Project 3: Finding Safe and Effective Drug Dosage
AVAILABLE: [Day 22] DUE: [Day 26]

The Scenario:
You have been contracted by a pharmaceutical company to study the way that the body absorbs a new drug, and to help determine appropriate dosage information for this drug.

First part of this assignment: Group work in class on Monday, March 15
Study the information which will be provided on a handout when you turn in the test on Friday, March 12. You are to compare two models for the rate as which the drug is eliminated from the body. Model A is a linear model, and Model B uses a differential equation of the form $dy/dt = -ky$. One of these models has been identified by the scientists in the pharmaceutical company's clinical tests as being more accurate. Come to class on Monday prepared to work together in your groups on these two models.

By the end of class on Monday, you are to turn in your answers for parts A and B, questions 1 – 5, for each of these two models.

The Project: Determining Safe and Effective Drug Dosage DUE: Monday, March 15
Solve the problems presented in C on the handout. Find a dosage level and schedule for administering the drug that maintains a concentration in the blood that is safe and effective. Write a report of your findings, answering the questions given in C (1 and 2). Submit your findings as a laboratory report with a cover letter on your professional letterhead stationery. (You can decide whether you work for a firm, or have your own consulting business. Design a logo to represent your firm.)

The audience for your paper: Your reader will be a professional scientist working for the pharmaceutical firm, but this person may not have taken a recent course in calculus. Very probably such a professional would have taken a course in calculus more than five years ago, and may be a bit rusty on the details of computations in calculus.

Grading Criteria:
Your paper will be graded on format, writing style, mathematical content and correctness, and evidence of synthesis and integration.

- **Format: 10%**
  Your paper should give a good professional first impression. It should be word-processed. Use the Equation Editor available in Word, or use the text-editing feature of Maple to write any complicated mathematical formulas and then cut-and-paste them into your document.
  Your report should be either a formal professional memorandum, or a cover letter attached to the report with your laboratory analyses. The memo or letter should be addressed to your contact person at the pharmaceutical company which has hired you to investigate this problem.
  - Does your paper should give a good professional first impression?
  - Is it word-processed and submitted via Educator?
  - Is your report presented in a formal professional memorandum, or with a cover letter attached to the report with your laboratory analyses?

- **Writing Style: 15%**
  This is a formal report, written clearly and simply in good business English using appropriate sentence structure and grammar. Use a spell checker and ask a friend to proofread your final paper. Remember that the spell checker will not alert you to incorrect words that are spelled correctly, such as "there" when you mean "their."
  - Is your report written clearly and simply in good business English using appropriate sentence structure and grammar?
  - Did you use correct spellings throughout the paper?

- **Mathematical Content and Correctness: 60%**
  Your work should answer the questions posed in part C, and be mathematically correct. Discuss your calculations and conclusions in a way that is clear to a professional scientist.
  Remember: your reader has taken calculus, but that was more than five years ago.
  - Do you correctly answer the questions posed in the handout?
  - Is your discussion clear? Would your calculations and discussions be clear to a professional scientist who has taken a course in Calculus more than five years ago?

  First part – Group work in class on parts A and B: x/10
  Problems in Part C: x/50

- **Synthesis and Integration: 15%**
  While a *B* paper will present a correct solution, an *A* paper will clearly present the mathematical reasoning leading up to your conclusions. The solutions to the problems in this project require you to use problem-solving strategies you have been learning throughout this course. You will need to find the solution of a differential equation, and then you will need to think carefully about what is happening in the body when someone takes repeated doses of a medicine.
  - Do you clearly present the mathematical reasoning leading up to your conclusions?

Submit your paper by uploading it to your folder for Calculus in [course management system]. It is due by 4 pm on Monday, March 22.

Source: This problem comes from *Problems for Student Investigation*, edited by Michael B. Jackson and John R. Ramsey, published by the Mathematical Association of America, MAA Notes Series #30, 1993. It is based on UMAP Module #72 "Prescribing Safe and Effective Dosage," by Brindell Horelick and Sinan Koont, published by COMAP, Inc., 1983 (reprinted in 1992).