Questionnaire – May 2, 2014

1. How is the paper coming along?

   done a lot so far : 0 started writing or doing work : 5 read it in detail : 3

   read parts of it : 8 haven't really started : 7

2. Are there any aspects of the paper you would like to discuss in class? (Be specific.)

   Only 7 people responded, and there was no consensus. I answer a few questions below with answers to #3.

3. Write down a question, comment, or suggestion you have pertaining to the course.

   See below

4. A theorem that we stated on Wednesday says that a lower bound of the radius of convergence for a series solution around a point x_0 for a second order linear differential equation of the form $P(x)y'' + Q(x)y' + R(x)y = 0$, where P, Q, and R are polynomials, is the distance between x_0 and the roots of P in the complex plane.

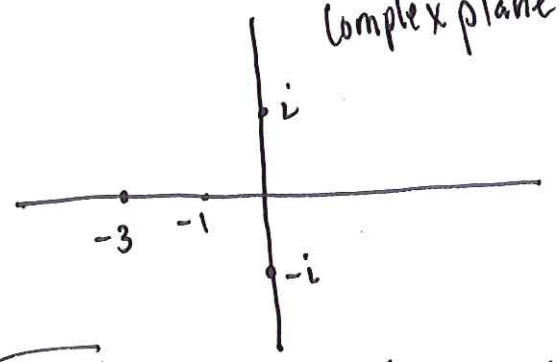
   Determine a lower bound on the radius of convergence of the series solution about $x_0 = -1$ for the differential equation:

   $$\underbrace{(x+3)(x^2+1)}_{P(x)}y'' + 4xy' + 2y = 0.$$

   Correct : 11
   Incorrect : 11

roots of $P(x) = (x+3)(x^2+1) = 0$

$x = -3, \pm i$



distance to -3 : 2.

distance to i : $\sqrt{1^2 + 1^2} = \sqrt{2}$

" $-i$: $\sqrt{1^2 + 1^2} = \sqrt{2}$

so $\boxed{\sqrt{2}}$ is lower bound on radius of convergence.

Questionnaire Responses – May 2, 2014

Find questions about the paper towards the end, questions 14–20.

1. **Is the final cumulative? What should we expect?** Yes. However, it will be weighted towards the material that was not covered by the first midterm.

2. **I found the notes sheet we were allowed to bring into the midterm helpful as a study tool and on the exam. Will we be allowed something similar for the final?** We will likely still allow it. I'll let you know for sure and provide details closer to the date of the final.

3. **Will the final exam be curved at all?** No. If any curving occurs, it will be the final grades.

4. **If we were to see a problem like the one we did in class on an exam, is it likely that we would be expected to do the whole process or only a portion?** You should be prepared to do a problem like the one we did in class. We will absolutely keep in mind that you only have 3 hours to complete the final exam. If we put longer problems on the exam, there will be fewer total problems of them to balance it out.

5. **Is there still tutorial?** Yes! Every Tuesday, Thursday, and Sunday from 7-9 pm. The TA has been sick, but in the future, I'll ask him to find someone to fill in if he needs to miss tutorial.

6. **Is the one point of extra credit equivalent to 1%?** Yes. If your final grade is 89% and if your extra credit assignment is complete and correct, your new grade will be 90%. So the extra credit will do you some good if your grade is border-line. Note that it is not worth as much as a normal homework assignment, which contributes 2–3 points to your final grade.

7. **Can we have practice telling forms/types of differential equations apart?** I'm not sure what you are specifically referring to. For first order, there are several things we had to keep in mind, like is this linear/nonlinear, separable, exact, etc. Is this what you mean? If so, please come to office hours/x-hour and we can talk about this material. For newer material, we worked with systems (which could be linear or nonlinear) and second order linear differential equations.

8. **Writing out the general steps on how to solve a problem is really helpful.** Okay. I've added a list of "general" steps for solving a problem like we did today in class on the website under "General steps for series solution around a regular singular point".

9. **There were lots of graphs in the homework.** The purpose of the graphs is to have you visualize the solution, which can give you a qualitative feel for the solutions. Some people are more visual-learners and will better understand the behavior of solutions from the picture, while others won't.

10. **I am wondering how out total workload will compare to previous sections of the class.** You can check out `http://www.math.dartmouth.edu/courses/by-course/` to see the websites for the Math 23 courses for the past 16 years. Some have had more work, some less. For computational classes like this one, it's important to practice, practice, practice.

11. **It seems like it just picked up a lot. I'm confused.** For Chapter 5, we are covering about a section per day. Read over the section, try the homework, and come to office hour/x-hour/tutorials. I'm happy to talk about it more!

12. **Will PDEs build on series solutions or go in a different direction?** The answer is... sort of. We will often have solutions which are a special type of series, called Fourier series. The main term for these is not $(x - x_0)^n$, but rather sines and cosines. The methods for solving will be different.

13. **Why can we set terms we subtract from sums (when we're changing indices) equal to zero?** We are setting the coefficient of x^{n+r} equal to zero for every n. We pulled out the first two terms since the coefficient of x^{n+r} was 0 for the third sum (but the general term wouldn't give us zero if we plugged in $n = 0$ or $n = 1$). We weren't subtracting these terms, just pulling them out of the sum. Try writing the sum out by terms and you should see that we didn't really change anything, just rewrote it in a convenient way. For more explanation, please come to office hours/x-hour or make an appointment.

14. **For the paper, is there a timetable for suggested steps along the way and will you look over the drafts?** I will think about this and discuss with the other instructor.

15. **For the paper, if we could go over Section 4.1/the fire portion/finding coefficients and parameters/biological aspects.** It seems that everyone requested something different to cover. Several students haven't yet read the paper in detail, and it will help for them to read through this first. I'll think about how best to address your requests. In the meantime, please come to office hours/x-hour or make an appointment.

16. **In the paper, it says to derive values, but values are given.** If you are talking about Section 2.4, what we are asking you to justify (in your own words) the choice for the parameters a_1, b_1, k, m_1, m_2, etc. That is, don't just give a list of parameters, but say where they're from.

17. **In the paper, can the steps we are supposed to follow from the beginning be simplified?** I'm not sure which steps you are asking about. Do you mean the steps at the end of each section? These are supposed to give you an idea of what goes in each section. Please come to office hours/x-hour and we can talk about it.

18. **For the paper, I don't understand the equations intuitively.** To understand each part, you should first understand the point of the logistic factor. This limits the rate of growth by saying that if in your current state, height (for example) is close to m, then the rate of change in height is close to zero (try to see this from the equation), while if height is closer to 0, then the rate of change in height is close to proportional to the current height.

19. **How important is the technical information and all the biological and ecological terms for writing the paper?** The most important thing is the math. However, you should be able to interpret your results in the discussion section in terms of biology.

20. **I wasn't aware of the length of the paper. Is seems unfair to spring a 20–30 page paper on us halfway through the course...** There is no length requirement for the paper. 20–30 pages is (approximately) what students have written in previous sections of Math 23 when given a similar assignments. This is **not** 20–30 pages of text. There are usually many pages of graphs/tables/matrices/formulas/code, etc. (Also, the example I've seen of a 30 page paper was double-spaced.) I have a few papers from previous Math 23 classes in my office, if you would like to get a feel for what your paper should look like. If you come by to office hours, I'd be happy to show you.

    As for it being unfair, other students could claim (and have claimed) that it's unfair to have 80% of one's grade depending on timed exams. The paper gives your more control over your grade, not less. In past classes, students have done well, and it has occasionally led to undergraduate research. It is certainly possible to do a good job in 4 weeks. In addition, it helps answer the question of "why do people study this stuff anyway?" Differential equations are important in physics and engineering and are becoming more and more important in biology, where they are used to model tumor growth, spread of disease, competing populations, and more.