Methods of Differential Equations

MATH 391 Section A, Spring 2015
M, W 8am – 9:15am in room NAC 6/111

Instructor: Jhevon Smith
Email: JhevonTeaches@gmail.com
Office Hours: By appointment. Also see tutoring times below.
Website: http://math.sci.ccny.cuny.edu/people?name=Jhevon_Smith
Text: (Optional) Boyce and DiPrima, *Elementary Differential Equations and Boundary Value Problems, 10th Edition.*
Math Dept.: NAC 8/133 **Math Dept. website:** http://math.sci.ccny.cuny.edu
Math 391 website: http://math.sci.ccny.cuny.edu/courses?name=Math_39100

Websites: I gave you my website since I will be posting documents and instructions for the class there, such as: review problems, announcements, solutions to tests and quizzes, etc. I gave you the math 391 website because you will need to go to that website to access past finals, and other study materials, etc. I gave you the math. dept. website because, well, you should have it.

Calculator: Calculators are *NOT* permitted on any quiz or exam in this course. You may need calculators for certain problems in the homework, but I encourage you to try and do without a calculator as much as possible to create/maintain good habits.

Grading: Grades will be assigned according to the following chart.

Letter Grade	**G.P.A.**	**Grade**	**Letter grade**	**G.P.A.**	**Grade**
A^+	4.00	98-100	C	2.00	74-76
A	4.00	94-97	**C-**	**1.66**	**70-73**
A^-	3.66	90-93	**D**	**1.00**	**60-69**
B^+	3.33	87-89	**F**	**0**	**Below 60**
B	3.00	84-86			
B-	2.66	80-83			

The grading chart is a formality. If you are in this class, then you are likely an engineering or math major, otherwise you're likely to be majoring in one of the hard sciences, or are a math enthusiast; in any and all of these cases, an A would be the appropriate grade to get, an A+ if you want to show off—none of the other grades matter or should be considered. An A (and the level of understanding that comes with it) should be the minimum grade that you should be aiming for. If this is not the case, then, to be bluntly honest, you don't belong here.

As department policy demands, the final exam is worth 40% of your grade in this course. The remaining 60% will come from your in-class grade. The breakdown is as follows:

Quizzes: 15% (Expect *at least* once per week. Two quiz grades will be dropped.)
WhileyPlus Homework: 10% (This homework will be submitted online.)
Participation: 5% (Based mostly on attendance.)
In-class tests: 30% (I will give 4 exams.)
Final Exam: 40% (This will be a cumulative exam given at the end of the course.)
Extra Credit: Provided the class average for the first test exceeds 80%, I will drop the lowest test score. Otherwise, expect no extra credit.

Make-up Exams/Quizzes: No way…

Don't miss any test or quiz! And work hard so that you don't end up in a position where you'd need extra credit!

Attendance: Attendance will be taken at the beginning of class. Note that you are graded for attendance. You are *late* if you arrive after I take attendance. You will be assigned a WU (failing) grade if you accumulate 5 unexcused absences.

To be excused for an absence (or lateness) you must email me within one day of the particular absence (or lateness) with the reason. Of course, proof is required where applicable. For example, if your absence or lateness was due to a doctor's appointment, I expect to see a doctor's note. If you miss a class, it is your responsibility to catch up. You can see me during my office hour to discuss what was done in class, or catch up on your own. It's up to you. **To reiterate, there is no make-up for a missed quiz/homework/exam. Seriously! The excuse does not matter.**

My Expectations:

Work ethic: You are not to slack off (more on this in class)! You are to read ahead! Read each section before coming to class. It's better if you have your mind working on the concepts before coming to class—it will be easier for you to keep up and ask intelligent questions. Aim for an A, and work as if your life depended on this class. Do not give yourself any excuse not to do well. Failure is not an option.

Homework: Homework will be done electronically and submitted online via WileyPlus—the textbook publisher's web-based interactive teaching and learning environment. See the WileyPlus flyer that appears after the course learning outcomes for info on how to register at the WileyPlus website. After creating an account, you will be able to access assignments. Late assignment submissions will not be accepted. The excuse does not matter. Give yourself enough time to do the homework and submit it online before the given deadlines. I will answer questions on each homework assignment in class, so be prepared to articulate what your troubles are with doing the homework, and have a printout(s) of the problem(s) you're having trouble with when you come to class.

Prior Knowledge: I also expect you to remember the math that you have done before this course. Math is cumulative. Each math class builds on the class that came before it. If you are not good at pre-algebra, then algebra will be difficult, and so on. Be sure you've mastered the level of math that came before this. I will assume you are all experts at the lower level math courses. **If this is not currently true for you, make it true, quickly; like by the end of the week.** Of particular importance to this class is calculus 2. The integration and differentiation techniques learned in and up to calculus 2 will be indispensable. The class will also feel like calculus 2, in that it will predominately focus on techniques and methods for solving various kinds of equations—just as how a large part of calculus 2 focused on techniques and methods for integrating and differentiating various kinds of functions. A dab of calculus 3 knowledge would come in handy, but only in a familiarity sense. It is my opinion that a good calculus 2 student can do well in this course with no knowledge of calculus 3 whatsoever. What we will use from calc 3 can be learned on the fly.

And now it is time for matra. Because some things should not be done in polite company—or any company—ever.

Repeat the following to yourself 10 times a day. Five times when you wake up and five times before you go to sleep.

I must NOT cancel across sums,
I must NOT distribute powers across sums,
I must NOT divide by zero,
All these are blasphemy!
But I will use brackets when appropriate.

So yeah, the above may seem like a joke, and it is somewhat, but here's the part that's not funny: **do NOT commit any of the blasphemies mentioned above! Doing so will result in an instant zero (0) on any exam or quiz in which such an offense is made! Regardless of how well you did otherwise.**

There are a couple other offenses that will incur a similar penalty. Making any one of the following mistakes will result in you getting a zero for the problem you make the mistake in.

1) Making the mistake of thinking $\int 1/x^n\,dx = ln\,(x^n) + C$ (this is NOT true unless $n = 1$!!!). And of course, absolute values are needed in that case. More on this in class.
2) Making the mistake of thinking the derivative (or integral) of a product (or quotient) is just the product (or quotient) of the derivatives (or integrals). That sounded confusing, I'll explain this in class.

Avoid these mistakes at all costs. I will punish you severely for making them.

Contact: You are to email me at the end of the first day of class using an email client that you check regularly, stating your name, your course and its section. I will deduct 5 points off your final grade if you fail to do this. I will be emailing important information from time to time; including progress reports, announcements and advice as needed. Please read the emails. If I email you, it means it is important—important enough for me to take the time to write an email so that you will have it in writing.

Feedback: I encourage you to give me feedback about my teaching or the class, whether positive or negative (just make it constructive please). You can email me or talk to me, or if you don't want to reveal your identity, there is an anonymous feedback page on my website.

Help: FREE tutoring is available in the Marshak Building, room 418S. I am also a tutor there. The hours for this semester are: Mondays through Thursdays 12pm – 5pm and Fridays 12pm – 4pm. The tutoring center will be open starting February 2nd.There are also online resources available. A great place to get math help, even at odd hours, is www.mathhelpforum.com. There are a significant number of brilliant people from varying time zones who decide to spend their free time helping others with math. Take advantage of this great service. Another great resource on the web is wolframalpha.com. You can use that site to check your answers. Brilliant site. Of course, there are other online contenders like YouTube, Khan Academy, etc. Check them out. Google is your friend…and big brother. Also, WileyPlus will have tutorials and hints for completing homework problems. And don't forget your classmates. You should get the contact information of at least one person that you can study with or get missed notes from if you are absent, etc. You're all in this together, help each other out. And, of course, there is always me! Don't be afraid to come to me if you have questions or concerns. You can contact me via email

or see me after class or during my office hour. My office hour is by appointment. I will also be at the tutoring center regularly and you can come and see me there.

Some class rules: Please silence your cell phones and don't use them when in class. Eating in class is NOT allowed. Drinking is permitted, as long as you remove your garbage afterwards. At this time of day, coffee may be essential to survival.

Academic Integrity: Any act of academic dishonesty will be dealt with by applying the most stringent penalties permitted. Cheating includes, but is not limited to, receiving help during exams and submitting homework without properly acknowledging persons who assisted you. Please read carefully the Policy on Academic Integrity posted on the CUNY website with URL http://www1.cuny.edu/portal_ur/content/2004/policies/image/policy.pdf

I really don't like cheating. Please don't do it. There, I asked nicely. I will not be nice if I catch you.

Spring 2015 Academic Calendar

January	
01/20/2015	Last day to apply for an e-permit
01/27/2015	**Last day for 100% tuition refund**
01/27/2015	Last day of Registration
01/28/2015	**CLASSES BEGIN**
01/27/2015 – 01/30/2015	Change of Program
01/31/2015	**FIRST DAY OF SATURDAY CLASSES**
February	
02/02/2015 – 02/03/2015	Change of Program
02/03/2015	Last day to file for Pass/Fail and Audit Options
02/03/2015	Last day to add a class to an Existing Program
02/03/2015	Last day to drop classes for 75% tuition refund
02/10/2015	Last day to drop classes for 50% tuition refund
02/12/2015	**COLLEGE CLOSED - Lincoln's Birthday**
02/16/2015	**COLLEGE CLOSED - President's Day**
02/17/2015	Last Day to drop classes for 25% tuition refund
02/17/2015	Last day to drop classes without the grade of "W"
02/18/2015	**Course withdrawal period begins (A grade of "W" is assigned to students who officially drop a class) – No Refund**
02/18/2015	**Monday Schedule**
2/18/2015	Verification of Enrollment begins
02/26/2015	Last day to submit proof of immunization for NYS residents
02/26/2015	Verification of Enrollment due to Registrar for assignment of WN grades
March	
03/02/2015	Deadline for filing Application for Degree for May 2015 graduation.
03/05/2015	**Last day to select a major for this semester's TAP awards**
03/13/2015	Last day to submit proof of immunization for non-NYS Residents
03/15/2015	**FAFSA priority deadline for 2015 – 2016 financial aid**
April	
04/03/2015 – 04/11/2015	Spring recess (College Open)
04/08/2015	INC grades for Fall 2014 for Undergraduate students convert to FIN
04/08/2015	INC grades for Spring 2014 for Graduate students convert to FIN
04/16/2015	Course withdrawal period ends, last day to drop with the grade of "W"

May	
05/15/2015	**LAST DAY OF CLASSES**
05/16/2015	**LAST DAY OF SATURDAY CLASSES**
05/17/2015	Reading Day
05/18/2015 – 05/24/2015	Final Exams
05/24/2015	End of Spring Term
05/25/2015	**COLLEGE CLOSED - Memorial Day**
05/28/2015	Last day for grade submissions for Spring 2015
05/29/2015	**Commencement**
June	
06/01/2015	**Summer Session Begins**

Topics and Assignments (based on 10th edition):

#	Section/Topic	Text Assignment for extra practice
1	1.1 Basic Mathematical models; Direction Fields	
2	1.2 Solutions to some differential equations	
3	1.3 Classification of differential equations	
4	2.1 Linear equations; Method of integrating factors	p. 40: 7-10, 11- 15odd
5	2.2 Separable equations	p. 48: 3-17odd; p. 50-51: 31-37odd,
6	2.3 Modeling with linear equations	p. 60-63: 1-4,7-10,16
7	2.6 Exact Equations (may skip integrating factors)	p. 101: 1,3,4,7-13odd,17,18
8	2.9 Miscellaneous	p. 132-133: 1 – 14, 28, 29; p. 135-136: 36, 37, 41,42,43,45,48,49
*	**Exam #1 on topics 1 through 8**	
9	3.1 Homogeneous equations with constant coefficients	p. 144: 1-11odd,16
10	3.2 Solutions to linear homogeneous equations; the Wronskian	p. 155-157: 1,3,5,14,16,38,39,
11	3.3 Complex Roots of the characteristic equation	p. 164: 1-11odd,17,19
12	3.4 Repeated Roots; Reduction of order	p. 172-174: 1-11odd,23,25,28
13	3.5 Nonhomogeneous equations; Method of undetermined coefficients	p. 184: 5-11odd,12,15,17, and 21-25 (Y(t) alone)
14	3.6 Variation of parameters	p. 190: 3,5,7,9,10,13,14
15	3.7 Mechanical and Electrical vibrations (Spring problems)	p. 203-204: 5,6,7,9
16	3.8 Forced Vibrations	p. 217: 5,6,9
*	**Exam #2 on topics 9 through 16**	
17	4.1 General theory of n^{th} order linear equations	
18	4.2 Higher order homogeneous equations with constant coefficients	p. 234: 11-23odd
19	4.3 Method of undetermined coefficients for higher order linear equations	p. 239: 13-18 (Y(t) alone)
20	4.4 Variation of parameters for higher order linear equations (may skip)	
21	5.1 Review of power series	
22	5.2 Series solutions near ordinary points, part I	p. 263-264: 1,2,5-17odd
23	5.3 Series solutions near ordinary points, part II	p. 263-264: 8, 14; p. 269: 1,2,3
24	5.4 Euler equations; Regular singular points	p. 280: 3 – 15odd
25	5.5 Series solutions near regular singular points	p. 286: 1-9odd
*	**Exam #3 on topics 17 through 25**	
26	6.1 Definition of the Laplace Transform	
27	6.2 Solutions to initial value problems using Laplace Transforms	p. 324-325: 13-17odd,21,22
28	10.1 Two-point boundary value problems	
29	10.2 Fourier Series	p. 605: 13-18
30	10.3 Fourier Convergence Theorem	
31	10.4 Even and Odd functions	p. 620: 15-19
32	10.5 Heat conduction problems; separation of variables for PDEs	p. 630-631: 1-12
*	**Exam #4 on topics 26 through 32**	
*	**Final Exam: Monday, May 18th 1 – 3:15pm**	**Location and seating assignments TBA**

COURSE #: 39100 **COURSE TITLE: Methods of Differential Equations** CATEGORY: required course for engineering majors TERM OFFERED: Spring 2012 PRE-REQUISITES: Math 20300 PRE/CO-REQUISITES: HOURS/CREDITS: 3HR/WK; 3 CR DATE EFFECTIVE:01/27/13 COURSE SUPERVISOR: Ethan Akin	**CATALOG DESCRIPTION :** First order equations; higher order linear equations with constant coefficients, undetermined coefficients, variation of parameters, applications; Euler's equation, series solutions, special functions; linear systems; elementary partial differential equations and separation of variables; Fourier series. Suggested Text: Elementary Differential Equations and Boundary Value Problems (10thEd), W. Boyce and R. DiPrima.

Math 391 Topics and Allotted Times

Text: Boyce and DiPrima, Elementary Differential Equations and Boundary Value Problems, 10th edition, Wiley

Suggested Periods	Sections	Topics
1	1.2-3	Solutions & Classifications
1	2.1	First order linear equations
2	2.2	Separable equations and homogeneous equations (exercises 30-38)
3	2.3	Modeling with linear equations (do examples 1-3; skip escape velocity)
1	2.6	Exact equations; skip integrating factors
1	3.1	Second order homogeneous LODE
2	3.2	Wronskians; Linear Independence; Abel's Theorem
1	3.3	Complex roots of the associated polynomial
1	3.4	Reduction of order; repeated roots
2	3.5	Undetermined coefficients
1	3.6	Variation of Parameters
2	3.7	Free vibrations in mechanical systems
1	3.8	Forced Vibrations
1	4.1	General homogeneous LODE
1	4.2	Higher order homogeneous LODE
1	4.3	Undetermined coefficients
1	5.1	Power series
1	5.2	Solutions near ordinary points
1	5.4	Euler's equation
1	5.5	Regular singular points
3	6.1-2	Laplace transforms
1	10.1	Two point boundary value problems
2	10.2	Fourier series
1	10.3	Fourier convergence theorem
1	10.4	Even / Odd functions
2	10.5	Heat Conduction Problems, separation of variables

COURSE LEARNING OUTCOMES

COURSE LEARNING OUTCOMES
Please describe below all learning outcomes of the course, and indicate the letter(s) of the corresponding Departmental Learning Outcome(s) (see list at bottom) in the column at right.

After taking this course, the student should be able to:	Contributes to Departmental Learning Outcome(s):
1. Solve a variety of first order differential equations selecting from a variety of techniques covered in the syllabus..	a. b, e2, g.
2. Likewise, solve a variety of second order differential equations, selecting from several techniques covered in the syllabus.	a, b, e2, g.
3. Be able to analyze certain physical problems (tank flow, compound interest, mechanical and electrical vibration), set up their determining differential equations , solve them using the techniques in 1. and 2. above, and use these solutions to answer questions about the physical system.	a, b, c, g.
4. Give series solutions (and approximations) for second order linear differential equations, both at ordinary points and at regular singular points.	a, b, g.
5. Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.	a, b, e1, e2, g.
6. Understand and be able to apply all the mathematical aspects that contribute to the solution of heat conduction of a rod problem with constant temperature boundary conditions (the method of separation of variables, the use of Fourier series, as well as the specific solution).	a, b, c, g.
7. Understand and be able to use various theoretical ideas and results that underlie the mathematics in this course covered in the syllabus (including various existence/uniqueness results, ideas of linear independence and the Wronskian, and convergence properties of Fourier series).	e1, e2, g.

COURSE ASSESSMENT TOOLS
Please describe below all assessment tools that are used in the course.
You may also indicate the percentage that each assessment contributes to the final grade.

1. The average of class examinations: 60% of grade
2. Comprehensive written final exam: 40% of grade.

DEPARTMENTAL LEARNING OUTCOMES *(to be filled out by departmental mentor)*

The mathematics department, in its varied courses, aims to teach students to

a. perform numeric and symbolic computations
b. construct and apply symbolic and graphical representations of functions
c. model real-life problems mathematically
d use technology appropriately to analyze mathematical problems
e. state (e1) and apply (e2) mathematical definitions and theorems
f. prove fundamental theorems
g. construct and present (generally in writing, but, occasionally, orally) a rigorous mathematical argument.

This course uses WileyPLUS

Find & Register for Your Course

- Copy and paste the correct Class Section URL listed below into your browser.
- Verify that the section matches your schedule
- Log in or create a new ID

Class Section Name	Class Section URL
Math 39100	http://edugen.wileyplus.com/edugen/class/cls438208/

OR

- Go to www.WileyPLUS.com and click Get started
- Search our course finder for your class section
- Verify that the section that you choose is correct before you continue

Getting Access

Option 1: Log In and Buy WileyPLUS Online *(WileyPLUS includes the complete interactive textbook online)

Option 2: Buy bundled with a printed textbook at your campus bookstore

"But I was going to rent or buy a used book."

Used and rental books do NOT include valid WileyPLUS codes, making this option the most expensive.

Not sure which option is best for you? **Grace Period** gives you temporary access for up to 14 days.

Need Help?

View a video **www.wileyplus.com/register**

LIVE CHAT! Technical Support: **www.wileyplus.com/support**

Questionnaire

What is your major? _____

Are you sure you need this class? _____

What is the highest level of math you *have yet to* complete? _____

How did you get into this class? (Passed the prerequisite course, placed here upon college entry, placed by an advisor, etc)

_____

_____

Are there any dates during the Spring for which you will not be able to take an exam/quiz due to religious reasons? If so, please state the date(s) and "occasion(s)" below.

_____

_____

How good would you say you are at Algebra? ____ Precalc? ____ Calc 1? _____ Calc 2? _____ (Enter 5 for "I can do it in my sleep!", 4 for "I'm not the best at it, but pretty awesome.", 3 for "I'm just OK; I'm good at the basics.", 2 for "I'm not the worst, but far from the best.", 1 for "The class was a blur that got more obscure over time!")

Any general feelings or concerns towards this course? (For example, are you: Scared? Excited? Curious? Indifferent? Based on your perceived ability in math, what grade are you expecting? etc)

_____

_____

_____

Are there any other relevant comments that you wish to add?

_____

_____

_____