

FINAL EXAM INFORMATION

Math 230, Fall 2020

The Final Exam will consist of a few take-home questions, distributed on Monday, November 16, and the in-class exam on Thursday, November 19, 9 – 11am. The exam will test your knowledge of concepts we have studied in this class. The exam will be cumulative, but will emphasize the material that we studied since the second midterm exam (nonlinear systems and numerical approximations).

Make sure you are familiar with St. Olaf College's final exam policies:

<https://catalog.stolaf.edu/academic-regulations-procedures/final-examinations/>

Take Home Question

The take-home portion of the exam will contain a few problems similar to the homework problems in this course. For this part of the exam, you may use your textbook, your notes, materials on the course web site, and computational technology (e.g., calculator, *Mathematica*, and *Wolfram Alpha*). If you have question about the exam, you may ask the professor. **Do not consult other sources, people, web sites, etc.** The St. Olaf Honor Code applies to the take-home exam.

In Class Exam

The in-class portion of the exam will contain problems that are intended to be completed without technology. Books, notes, and internet-capable devices will not be permitted during the in-class exam. Calculators will be allowed, but probably not very useful, and certainly not necessary.

Concepts, Definitions, and Theorems

You should be able to define, illustrate, use, and briefly summarize the following:

- Ordinary differential equation
- First-order differential equation
- Equilibrium solution
- Initial condition
- Qualitative analysis
- General solution
- Particular solution
- First-order system of differential equations
- Autonomous differential equation
- Slope field
- Euler's method
- Existence and Uniqueness Theorem
- Phase line
- Source, sink, and node
- Bifurcation
- Homogenous differential equation
- Linear differential equation

- Linearity Principle
- Method of undetermined coefficients
- Integrating factor method
- Phase portrait
- Equilibrium points
- Harmonic oscillator
- Second-order differential equation
- Linearly independent (vectors, solutions)
- Eigenvalues and eigenvectors
- Characteristic polynomial
- Straight-line solutions
- Trace-determinant plane
- Steady-state solution
- Method of Undetermined Coefficients
- Resonance and beats
- Linearization
- Jacobian matrix
- Separatrix/separatrices
- Nullcline
- Hamiltonian system
- Saddle connection
- First-order approximation method
- Improved Euler's method
- Runge-Kutta method
- Power series solution
- Cauchy-Euler equation

Practice Problems

Consider any of the following problems for practice:

- Chapter 5 review (pages 555–557) exercises 1–6, 8–10, 11–29
- Chapter 7 review (page 670) exercises 1–7
- Appendix B exercises 1–18
- Problems from the sample exams by Bob Devaney (one of the authors of our textbook) at <http://math.bu.edu/people/bob/MA226/sample-exams.html>