

# Differential Equations

Instructor: Lia Vas, Ph.D.

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**Instructor's Website** (with class handouts, review sheets, and class recordings): <http://liavas.net>  
In addition, you should be able to access the course page on **Canvas**. I will be posting the solutions of any graded material (assignments, projects and exams) on Canvas.

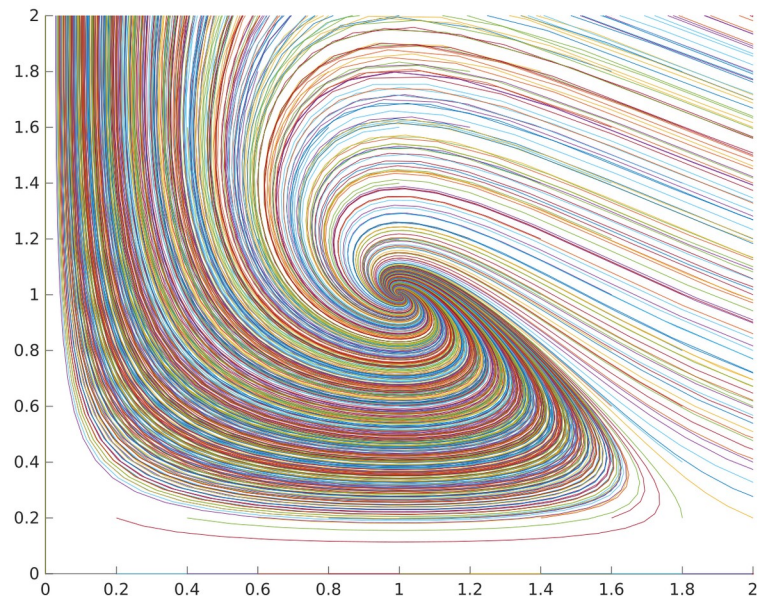
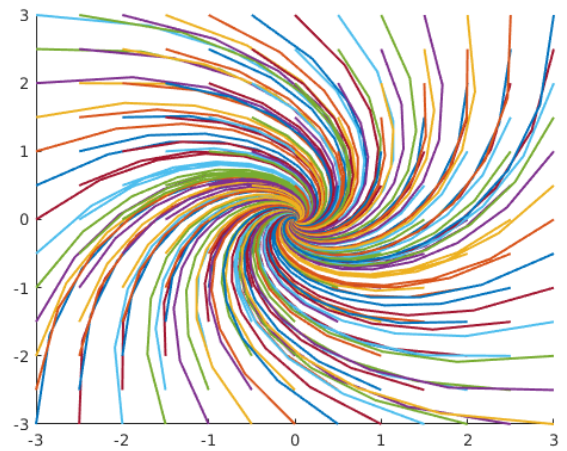
**Class format in Fall 2023:** The classes will be held on the University City campus. In case of absence, the recordings of classes covering the course material are on my website <http://liavas.net>

**Class times and place in Fall 2023:** Tue and Th 11:00–12:15 in STC 147.

**Office hours in Fall 2023:** Tue and Th 3:15 pm or at other times by appointment – email me and we will find a time for us to meet. I will be glad to answer all of your questions about the course material, go over some problems together with you, check your assignment work, review together for an exam, or simply discuss course content you may have questions about.

## Topics covered:

1. First order differential equations.  
Basic ideas.
2. Separable differential equations.
3. Linear differential equation.
4. Homogeneous diff. eq. Bernoulli diff. eq.
5. Exact equation.
6. Numerical solutions. Euler's method.
7. Autonomous differential equations.
8. Modeling with differential equations.  
(Exam 1)
9. Second and higher order equations.
10. Homogeneous higher order linear equations.
11. Nonhomogeneous equations:  
variation of parameters.
12. Nonhomogeneous equations: the  
method of undetermined  
coefficients.
13. Applications of higher order equations.  
(Exam 2)
14. The Laplace transform. Definition. Properties.
15. Inverse Laplace transform.
16. Transforms of discontinuous and periodic functions. Box and step functions.



17. Delta function. Convolution.
18. Solving linear systems with Laplace transforms.  
(Exam 3)
19. Systems of first order differential equations. Phase plane analysis.
20. Nonlinear systems of differential equations.
21. Modeling with systems of differential equations. Steady states and stability.  
(Final Exam)

**Text:** No textbook required. Handouts with new material and practice problems are available on my website for each topic.

**Technology:** Matlab will be used extensively and you will be able to install it on your home computers. All students are also recommended to have a calculator.

**Tentative Exam Schedule, Fall 2023:**

Exam 1. During week 4 (Sept 21)  
Exam 3. During week 12 (Nov 16)

Exam 2. During week 9 (Oct 24)  
Final Exam. During week 15 (the finals week)

**Grading:**

3 Exams	18% each
Final Exam	22%
3 assignments	12%
3 projects	12%
<b>TOTAL</b>	<b>100%</b>

Grades are computed according to the following system:

letter grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
number grade	93 to 100	90 to 92	87 to 89	83 to 86	80 to 82	77 to 79	73 to 76	70 to 72	67 to 69	60 to 66	0 to 59

**Relevant Course Elements.**

**Number of Credits:** 3

**Prerequisites:** Calculus 2 or the permission of instructor.

**Attendance:** The class lectures will be delivered at the locations and the times listed above. Recordings of the lectures are available for students who miss some classes. To stay on track, it is highly recommended that students attend the classes and use the recordings just for reference.

Students are responsible for all material covered in class, even if attendance is not checked or assignments collected.

**Exams and assignments:** There will be **three semester exams, three assignments, three projects, and a cumulative final exam**. Assignments and projects turned in after their due date will receive an automatic reduction in grade. Any makeup exam must be taken **before** the next regularly scheduled exam. No assignment, project, or exam grade will be dropped.

The projects will focus on numerical solutions using Matlab and applications. Students will be

able to install Matlab on their home computers or to use it from a web browser.

**Course Objectives.**

- Solve differential equations using various techniques.
- Identify situations that require the use of differential equations, develop mathematical models involving differential equations and justify their solutions.
- Use appropriate technology to find and examine solutions of differential equations.

**Learning outcomes.** Students will:

- demonstrate proficiency in solving differential equations,
- develop understanding of various mathematical concepts involving differential equations,
- develop understanding of modeling techniques required for successful application of mathematics,
- demonstrate the use of differential equations in problem solving,
- demonstrate proficiency in using mathematical software,
- use appropriate technology to solve problems involving differential equations.

**Academic Integrity Statement:** Saint Joseph's University encourages the free and open pursuit of knowledge; we consider this to be a fundamental principle and strength of a democratic people. To this end, SJU expects its students, its faculty, its administrators, and its staff to uphold the highest standards of academic integrity. The University expects all members of the University community to both honor and protect one another's individual and collective rights.

**Students with Disabilities Statement:** Reasonable academic accommodations may be provided to students who submit appropriate documentation of their disability. If students have need of assistance or questions with this issue, they are encouraged to contact the Office of Student Disability Services (SDS) at [sds@sju.edu](mailto:sds@sju.edu) or by phone at 610.660.1774. The Office of SDS also provides an appeal/grievance procedure for complaints regarding requested or offered reasonable accommodations. More information can be found at: [www.sju.edu/sds](http://www.sju.edu/sds).

**Health and Wellness Statement:** Saint Joseph's University recognizes that physical and mental health strongly impact one's ability to do well in school and in life. As a result, there are many helpful campus resources designed to help students to care for their physical, mental, and spiritual health. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc. All of us benefit from support during times of struggle and challenges. If you are experiencing concerns, seeking assistance sooner rather than later is a courageous thing to do for yourself and those who care about you. The resources at <https://sites.sju.edu/counseling/> can help you to cope with stress and to achieve your academic and personal goals.