Math 105—Calculus I Project 2
vaporous emissions...

by Gavin LaRose (glarose@NebrWesleyan.edu), Nebraska Wesleyan University, January 1997

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After your first big contract success as a member of the elite Independent Mathematical Contracting team, you have been assigned to a second project. The Lonlinc (Skanebra) CPE (Council on the Protection fo the Environment), after discovery of some groundwater problems at the old Lonlinc Paint company—which were previously investigated by I.M.C. consultants—has contracted with you on additional matters involving the troubled site before allowing its sale to the world-wide MPC, Inc. conglomerate.

Lonlinc CPE
the Lonlinc Building
South 9th Avenue
Lonlinc, SK 08685

21 February, 1997

Independent Mathematical Contractors, Inc.
Suite 2, Strawmarket Business Plaza
Lonlinc, SK 04685

Dear IMC:

The Lonlinc CPE is required to investigate sites with possible environmental contamination prior to their sale to new owners. Recently the site of the old Lonlinc Paint company has become the subject of a possible sale, resulting in our investigation of the same. Lonlinc paint discontinued its operations in 1979, and there appear to be two environmental hazards associated with chemical spillage at the site. The first is extensive groundwater contamination—which your company addressed last year—and the second, delineated below, is the matter on which we are currently contacting you.

Owing to spillage from the primary chemical mixing vats, the sheet of bedrock on which the plant was constructed has been saturated with chemical residues which emit a low-level, but harmful, vapor. While the bedrock does not extend throughout the entire site of the old plant it has recently been judged prohibitively expensive to remove it, and we have therefore contracted with you to determine the nature and implications of the vapor emission.

At yearly intervals for the past five years we have measured the total vapor emissions (over a 24 hour period) from the bedrock. This data is given in Table 1 below.

t (in years)	1	2	3	4	5
e (in ppm)	381	182	99.3	51.2	27.8

Table 1: Total vapor emissions vs. time

The rate of decrease in the chemical present in the bedrock is roughly proportional to the emissions given in Table 1, with a constant of proportionality $k = 0.1$. We need from your company (1) this the rate of decrease as a function of time; (2) the total decrease in the chemical between now and the year 2000; (3) the total decrease in the chemical between now and the year 2020; and (4) the time at which there will be less than 0.5ppm of the chemical present, given that the current saturation level is 3.5ppm.

To assure your success in the completion of this project, we have again secured the services of a local scientific expert, Dr. Gavin LaRose, who will be available to answer any technical questions you might have in the course of your investigation—feel free to contact him (with all members of your consulting team) with any questions you might have. You should additionally plan to see him by the 28th of January with an indication of your preliminary work on the project. A further update should be provided by the 13th of March, and your finished report is due by the 17th of March. Failure to meet any of these deadlines will of course be grounds for reducing your payment.

We look forward to receiving your report, which should be typewritten and 3–5 pages in length. Equations explaining your solution should be included in the report, and it is permissible to hand-write these in blank lines between your typewritten explanation if this greatly facilitates the production of the report.†

Sincerely,

Jack C. Ousteaux
Director, Lonlinc CPE

† *Sample reports are available for examination from Dr. LaRose.*