**Math 105—Calculus I  Project 1**
**a placid midwestern lagoon...**

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The Independent Mathematical Contractors (, Inc.) company, after a year of successful operation, has just hired you in an expansion of its base of mathematical consultants to meet its burgeoning list of contracts. The latest contract received is from the Lonlinc (Skanabra) CPE (Council on the Protection of the Environment), and regards the site of the old Lonlinc Paint company, under investigation prior to its proposed sale to the world-wide MPC, Inc. conglomerate.

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

6 September, 1996

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

Dear IMC:

The Lonlinc CPE, as part of its mission to protect the citizens of Lonlinc from environmental hazards posed by modernization and industrialization, 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. As you may know, Lonlinc Paint produced paints from 1961 until 1979 (with over 50% of its production coming in the years 1974–1978), at which point its owners without explanation abruptly ceased operations at the plant.

Our investigation of the site, which began a number of years ago, has determined the following information. There is a large "lagoon" at the center of the plant into which paint residue and waste chemicals were flushed regularly in the course of Lonlinc Paint's operations. The chemical contaminants from the lagoon have leached down to the water table in the region, and are being transported in the aquifer below the site toward the nearby Flatt River. In order to determine the threat this poses to local water supplies, we have investigated the water contamination at a number of wells near the site.

The first three wells were drilled by the owners of Lonlinc Paint, and it is from their records that we obtain the following data:

| well | distance from lagoon | water table level (measured up from a reference level) |
|---|---|---|
| 1 | 500 ft | 60 ft |
| 2 | 700 ft | 58 ft |
| 3 | 1000 ft | 55 ft |

(at the lagoon the water table is 70 feet). In 1980 all three were clean, while in 1986 contaminants were detected in the water at wells 1 and 2 but not 3. In 1991 there was some discussion of the sale of the site of the company, and, on investigation, we found contamination in well 3, and drilled an additional well, well 4:

| well | distance | water table |
|---|---|---|
| 4 | 1200 ft | 49 ft |

In 1991 this well was not contaminated. This sale did not go through, and while the site was listed as a possible SuperFund site, funding was then unavailable to begin cleanup. This year, however, there is active discussion on the possibility of its sale. We have determined that well 4 is now contaminated, and have drilled three additional wells:

| well | distance | water table |
|---|---|---|
| 5 | 1500 ft | 40 ft |
| 6 | 1700 ft | 34 ft |
| 7 | 1900 ft | 28 ft |

We found contamination in wells 5 and 6, but not in well 7.

We need from your company:

1. an analysis of the manner in which the contaminant has spread from the site since the years in which the company was operating, with some justification of your model, and
2. a prediction of the amount of time it will take the water contamination to reach a distance of 2500 feet from the lagoon (the location of the nearest well providing drinking water). Your prediction should include an indication of the rate at which you believe the contamination to be spreading and why.

To assure your success in the completion of this project, our department's scientific expert, Dr. Gavin LaRose, 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 13th of this month with an indication of your preliminary work on the project. A further update should be provided by the 25th, and your finished report is due by the 30th. Failure to meet any of these deadlines will 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