Math 105—Calculus I Project 3
...facing some resistance

Sad but true, all good things must come to an end, and you find yourselves faced with your final project as IMC consultants. This, the cherry capping your work, comes from the chemical manufacturing and reclamation company, Chemproc, Inc.—which in the past few years has opened a chemical processing plant in Lonlinc.

Chemproc, Inc.

20000 Ryan-ears Blvd.
Lonlinc, SK
04685

31 March, 1997

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

Dear IMC:

As you know, Chemproc, Inc. is a premier manufacturer and reprocessor of chemicals and chemical waste. In this capacity, we are frequently constructing conduits connecting primary and secondary chemical storage containers. As these are often large and are reproduced in large numbers throughout our plants it is to our advantage to have the chemical flows between the containers be as efficient as possible, and it is to provide specifications for such efficient conduits that we are contracting with your firm.

A typical chemical tank configuration is shown in figure 1.

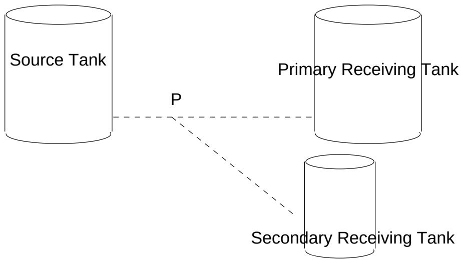

Figure 1: Tanks with chemical conduit paths.

In this configuration chemicals are transported from the source tank to the primary and secondary receiving tanks through conduits indicated by the dashed lines. The circular conduit between the source and primary receiving tanks is of one radius, r_1, and that leading from the point P on this conduit to the secondary tank is a different radius, r_2. The three tanks are geometrically at the three vertices of a right triangle, the legs of which have lengths determined by the specific tank situation under consideration.

We know that the resistance to flow through a pipe such as the conduits we use to connect the chemical tanks is given by Poiseuille's law, which says the total resistance, R, is given by $R = kd/r^4$, where k is a constant of proportionality, d is the distance the fluid flows through the pipe, and r is the radius of the pipe. Additionally, it is reasonable to consider the fluid that begins in the source tank and ends in the primary receiving tank as separate from that which ends in the secondary receiving tank.

Your contract is to determine the conduit configuration that will provide the least resistance to flow from the source to the receiving tanks. To assist you with this project, we have instructed our consulting scientist, Dr. Gavin LaRose, to answer such questions as you might have in the course of your investigation. You should also contact him by the 18th of April with an indication of your preliminary work on the project, and again by the 25th of the month with an update on your progress. We look forward to receiving your 3–5 page final report† by or on the 2nd of May.

Sincerely,

E. Idu Pont, President
Chemproc, Inc.

† *Sample reports are available for inspection from Dr. LaRose; your report must be typewritten, but equations may be written in by hand.*