAGAN

Instructor: Rebecca Tyson Course: MATH 225

Date: Jan 29th, 2018 Duration: 35 minutes.

This exam has 4 questions for a total of 20 points.

SPECIAL INSTRUCTIONS

- Show and explain all of your work unless the question directs otherwise. Simplify all answers.
- The use of a calculator is not permitted.
- Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, ask for extra paper.

This is a two-stage exam. You have 35 minutes to complete the exam individually, then you will hand in the tests and join your group to redo the test as a group in the remaining 35 minutes.

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|-----------|---|---|---|---|-------|
| Question: | 1 | 2 | 3 | 4 | Total |
| Points: | 6 | 6 | 3 | 5 | 20 |
| Score: | | | | | |

- 6 1. Consider the ODE $y' = (y - 1)(y - a)$. Sketch the phase line and state the nature of its steady states. Note that your answer depends on the value of a . You should consider all possibilities.

- 6 2. Obtain the general solution to the equation

$$\frac{dy}{dx} = \frac{y}{x} + 2x + 1$$

3. Show that the ODE below is exact.

$$\left(\frac{1}{r} + 2s^2r\right) dr + (2sr^2 - \cos(s))ds = 0$$

4. Suppose a brine containing 0.3 kilograms (kg) of salt per litre (L) runs into a tank initially filled with 400 L of water containing 2 kg of salt. The brine enters at 10 L/min, the mixture is kept uniform by stirring, and the mixture flows out at the same rate.

5. (a) Let $X(t)$ be the amount of salt in the tank at time t . Write down the ODE and initial conditions for $X(t)$.

- (b) What is the mass of salt in the tank after 10 min?