

Montana Industrial Storage Company
27182 Morningside Drive
Helena, MT 59602

Dear Calculus Student:

My name is Brook Taylor, and I'm the manager of the Montana Industrial Storage Company located here in Helena. We own and operate dozens of industrial storage warehouses in the Northwest. I recently encountered a problem at one of our warehouses, and I'm hoping that you can advise me on how to proceed. One of our customers has a very, very heavy item stored at our warehouse and needs to transport it to another location. The item is too heavy for us to use a forklift, so we hope to use our warehouse crane to move the item. This is where I need your help.

Our warehouse is a rectangular building 500 yards long and 100 yards wide. The warehouse is divided into five 100 x 100 yard rooms by 4 walls that run parallel to the north and south walls. Each warehouse division is connected to the next by a door that is 20 yards wide. From south to north, the door's walls extend 60 yards, 20 yards, 80 yards, and 40 yards from the east wall, respectively. We use an industrial crane mounted to a track along the ceiling to move large items around the warehouse. (It's actually very similar to the cranes seen in arcades, but we use it for heavy things instead of stuffed animals.) The crane is controlled by a master computer, which requires as input a mathematical function describing the desired path.

The equipment that we need to move currently is located against the south wall of the warehouse right in the middle. We need to move it to the north entrance of the building: a 20 yard wide door located directly in the middle of the north wall. Because of the width of the equipment, we need to clear the walls by at least 1 yard on either side. Once we set a path for the crane, it will move automatically at a rate of 10 yards per minute in the north-south direction. For safety reasons, our crane is only capable of moving in the east-west direction at a maximum rate of 10 yards per minute when it's carrying a load.

In order to specify the path through the warehouse, we need you to create a mathematical function which will specify crane's position as it moves across the warehouse. The input into this function will be the distance from the south wall of the building, which will run from 0 to 500 yards. The output of this function must give the distance of the crane from the east wall, in yards. This mathematical function should be described by a single formula, so please do not use a piecewise function. Your report must contain a graphical plot of this function for verification. We would further like a full report which both verifies that all our requirements are met by your function, and which also explains your rationale for why your design is a good path for the equipment. Further since we may have the need to move other heavy machinery across the warehouse (or our other warehouses) in the future, please describe how you created your function.

Thank you very much for your assistance, and we look forward to seeing your proposal.

Sincerely yours,

Brook Taylor
Manager, Montana Industrial Storage Company

MA 131 - Grading Outline for Projects

Project

	SCORE	POSSIBLE POINTS
Summary – not more than one page; problem is clearly stated; general approach is discussed; results are clearly stated		10
Introduction - the problem to be solved is clearly stated, so that someone who has not read the assignment handout will understand what is being done; the approach to be taken is clearly explained		10
The Function - the method of creating the function is clearly discussed, different attempts may be plotted, and we verify that the final function begins and ends in the right position, and has the right general structure.		20
Steepness – verification that the crane does not move too quickly.		15
Clearance – verification that the crane has adequate clearance of all doors.		15
Effectiveness - A discussion of why this particular path is effective and efficient.		15
Conclusion & References – text and any other sources are listed and they are cited if necessary		5
Spelling/Grammar/Typesetting – paper uses correct spelling, grammar, and punctuation, equations are formatted using equation editor.		10
Presentation		20
TOTAL		120

Presentation

Mathematics

- 6 pts. All mathematics is correct. Proper mathematical notation is used. All unknown terminology is explained. Presentation demonstrates an understanding of the mathematics.
- 4 pts. The above is mostly done well, but there are occasional minor problems with one or more areas.
- 2 pts. One of the above is done badly, or there are many minor problems.

Communication

- 6 pts. Presenters communicate material effectively. Demonstrate enthusiasm, interest, and creativity. All team members contribute to the presentation.
- 4 pts. The above is mostly done well, but there are occasional minor problems with one or more areas. Presenters talk to the screen or a paper instead of the class
- 2 pts. One of the above is done badly, or there are many minor problems.

Organization

- 6 pts. The presentation is organized and the method of presentation is well chosen. The problem is clearly described. Ideas are connected to the topic and each other. The timing and pace is appropriate for a 10- minute talk.
- 4 pts. The above is mostly done well, but there are occasional minor problems with one or more areas.
- 2 pts. One of the above is done badly, or there are many minor problems.

2 pts. will be given for attending all talks. (This will be done on an individual, rather than a group, basis.)

Total presentation points: _____ (20 possible)

MA 131 – Group Project

Guidelines and Important Dates

Important Dates

December 5 - 7 – Oral Presentations (5 to 10 minutes each)

December 8 – Written report due via Moodle

Guidelines:

You must work in groups of 2 or 3 students. You should turn in one written report for your group, and your oral presentation will be done as a group. Every student should have some part in the oral presentation, and the presentation should be done with Power Point.

The main purpose of a paper in mathematics is to explain a series of calculations, so that the reader can clearly understand what math is being done and why. Explaining your math is the heart and soul of your paper. A good paper will often alternate between an equation and a paragraph explaining exactly what is being done and the purpose of this calculation. Your written report should be done in Microsoft Word, using equation editor, or some other comparable word processor with mathematics capabilities. It must be broken into sections (beginning with section titles in large bold letters), including an **introduction**, a **conclusion**, and **references**. You should use the introduction to briefly summarize the problem in your own words and set the stage for your paper. In the conclusion you should summarize your results and tie things together. Your textbook should be listed as a reference, as should any other sources (books or web sites) you consult.

One other requirement for the written report is that it must begin with a **one-page summary**. This should be an abstract, a brief overview of your entire project, including a very short problem description (shorter than in the introduction), the main methodologies used, and a brief statement of the main results you achieved. Think of this as possibly the only part of your report that a senior manager might read. It needs to clearly and succinctly summarize what you have done.

No rough draft is required, but I strongly encourage all groups to schedule a meeting with me to discuss the project and presentation.

Some Writing Suggestions

Write in the first person, and use the active voice whenever reasonable. For example, rather than, “It was discovered that...”, write “We discovered...”.

Show your equations and figures clearly. Label all tables and figures, and be sure to explain them in the text. If a figure or table isn’t explained in the text, then it should not be included in the paper. Plots should clearly label both the x and y axes.

The paper should be more than just a list of answers to homework-style questions – it should tell the story of your project. It is not necessary, nor even desirable, to list the number of the question you are answering. Instead, collect your answers and tell your story with them. Also, feel free to let your

personality shine through; it's great to insert humor or invent characters to support your problem scenario.

Spelling and grammar count – proofread carefully!

The introduction and conclusion should *not* be judgments about the problem – refrain from saying, for example, “In conclusion, this was a worthwhile project. I learned a lot.” Your introduction should set the stage for your paper – sort of an overview of the problem. Your conclusion should tie together the paper and highlight the major result(s).

Some Presentation Suggestions

Have fun making your slides, but beware of getting so fancy that it detracts from your content. Very plain slides with no moving words are perfectly acceptable.

You will probably not have time during your presentation to discuss every aspect of your problem. Do be sure, though, that you appropriately introduce your problem.

Make sure you can access your presentation in two different ways (for example, from your X drive and on a flash drive). I have seen several groups in the past have trouble with corrupted disks. You are responsible for having your presentation in working order at the time you are scheduled to present.

Contributions, References, Plagiarism, & Integrity:

Each team must submit a page, signed by all team members, either stating that all team members contributed equally to the project or offering an explanation and relative efforts if contributions were not equal. All papers must contain a “References” section in the APA style that lists our textbook: Our text was the original source of most of the techniques that you will use in this project. If you get any other help on this project from other books, web sites, other student work/papers, or even if you talk to other classmates outside of your team, you need to include these in your reference section, acknowledging that not everything in your paper was your own original idea. It is very important that there is no file sharing, of Word documents, Matlab commands, or any other electronic files of any kind: That is considered cheating. You and your team must type in everything yourselves, into Word, into Matlab, and any other tools that you may use. You may talk to your classmates outside of your team about the general ideas of the project, but you may not copy the specifics: We expect all teams to create their own unique functions.