

Your project is an important component of this course. Your project will be done in a group of two to four people. At the conclusion of your research your group will present your results to the entire class. Both you and your partners will receive the same grade for certain parts of the project, however, you will be grading each other as well so keep track of the time you both spend.

Your topic will be of your own choosing, but must use differential equations as a substantial component. My suggestion is that you choose a topic that pertains to your chosen field of study. This may require that you go to an instructor in that area and ask for assistance on picking a topic or problem. If you are having difficulty determining a topic, please see me before **April 16<sup>th</sup>**!

Here are some suggestions to get you started:

- ❖ **Group work:** Be sure that you get off to an early start. These projects require extensive thought and development of ideas, as well as clear, concise write-ups. You should begin thinking about the topic as well as a partner with whom to work as soon as possible.

It is important that everyone in the group participate in the work of the group. In particular, everyone needs to understand how the problem is being solved. To insure this, you should rotate the role of leader/secretary of your group. Be aware that either member of the group may be asked to report on the group's progress or final results.

- ❖ **Consultations:** You should feel free to consult with me about your project. I will be meeting with each of your groups as soon as you have selected a topic to determine that you are on the right path.
- ❖ **Formal Write-up:** Your final report is to be typed on standard 8.5 x 11" paper. Equations and graphs, however, may be neatly handwritten. Graphs are to be clearly drawn and well labeled, or computer produced. Be sure that the names of all the members of the group appear on the cover page. If you use Matlab or Maple, your work is also to be included, perhaps in an appendix.

In writing your report, assume the reader is a student in this course who has no knowledge of your project topic. Annotate any derivations that appear in the report, and explain the steps in your reasoning. Be sure to include an introduction as well as a conclusion to your paper.

- ❖ **Free Reading:** If you submit your project report to me by the date listed below, I will read it to detect any major misconceptions or errors and return it to you for revision before the due date. This service will not lower your grade. Be sure to have someone who is not in the class read over your report to correct it for misspelled words or incorrect grammar; this service is available for free in the RLC Writing Center.
- ❖ **Efficiency:** here are some suggestions to help you work more efficiently. Word processing is a big help since it allows corrections to be made easily. Word processing also makes it possible for different people to share in the typing of the report (and to send via e-mail or create a Google document). You should **AVOID** a group set-up where one person does the "thinking" and a different person is responsible for "production" of the report; this rarely creates a good report.
- ❖ **Meetings:** Meetings should probably have some structure and a time limit. Prepare for each meeting by agreeing at the previous meeting what each person should do for the next meeting. After two hours,

almost any meeting is much less productive. Before the end of any meeting, you should decide what is to be done and who is doing it before the next meeting.

- ❖ **Log:** Your group will keep a DETAILED log of your meetings; this may include time spent using Google docs if you choose to use this format. . Consider that this log will be your evidence for ‘charging’ a client for your time. The log will be handed in after you have given your oral presentation. It includes at least the following:
  - Time and duration the group met,
  - Brief summary of any decisions reached,
  - Outline of work accomplished and individuals who attended the meeting as well as a
  - Time total for each individual group member
  
- ❖ **Peer Evaluation:** Each member will hand in a typed evaluation of your project group members and yourself (no more than two pages total!) This report is confidential. The evaluation is to be turned in after you give your oral presentation. It will include the following information:
  - Detailed description of the work done by the group member.
  - Your partners’ strengths and weaknesses.
  - Your own strengths and weaknesses.
  - What you learned about your abilities when working in a small group setting with a very open-ended project.
  - What you learned that might suggest changes for you when working on a successful future project.

## The Research Project Details

There are four main parts of your project: the explanation of the problem, the derivation of the differential equation, the solution of the equation and the explanation of how the solution applies to the original problem. Remember that you will be writing a paper as well as giving an oral presentation.

- ❖ **Abstract:** This is a very short statement that describes what you are researching. It may contain the purpose, the results and the contents of your paper. In other words, it can be read quickly to determine the purpose of your research paper.
  
- ❖ **Introduction:** The first part of your paper will present background for the problem you are trying to solve. This may include the historical context of where the problem appeared or the practical context of the problem. Why is your problem important? Why is it useful?
  
- ❖ **Body:** Give a complete explanation of the problem. **Carefully** derive the differential equation and any initial or boundary conditions. This means that you must explain every piece of the differential equation, even if we have developed similar theory in class. EVERY variable should be well defined. The reader of your report should understand how and why the components of the differential equation model the problem. Explain why your chosen conditions are applicable. Are they changeable or would that significantly impact the context of your problem? What simplifications or assumptions did you make in your problem. Explain what impact these assumptions might have on the solution.

Explore the solution using every tool available to you. This means using slope fields, phase portraits, numerical methods or other computer techniques. **If you need to write a program for Maple or Matlab you must include a copy of all of your work.** In addition, you must solve your differential

equation using analytical methods, if it is possible. Be sure that you explain every step.

- ❖ **Conclusion:** Your conclusion should be a lengthy explanation of what the solution actually means in the context of your stated problem. Are there any implications about the solution? Graph the solution and explain how the graph relates to the differential equation and the original problem. Are there any suggestions for improvement of either the model or the solution? What does your solution mean in a practical sense?
- ❖ **References:** Include a list of all of the references that were consulted. These should include all books and magazines as well as conversations with experts in the field of study! Remember that Wikipedia is NOT a valid reference. It is a good initial starting point for information, but may never be consulted without further research. You may cite works using **MLA or APA documentation style**. A very useful tool is the “Landmarks Citation Machine”. The link is [http://landmark-project.com/citation\\_machine/index.php](http://landmark-project.com/citation_machine/index.php) which will help you properly format your citations. Be aware that once you paste your citation to your word document, you may have to check the capitalization, underlining and indentation, and you may have to reformat some of this. **The Writing center and the Tutor Center will provide help with work cited pages.** I do check all of your references, so be sure that if you include a website I can actually access that website.
- ❖ **Plagiarism:** Taking even one sentence verbatim from a source without citing the source is considered plagiarism and can result in a zero for the entire project. I do check your resources so make sure that I am able to access your original source for any citation provided on a Reference page. Any citation that fails to provide me with access to the original article will not be accepted. Internet research will not be accepted without complete bibliographical information (author, date, organization, source etc.)
- ❖ **Oral presentation:** You will have a specific time limit for your presentation. Your PowerPoint will be included in your grade (check out the example on WAMAP). More details will follow about how you and your group will be assessed as we get closer to the presentation times. I encourage you to schedule a group session in Green River’s Speaking Center. You can reserve time slots online on the Green River College website. Presentations will be given the last week of the quarter.

## **TIMELINES AND SPECIFIC REQUIREMENTS**

You should have a solid idea of your topic for presentation by **April 16<sup>th</sup>**. In this light, I would like the following information returned to me by **April 16<sup>th</sup>**.

- Your partners’ names.
- Your chosen topic and a rough outline detailing the concepts involved in your topic.
- Resources you plan to use for your topic.

Your written report of your project is due on or before **May 23, 2018**. The written report must follow these guidelines.

Your final report is to be typed on standard 8.5 x 11’ paper. Equations and graphs, however, may be neatly handwritten. Graphs are to be clearly drawn and well labeled, or computer produced. Be sure that all members’ names appear on the cover page. You need to include an introduction to your paper so that someone other than you will know what you are talking about. Also, include a conclusion that demonstrates the results that you have discovered.

In writing your report, assume the reader is a student in another Differential Equations Class who has never worked on this particular project. Annotate any derivations that appear in the report, and explain the steps in your reasoning.

Take as much pride in your report as you would if you were writing it for an employer you want to favorably impress. Many students have used this project for graduation writing requirements at universities.

If you submit your project report by **May 18<sup>th</sup>** I will read it to detect major misconceptions, and return it to you for revision before the due date. This service will not impact your grade negatively. **ALL PAPERS ARE DUE BY May 23<sup>rd</sup>**.

Your group will also be evaluating another group's presentation. This will be part of your grade as well as part of the group's grade that you evaluate. You will receive a copy of the Presentation Evaluation that you will fill in while observing another group. This evaluation will be turned in on the last day of the presentations.

All presentations will be given during class time. I will schedule at most three on any given day. Your presentation will include a PowerPoint slide show that will be sent to me via e-mail after your presentation. This presentation is not to show off all of the hard work you have done, rather to demonstrate how you arrived at the differential equation and its conditions, what techniques you used to solve the equation, and what the solution means to the problem you are modeling. Think of it as a teaching demonstration of a topic on which you are now an expert!

## Assessment Rubric

Names:			
Introduction	Abstract Interesting opening. Historical context. Applications. Significance.		(5)
Explanation of Model	Careful construction of model. Explanation of assumptions. Description of I.C.(s) and their implications.		(15)
Derivation of the DE	Classification of DE. Description of technique and any limitations. Details of solution process.		(10)
Solution of the DE	Correct units. Graph of solution curve with IC(s). Significance of solution in context.		(5)
Conclusion	Applicability to originally stated problem. Practical applications. Summarize your work. (Repeat your intro!)		(10)
Grammar	Be sure to have someone else read your report!		(5)
References	Use appropriate format (See project for details)		(5)
Log	(See project for details)		(5)
Peer Evaluation (includes your eval of another group)	Details of strengths and weaknesses of you and your partners. What you learned about working in open-ended project with group. Any changes you would make		(10)
Oral Presentation	See next page for details.		(25)
Ppt Slides	Clearly visible equations Correct notations		(5)
<b>Total</b>			<b>(100)</b>

## Presentation Evaluation

### Content:

- **INTRODUCTION:** (attracted audience's interest and clearly explained the main idea.)

- **DELIVERY:** (used appropriate speaking behaviors for teaching)

Names				
Audience Contact				
Voice				
Bodily Action				
Group performance				

- **DEVELOPMENT**

All specific information relevant to the topic was given. Mathematical models were carefully explained.

Diagrams, graphs and tables were used effectively to supplement math models.

Demonstrations, class interactions, films and other teaching tools were used.

- **Creativity/PowerPoint presentation:**