Teaching Dossier

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Teaching Responsibilities

I have worked as a teaching assistant during my graduate studies at McMaster University and undergraduate studies at Cape Breton University. I also had the opportunity to teach a second year differential equations course at McMaster in the summer of 2015.

♦ Instructor (*McMaster, Summer 2015*)

Math 2C03 – Differential Equations (48 students)

In the summer of 2015 I was a sessional instructor at McMaster University for the second year ordinary differential equation course Math 2C03. The students enrolled in this course came from a variety of disciplines, ranging from first-year general science students to third year math majors. Course topics included first-order differential equations, Laplace transforms, and series solutions. I was the sole instructor for this course. As such, I designed the course outline, assessment materials, and wrote and led two 3-hour lectures per week. See appendix for course outline, sample assessment, and sample lecture notes. See the *Evidence of Teaching Effectiveness* section for course evaluation scores.

♦ Teaching Assistant (*McMaster, 2011-2015*)

Tutorial Leader (Head TA)

As a Ph.D. student at McMaster, I worked as a tutorial leader in the fall and winter semesters. My duties involved leading tutorials and holding office hours. As the head TA for larger courses, I attended a weekly course planning meeting with the course coordinator and instructors. For smaller courses, I marked assignments/exams.

As a tutorial leader, I spent class time reviewing key concepts, answering questions, and going over multiple examples. For larger classes, I used a combination of slides and chalkboard (or Smartboard technology/OneNote). For smaller classes, we worked primarily on the chalkboard. I created a webpage for each tutorial, where I posted tutorial notes and slides. I also provided helpful links and had a comment section for anonymous student suggestions. For large first-year courses, these resources were used extensively.

The details of each TA assignment are listed in the chart below.

Date	Course Title	# of Students	Description	TA Duties
Fall 2015	Math 2Z03- Engineering Mathematics III	~1000	Second year ordinary differential equations course for engineers.	Designed and led three tutorials (~300 students per tutorial).
Winter 2015	Math 2XX3 - Advanced Calculus II	83	Second year vector calculus course. Topics include path integrals, surfaces integrals, and classical integration theorems.	Designed and led three tutorials (~25 students per tutorial); marked assignments, midterms, and exams.
Fall 2014	Math 2X03 - Advanced Calculus I	128	Second year vector calculus course. Topics include directional derivatives, integrals of vector fields, and multiple integration.	Designed and led three tutorials (~40 students per tutorial).
Winter 2014	Math 1ZC3/ 1B03 - Linear Algebra I	603	A first year course in linear algebra. Topics include matrix algebra and real vector spaces.	Designed and led two tutorials (~300 students each) consisting of engineers and general science students.
Fall 2013	Math 1B03 - Linear Algebra I	70		Designed and led one tutorial consisting of math majors (70 students).
Winter 2013	Math 1ZC3/1B03 - Linear Algebra I	623		Designed and led two tutorials (~300 students each) consisting of engineers and science students.
Fall 2012	Math 2A03 - Calculus III	66	A second year vector calculus course for science students. Topics include multiple integration, path integrals, and surface integrals.	Designed and led one tutorial (66 students).

Tutor (Math Help Centre)

McMaster has a drop-in Math Help Centre for first year students. Students drop by to work together on homework problems and seek help from the TA's on staff. In addition to my duties as a head TA, each semester I also worked in the Math Help Centre, where I tutored students in a variety of first year math courses, including advanced functions, calculus, linear algebra, statistics, and introduction to mathematical reasoning. Students came from a variety of disciplines, including the humanities, social sciences, life sciences, engineering, and business. I also designed and led review sessions for first-year math courses before midterms and final exams.

Guest Lecturer

I was invited to give several guest lectures at McMaster University for courses in which I was working as a teaching assistant.

Math 1ZC3/1B03 (Linear Algebra)

- Topic: *Row Space, Column Space, and Null Space*, 04/14
- Topic: *Real Vector Spaces*, 04/14
- Topic: *Systems of Linear Equations*, 01/14
- Topic: *Matrix Operations*, 01/14
- Topic: *Complex Numbers*, 02/13

Math 2A03 (Calculus III)

- Topic: *Vector Calculus Review*, 12/12

♦ Teaching Assistant (*Cape Breton University, 2009-2011*)

During my undergraduate degree, I worked as a teaching assistant at Cape Breton University. My duties included tutoring first-year students at the Math Help Centre and marking assignments for an introductory computer programming course (C++). I also tutored students with disabilities at the university's accessibility centre.

Evidence of Teaching Effectiveness

Course Evaluations

The Department of Mathematics and Statistics at McMaster University keeps all instructor and TA course evaluations, but only calculates statistics for faculty and postdoctoral instructors. The statistics computed for each faculty and postdoc is the average of student replies to the question, "Overall for this course, what is your opinion of the effectiveness of the instructor?" The average of these averages gives the metric used to compare instructor performance.

Math 2C03 – Differential Equations (Instructor, Summer 2015)

Question (*13/48 students responded*)	Mean	Math Dept. Mean
▪ Overall for this course, what is your opinion of the effectiveness of the instructor? (*10=Excellent, 9=Very Good, 8=Good(+), 7=Good, 6=Good(-), 5=Acceptable(+), 4=Acceptable, 3=Acceptable(-), 2=Poor, 1=Very Poor*)	8.31	6.9
▪ How do you rate the overall organization of the course including the instructor's response to students (approachability, attitude, availability, timing and appropriateness of feedback)? (*5=Very Good, 4=Good, 3=Acceptable, 2=Poor, 1=Very Poor*)	4.31	*(not available)*

** McMaster University has recently switched to an online system for end-of-course evaluations, which has led to a decline in response rates.*

Tutorial Evaluations

Date	Course Title	Overall Effectiveness of TA (Mean) (*5=Very Good, 4=Good, 3=Average, 2=Below Average, 1=Poor*)	Number of Student Responses
Fall 2015	Math 2Z03 - Engineering Mathematics III	*(in progress)*	*(in progress)*
Winter 2015	Math 2XX3 - Advanced Calculus II	4.67	16/83
Fall 2014	Math 2X03 - Advanced Calculus I	4.7	39/128
Winter 2014	Math 1ZC3/ 1B03 - Linear Algebra I	4.61	51/603
Fall 2013	Math 1B03 - Linear Algebra I	4.81	28/70
Winter 2013	Math 1ZC3/1B03 - Linear Algebra I	4.88	68/623
Fall 2012	Math 2A03 - Calculus III	4.1	21/66

Professional Development

Teaching and Learning Certificates

I obtained the following two certificates through the McMaster Institute for Innovation and Excellence in Teaching and Learning (MIIETL). (See Appendix F for the certificates.)

Teaching and Learning Scholar Certificate, 08/2015

To earn this certificate, one must complete the requirements for the Teaching and Learning Foundations Certificate described below, as well as the following courses:

- *Edu700: Essential Skills in Teaching and Learning (II)*

  Students complete six workshops focused on key scholarly themes in teaching and learning in higher education. For me, the largest benefit of this course was the discussions I had during the workshops with other graduate students and the workshop leader on the various topics covered. The participants came from a wide range of disciplines, so it was enlightening to learn about their teaching strategies and perspectives, as it opened my eyes to new things I could be doing in the classroom.

- *Edu750: Principles and Practices of University Teaching*

The full-semester course is focused on honing essential pedagogical and practical teaching skills. It includes sessions on curriculum design, teaching strategies (e.g. Inquiry & Problem-Based Learning), assessment strategies, and research on teaching and learning. This course was extremely useful to me – not long after finishing it, I ended up in charge of teaching a course in differential equations. For that course, I had to create a course outline, decide on material covered, and identify good assessment techniques. The good practices I learned in Edu750 helped guide me through this.

- *Edu760: Self-Directed Study*

Students engage in a self-directed study on a teaching and learning topic of their choice, with a mentorship from MIIETL. My topic was "A Guide of Using Writing in a Differential Equations Classroom". I chose this topic because I knew I would begin teaching a second-year differential equations course at McMaster shortly after completing this class. As such, this course was extremely beneficial to me because I learned a lot about the existing literature on teaching differential equations, and in particular, learned about how writing could be used in the classroom. This influenced the topics I chose and the assessment material I designed for the course.

Teaching and Learning Foundations Certificate, 04/2015

- *Edu600: Essential Skills in Teaching and Learning*

Students complete six workshops focused on key foundational themes in teaching and learning in higher education. My main takeaway from this course was gaining a baseline for the terminology and topics of interest in the world of teaching and higher education.

- *Edu650: Peer-Evaluated Teaching Experience*

This course focuses on effective strategies for planning and delivering a lesson. Students plan and deliver short lessons and receive peer feedback geared towards improving the lessons. This course is modelled after the Instructional Skills Workshop (ISW) Program. I thoroughly enjoyed this course. The feedback I received from each lesson was extremely useful. Each lesson was also recorded, and watching myself back at home was a great learning opportunity. I left the course with more confidence in my presentation skills and tips in mind for how to plan an effective lesson.

Teaching Seminars/Workshops Attended

- **MathEd Forum,** 01/2015 – present (monthly)
  Details: A monthly seminar promoting discussion on issues pertaining to mathematics education at all levels, with a special emphasis on education in the Province of Ontario. This monthly seminar gives me the opportunity to meet other math educators, hear about new developments in the literature of teaching and learning, and learn new teaching techniques, Fields Institute, Toronto, ON
- **Math + Coding Symposium,** 06/2015
  Details: A workshop focussed on how programming can be used to enhance the learning of mathematics at all levels. There were lectures and small group sessions. I learned about how programming is being introduced into elementary school level curriculum, and also how other instructors are using it in their university classrooms,
  Western University, London, ON
- **Canadian Mathematics Society Summer Meeting,** 06/2015
  Details: Mathematics instructors from various Canadian universities shared their successes and failures in teaching first-year mathematics courses. I really enjoyed this session, as I left with some concrete ideas of new things I could try in the classroom. Session: Reaching our Students: Increased Participation and Persistence in First-Year Math Courses, University of Prince Edward Island, Charlottetown, PE
- **Mathematics Department Teaching Seminar,** 09/2011-11/2011 (weekly)
  Details: In this seminar, we discussed numerous issues in teaching mathematics. This complemented the general teaching and learning principles and knowledge I gained later in the professional development courses listed above,
  McMaster University, Hamilton, ON

Research on Teaching and Learning

My Ph.D. thesis is on a topic in pure mathematics. However, I have also been interested in mathematics education research for quite some time. First, through a teaching seminar and later, by attending conferences and giving talks, I have been learning about and investigating themes related to tertiary mathematics education, such as the role of programming in the mathematics curriculum (which is a topic of increased importance) and psychological determinants of student success in mathematics.

I am currently conducting a study with Dr. Miroslav Lovric on the ways writing can be used to improve the learning of mathematics. In particular, we are trying to determine whether or not the use of writing exercises enhances learning certain concepts in a second-year differential equations course. We received ethics approval to analyze students' written assignments, as well as their replies to selected test and exam questions. I have also conducted a survey with my students to examine their perceptions about how the written assignments contributed to their

learning. This study is ongoing; we are analyzing the data. We plan to present the results in an upcoming seminar at the Fields Institute early in 2016, as well as publish our findings in a mathematics education journal.

Appendices

Appendix A: Course Outline

The following is the course outline I designed when I was a sessional instructor at McMaster for the second-year differential equations course Math 2C03. The course combines theory and qualitative analysis with algebraic techniques and algorithms, so I wanted to make sure that both components were given appropriate amounts of time and attention. To give my students ample opportunity for practice, I decided on frequent assessment, both in-class (weekly quizzes) and outside the classroom (weekly assignments). Frequent testing has been shown effective in numerous situations in mathematics courses, especially those that include heavy algebraic components. To facilitate communication, I organized an online discussion forum for my students.

Tentative course schedules help my students organize their work by clearly indicating the agenda for each lecture. Since students at this level need guidance, instead of telling them to pick questions from the textbook, I give a list of suggested problems for each section that we cover.

McMaster University
Math 2C03: Differential Equations
Summer Term 2015

Instructor: Lauren DeDieu

Office: HH 303
Extension: 27246
Email: dedieula@math.mcmaster.ca

Office Hours: Mon. 5:30-7pm, Wed. 5:30-7pm, or by appointment.

Lectures: Mon. 7-10pm (HH305)
Wed. 7-10pm (HH305)

Course Webpage: http://ms.mcmaster.ca/~dedieula/2C03.html

Required Text: Differential Equations With Boundary Value Problems, 8th Edition, Zill & Wright, published by Brooks Cole.

Prerequisites: One of Math 1AA3, 1LT3, 1NN3, 1XX3, ARTS&SCI 1D06, lSCl 1A24, and one of Math 1B03, 1D03, 1ZC3.

Antirequisites: Engineering 2Z03, Math 2M03, 2M06, 2P04, 2Z03.

Course Topics: Ordinary differential equations (ODE's): basic concepts, first order ODE's, higher order linear ODE's, Laplace transforms, series solutions (see tentative schedule below for more details).

Course Format:

We will meet as a class twice per week for three hours. Class time will be spent underlining key concepts from the assigned textbook chapters and working through examples. There will be no tutorials. There will be a 10 minute quiz at the beginning of class each Monday (and one extra quiz on Wed. July 29th). The midterm and exam will also be written during class time.

Intended Learning Outcomes:

By the end of this course, students should be able to:

- solve ordinary differential equations using a variety of techniques learned in class.
- analyze (both qualitatively and quantitatively) the solutions of ordinary differential equations.
- apply the theory learned in class to key examples using logical arguments and mathematical writing.

Course Evaluation:

- **Assignments (20%):** There will be 5 assignments. Each assignment will have an online component and a written component.

  Written components must be deposited in the course assignment locker located in the basement of Hamilton Hall by 2pm on the due date. Late assignments will not be marked. Students are encouraged to discuss assignment problems with their classmates, but must write their own solutions individually.

  Questions for the online portion of the assignment are available through WeBWorK at the following link: http://webwork.math.mcmaster.ca/webwork2/2C03-Summer-2015/ . Your login is your MacID and your password is your student number. You can then change your password if you prefer. To obtain credit, online assignments must be completed by 11:59pm on their due date. Non-multiple choice questions will have unlimited attempts. There is an Orientation module located at the above address which explains how to use WeBWorK.

- **Quizzes (15%):** There will be a 10 minute quiz at the beginning of class each Monday (and one additional quiz on Wed. July 29th). Your best 5 of 6 quizzes will count towards your final grade. There will be no rewrites – if you miss a quiz you will receive a grade of zero. We will be discussing the answers immediately following the quiz, so make sure you arrive to class on time! At the end of each week, I will provide a list of possible quiz

questions, and the quiz will consist of a few questions from this list (so it shouldn't be stressful!).

- **Midterm:** There will be one midterm written during class time (room TBA). The midterm will last 90 minutes, followed by a short lecture. The Standard McMaster calculator Casio fx 991MS+ may be used. No make-up midterms will be arranged. In the event that you miss the midterm, the weight from the midterm will be transferred to the final exam (see Marking Scheme #2). One question on the midterm will be taken directly from the Practice Problems.

- **Final Exam:** There will be one 3-hour exam written during class time (room TBA). Standard McMaster calculator Casio fx 991MS+ may be used. Two questions on the exam will be taken directly from the Practice Problems.

Marking Scheme: Option #1			
Assignments	Online	10%	4% each
	Written	10%	
Quizzes		15%	3% each (best 5 of 6)
Midterm		25%	
Exam		40%	

Marking Scheme: Option #2			
Assignments	Online	10%	4% each
	Written	10%	
Quizzes		15%	3% each (best 5 of 6)
Midterm		0%	
Exam		65%	

Online Forum: There is an online discussion forum for the course located at http://ezh.ca/. You are encouraged to use this forum to ask and answer questions about particular concepts, theorems, Practice Problems, etc. I will monitor the forum, but students are encouraged answer their classmates' questions. If you regularly use the online forum to ask and answer questions, you may receive up to three bonus points. The number of bonus points will be determined by me at the end of the course. In order to be eligible for receiving bonus points, you must register with your @mcmaster.ca email account and must make your username your LastName_FirstName. If you would like to anonymously ask questions, feel free to make another username, but in this case you won't be eligible to receive bonus points.

Note: Apart from this online forum, there will be no additional way to earn bonus marks in this course.

Practice Problems: There will be a list of recommend practice problems posted on the course website each week. The practice problems will come from the course text. These problems are not to be handed in, but you are strongly encouraged to complete them in order to succeed in this course. One of these problems will appear on your midterm, and two will appear on your final exam.

Tentative Course Schedule:				
Date	**Topics**	**Assessment**		**Practice Problems**
Week 1				
June 22nd	Introduction (1.1), Initial Value Problems (1.2)	Assignment #1 (due Fri. Jun. 26)		1.1: 1,3,5,7,9,15,33,35,43 1.2: 5,7,15,19,25,27,49
June 24th	Separable Equations (2.2) Linear Equations (2.3), Exact Equations (2.4),			2.2: 1,5,7,25,29,31,37,49 2.3: 25,27,33,46,48 2.4: 1,7,25,31,39,44
Week 2				
June 29th	Solutions by Substitution (2.5) Solution Curves Without a Solution (2.1)	Quiz #1 (in class)	Assignment #2 (due Fri. Jul. 3)	2.5: 1, 13,17, 27 2.1: 1,15,21,23,25,29
July 1st	**Canada Day** (no class)			
Week 3				
July 6th	Linear Equations (4.1), Reduction of Order(4.2), Homogeneous Linear Equations (4.3)	Quiz #2 (in class)	Assignment #3 (due Fri. Jul. 10)	4.1: 5,21,29,35,39,53,69 4.2: 3,11,17 4.3: 1,5,11,15,23 35,49,55
July 8th	Annihilator Approach (4.5), Variation of Parameters (4.6),			4.5: 5,21,29,35,39,53,69 4.6: 1,11,17,23,25,29,32 4.7: 1,5,15,21,27,40

	Cauchy-Euler Equation (4.7)			
Week 4				
July 13th	Laplace Transforms (7.1), Inverse & Derivative Transforms (7.2)	Quiz #3 (in class)		7.1: 1,9,21,29,52 7.2: 3,11,15,17,31,37
July 15th	Operational Properties (7.3)	Midterm (in class)		7.3: 1,5,11,13,17,27,37, 45,49,55,63,67
Week 5				
July 20th	Operational Properties (7.4), Dirac Delta Function (7.5)	Quiz #4 (in class)	Assignment #4 (due Fri. Jul. 24)	7.4: 1,3,7,11,13,19,21, 25,27,31,37,45 7.5: 1,3,9,11
July 22nd	Systems of Linear Differential Equations (7.6) Power Series (6.1)			7.6: 1,3,9 6.1: 3,11,19,25,29,31
Week 6				
July 27th	Ordinary Points (6.2), Singular Points (6.3)	Quiz #5 (in class)	Assignment #5 (due Fri. Jul. 31)	6.2: 1,7,13,19,21, 23,25,26
July 29th	Special Functions (6.4)	Quiz #6 (in class)		6.3: 1,3,5,13,15,23, 25,27,29
Week 7				
Aug. 3rd	**Civic Holiday** (no class)			
Aug. 5th		Final Exam (in class)		

*parts of the Course Outline have been omitted (e.g. the university policy on academic dishonesty, etc.)

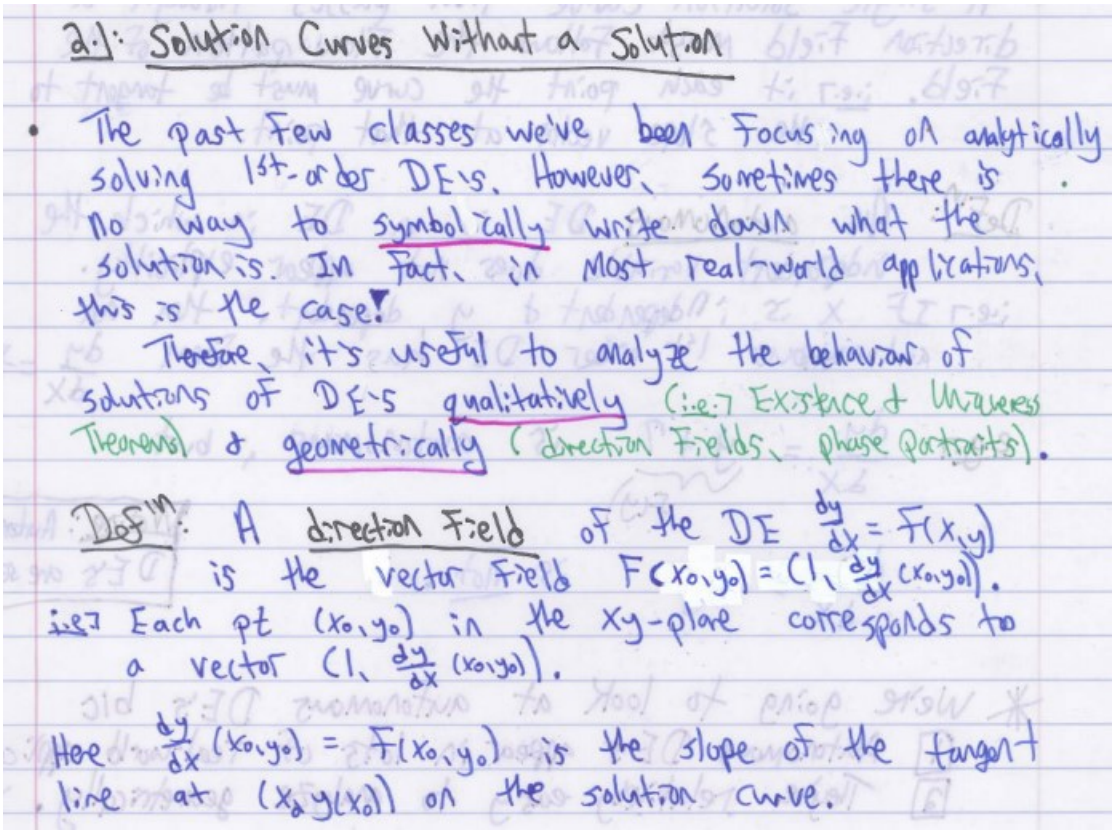
Appendix B: Sample Lecture Notes

The following is a snippet of my lecture notes from the second-year differential equations course I taught at McMaster. This is a few pages from my Class 3 lecture notes when we covered direction fields and first-order autonomous differential equations.

The concept of a direction field is very important, so I decided to spend a good amount of time discussing it. First, I connect to the material discussed previously, and then introduce a direction field in a definition. To make sure that my students understand the definition, I use different algebraic and geometric approaches (my notes contain only parts of calculations and only some of the diagrams that I actually use in my lecture).

Some material is given on a handout, for students' active participation. They are supposed to work on the question sheets on their own, and also discuss solutions with their neighbours.

In my notes, I indicate places where I talk about the broader context and give rationale for the material introduced in lectures (for instance, by giving reasons why and how we use autonomous equations). This is important, as it helps students further understand and internalize differential equations.



2.1: Solution Curves Without a Solution

- The past few classes we've been focusing on analytically solving 1st-order DE's. However, sometimes there is no way to symbolically write down what the solution is. In fact, in most real-world applications, this is the case!

  Therefore, it's useful to analyze the behaviour of solutions of DE's qualitatively (i.e. Existence & Uniqueness Theorem) & geometrically (direction Fields, phase portraits).

Defn: A direction field of the DE $\frac{dy}{dx} = F(x,y)$ is the vector field $F(x_0,y_0) = (1, \frac{dy}{dx}(x_0,y_0))$.

i.e. Each pt (x_0,y_0) in the xy-plane corresponds to a vector $(1, \frac{dy}{dx}(x_0,y_0))$.

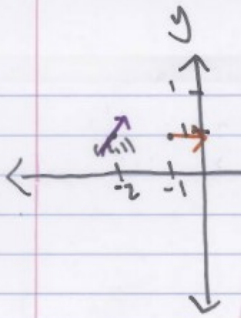
Here $\frac{dy}{dx}(x_0,y_0) = F(x_0,y_0)$ is the slope of the tangent line at $(x_0, y(x_0))$ on the solution curve.

e.g.: $\frac{dy}{dx} = x^2 - y$.

The graph of a solution to this DE that passes through the point $(-2,1)$ must have a slope $(-2)^2 - 1 = 3$.

i.e.: $F(-2,1) = (1,3)$. $F(-1,1) = (1, (1)^2 - 1) = (1,0)$.

To graph these, identify the point $(-2,1)$, & draw the vector $(1,3)$ at that pt.



$F(x,y) = (1, x^2 - y)$.

[Print this VF & give as handout].

- A single solution curve that passes through a direction field must follow the flow pattern of the field. i.e.: at each point the curve must be tangent to the slope vector at that point.

Def^{n}: An autonomous DE is a DE in which the independent variable does not appear explicitly.

i.e.: If x is independent & y dependent, then an autonomous 1st-order DE has the form $\frac{dy}{dx} = F(y)$.

e.g.: $\frac{dy}{dx} = \underbrace{y + 7}_{F(y)}$ is autonomous, but

$\frac{dy}{dx} = xy$ is not.

Notice: Autonomous DE's are separable!

* We're going to look at autonomous DE's b/c
  1. Autonomous DE's appear in lots of real-world applications.
  2. They're relatively easy to analyze geometrically. *

Def^{n}: Given $\frac{dy}{dx} = F(y)$, the zeros of F (i.e.: $\{c \in \mathbb{R} \mid F(c) = 0\}$) are called critical points (aka: equilibrium points).

Notice: If c is a critical point, then $y(x) = c$ is a solution to the DE $y' = F(y)$.

Recall: Given a function $y(x)$, the sign of the derivative $\frac{dy}{dx}$ determines where $y(x)$ is increasing / decreasing.

Given an autonomous DE $y' = F(y)$, we keep track of where the solutions of this DE are increasing / decreasing in **phase portrait**:

Assuming F & F' cont. on some interval I.

e.g.: Consider the autonomous DE $\frac{dy}{dx} = \underbrace{y^2 - y^3}_{F(y)}$.

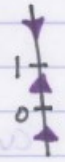
$y^2 - y^3 = 0 \iff y^2(1-y) = 0 \iff y = 0$ or $y = 1$.

$\therefore$ The critical pts are 0 & 1.

Now we check to see where $y(x)$ is increasing / decreasing on each interval determined by these critical pts:

y	-1		0		$\frac{1}{2}$		1		2
$y' = F(y)$		2			$\frac{1}{8}$			-4	
sign		$+$			$+$			$-$	

The phase portrait is:



i.e.: $y(x)$ is increasing on the intervals $(-\infty, 0)$ & $(0,1)$ & is decreasing on $(1, \infty)$.

With this info, we can sketch the solution curves:

$\therefore$ A nonconstant solution must lie entirely on one side of an equilibrium solution.

A nonconstant solution can't cross an equilibrium solution, bc: if it did, then the pt it crosses at has 2 unique IVP solutions. ↯

Appendix C: Sample Assignments

I created the following two assignments in the second-year differential equations course I taught at McMaster University. Part I of these assignments consisted of computation based questions and was completed online. Part II was a written component to be handed in. I include the questions from Part II here.

Writing is an essential component of learning mathematics, as it helps students organize their thoughts. Written Assignment 2 asked students to explain their mathematical reasoning. Written Assignment 4 asked students to communicate their knowledge in a language understandable to those who are not in the course. "Forcing" students to communicate their knowledge in this way improves their understanding. (The best way to test that we have learned something is to make someone else understand it.)

Math 2C03: Assignment #2
Due: Friday, July 3rd

Part I: Online

The online portion of your assignment is available on WeBWork.

Part II: Written

Please deposit the written part of this assignment in the course locker (basement of HH) by 2pm on the due date.

If you are unable to make it to campus, I will accept online submissions: either TeX your assignment OR *scan* your handwritten assignment. (Please do not take a photo, because it will be too difficult to read). Submit your file as a PDF via email, making the title your LastName_FirstName_Assignment2.

Questions:

Answer each question fully, explaining all reasons. If you use a Theorem, explain why you are allowed to use it (i.e. why are the assumptions of the theorem satisfied?)

1. (4ts) Consider the initial value problem $2y' + 8xy = x^3e^{x^2}$, $y(0) = 2$. Without solving this IVP, explain why a solution exists. Can there exist more than one solution to this IVP on a given interval? Explain.
2. (2pts) Consider the first-order differential equation $(y')^2 + 8 = 0$. Does this equation possess any real solutions? i.e. Can there exist a real-valued function $y = \phi(x)$ which satisfies this DE on some interval? Explain.
3. (4pts) Suppose you are given a first-order differential equation $y' = f(x, y)$, which satisfies the hypotheses of Theorem 1.2.1 in some rectangular region R. Could two different solution curves in its 1-parameter family of solutions intersect at a point in R? Why or why not?

Math 2C03: Assignment #4
Due: Friday, July 24th

Part I: Online

The online portion of your assignment is available on WeBWork.

Part II: Written

Type your response to this question (double-spaced, at most one page), save it as a PDF, and title it LastName_FirstName_Assignment4. Submit your PDF to me, via *email*, by 2pm on the due date.

Question:

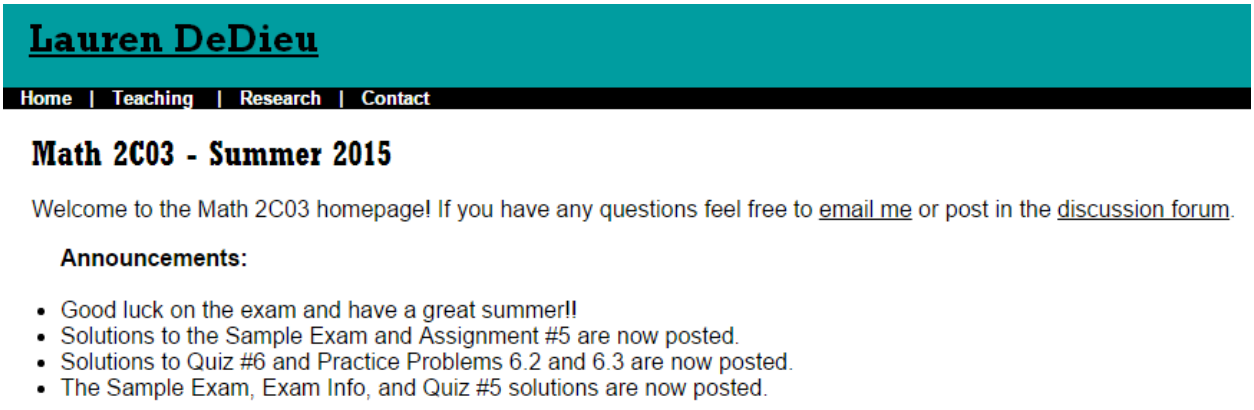
1. (10pts) Imagine yourself standing in front of an audience of high school students. Your task is to introduce to your audience in the simplest way the concept of an ordinary differential equation. Elaborate in 2-3 paragraphs how you would complete this task. Support your ideas with examples and describe/explain the various approaches to solve such an equation.

   Remember: Keep your audience in mind. They have little to no knowledge of calculus, so writing down the definition of a differential equation as we did in class would be of no help to them (they might not know what a derivative is!). You're encouraged to consult the textbook and internet for real life examples that might help you illustrate your point.

Appendix D: Course Website Layout

Below is a snippet of my course webpage for the second-year differential equations course I taught at McMaster. The entire webpage is not displayed below. Visit http://ms.mcmaster.ca/~dedieula/2C03.html for the complete webpage.

This webpage was a one-stop place where students could find the course outline, assignments, class notes, solutions, and all relevant course information.



- **Course Outline**
- **Office Hours:** Mon. 5:30-7pm, Wed. 5:30-7pm, or by appointment (HH303).

Lecture Notes:

- Class 1
- Class 2
- Class 3
- Class 4 (slides)
- Class 5
- Class 6
- Class 7
- Class 8
- Class 9
- Class 10
- Class 11

Assignments:

The questions for the writen part of your assignment will be posted here. The online part is found in WeBWork.

- Assignment 1 (solutions)
- Assignment 2 (solutions)
- Assignment 3 (solutions)
- Assignment 4 (solutions)
- Assignment 5 (solutions)

Links:

The following may be useful:

- Table of Laplace Transforms
- Solving DE's Guide (by Chris Litfin)
- Graphing Direction Fields

WeBWork:

Your WeBWork assignments can be found here. Your username is your MacID and your password is your student number.

- WeBWork

Discussion Board:

Ask and answer questions in the class discussion forum!

- Math 2C03 Discussion Forum

Appendix E: Letters of Teaching Observations

Lauren DeDieu
Teaching Observation

Report by: Miroslav Lovric, Acting Associate Chair (Undergraduate),
McMaster University

I was present at Lauren's lecture in Math 2C03 on July 20th, 2015. The lecture started on time, with almost all students present. The topic was Laplace Transforms.

1. Teaching Techniques

Lauren definitely demonstrated mastery of content, as well as awareness of the fact that the material is new to almost all students. She started the class by summarizing the material taught in the previous class, and – on a poster – displayed all relevant formulas (the topic is quite technical). Next, she illustrated new concepts and formulas in examples, which was very well received by the students.

Lauren was really well prepared for the class - evidence for this is a suitably chosen pace that she used in calculations, as well as correct answers to student questions and frequent recalling of relevant theoretical results.

Active teaching strategies that Lauren uses (questions, in-class exercises, and also online assignments) keep her students' attention and motivation.

Lauren' explanations are clear and concise. Frequently she asks questions, and welcomes student participation. Clearly, students have been used to this style, as they were ready to answer questions, or ask their own questions.

Although the material is not most interesting mathematically, Lauren was able to maintain students' attention. Students were aware of the relation of the material to other parts of the course.

2. Effective Planning

Lauren is well-prepared for her classes, and chooses good examples to illustrate theoretical concepts. Her notes are complete, and demonstrate extensive reflection about the intricacies of the material she needs to discuss. Pace of her lecturing is adequate; students seemed to be following her presentation without difficulty.

3. Student/Teacher Relationships

Lauren was able to maintain student interest and attention. By carefully answering students' questions, she was able to clarify details of (what students feel are) tricky calculations. Her attitude towards students is positive and encouraging. She is able to maintain a friendly and respectful teacher-student relationship.

4. Classroom Environment

Given the size of the class, the classroom is suitable. There is sufficient blackboard space, which Lauren uses very effectively.

Lauren's writing on the blackboard is clear, and sufficiently large (she is well aware of the size of the classroom). Her voice projects well into the classroom, students had no problems hearing her.

5. Conclusion

Lauren is an excellent, careful and dedicated teacher, focused on helping her students develop good problem solving and logical thinking skills.

Very well prepared and delivered lecture. Excellent attitude towards students in class, and obvious concern for their learning. Good blackboard skills, clear and understandable explanations, and adequate pace of exposition.

Miroslav Lovric,
Acting Associate Chair (Undergraduate),
Department of Mathematics and Statistics,
McMaster University

October 22, 2015

Lauren DeDieu
Teaching Observation
Report by: Megumi Harada (Associate Professor, McMaster University)

I observed a video recording of Lauren's lecture in Math 2C03 (the recording was made in July 2015). The following report is based on what I saw in the video recording, in addition to numerous conversations I have had with her in the past several years regarding her teaching.

Teaching Techniques.

- Lauren is clearly extremely well-prepared for her lectures. Her lecture notes are detailed, well-thought-out, and illustrative of very careful preparation.
- Although her voice is not loud, she speaks clearly and it is clearly not a problem for students to hear every word she says.
- Her handwriting is neat and legible, and her blackboard style is organized.
- Lauren makes excellent use of colored chalk for drawing figures and for emphasis of key ideas.
- She frequently makes eye contact with her class, scanning for visual cues and for student questions.
- The students appeared to be clearly attentive. They asked questions while I was watching the class, and Lauren responded well and with a good attitude. It was apparent that she had a good rapport with the students. There was laughter in the room, which is quite an accomplishment in a summer math course!
- She draws good pictures to accompany well-chosen examples to illustrate the concepts.

Summary.

Lauren is a conscientious and capable instructor. She very clearly cares about doing a good job, and cares about helping the students acquire basic mathematical, logical, and critical-thinking skills. She is willing to put in a lot of work in preparing her lectures, getting feedback from the students, and generally having a positive, "can-do" attitude towards communicating the material in a way that the students can understand.

Should you need any further information, please do not hesitate to contact me.

Megumi Harada
Department of Mathematics and Statistics
McMaster University

Appendix F: Teaching and Learning Certificates

is hereby presented to

Lauren Dedieu

to recognize the successful completion of the

Teaching and Learning Foundations Certificate

delivered by the McMaster Institute for Innovation and Excellence
in Teaching and Learning and the School of Graduate Studies.

Courses completed include:

EDU 600: Essential Skills in Teaching and Learning (I)
EDU 650: Peer-Evaluated Teaching Experience

Arshad Ahmad

Arshad Ahmad
AVP Teaching & Learning, Director, McMaster Institute
for Innovation & Excellence in Teaching & Learning

April 27, 2015

is hereby presented to

Lauren Dedieu

to recognize the successful completion of the

Teaching and Learning Scholar Certificate

delivered by the McMaster Institute for Innovation and Excellence
in Teaching and Learning and the School of Graduate Studies.

Courses completed include:

EDU 600: Essential Skills in Teaching and Learning (I)
EDU 650: Peer-Evaluated Teaching Experience
EDU 700: Essential Skills in Teaching and Learning (II)
EDU 750/751: Principles and Practices of University Teaching
EDU 760: Self-Directed Study

Arshad Ahmad

Arshad Ahmad
AVP Teaching & Learning, Director, McMaster Institute
for Innovation & Excellence in Teaching & Learning

August 7, 2015