Geology 398-3: Quantitative Geology   Name:
Hour Exam #1
9 February 2004

This exam is open book, open notes. The JMU Honor Code applies.
You are strongly advised to look over the whole exam before beginning, and to do
whichever problems you find easiest first. Also, remember that partial credit will be
awarded, so it is in your best interest to get something down for each problem.

Prob 1) (20 points) **Drillers & Roughnecks Dept:**

   The attitude of a certain bed is
critically important to an oil
exploration project. There are three
drillholes already in the area (see
sketch at right, distances in meters),
and the information is available for
each of them. Assume that each
drillhole is collared at the same
elevation and that the bed is planar.
The depths to the bed at issue are
400 m in DH-1, 600 m in DH-2, and
700 m in DH-3.
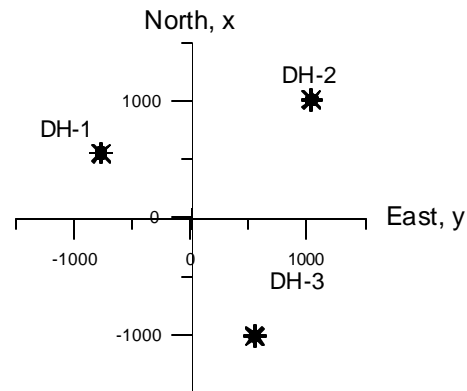
   a) What is the matrix of coefficients necessary to solve the 3-point problem using
       the slope and intercept method?

   b) What are the strike and dip of the bed, based on these data?

c) Two new holes are drilled to help with the problem, since there is doubt about the accuracy of the previous depth determinations (big +/- issues on those depths). One hole is located at (0,0) and encounters the bed at 560 m while the other is at (−1000, -1000) and finds the bed at a depth of 517 m. What are the most likely values of m_x, m_y, and z_0 determined from all of the available data?

Prob 2) (20 points) **Apportioning Responsibility Dept:** A Chicken farm in the Shenandoah produces an effluent that is 40% nitrate, 40% sulfate and 20% phosphate. A nearby Turkey plant contaminates in the relative proportions of 10%, 45%, and 45%. There is also a feedlot in the area which generates waste that is 70% nitrate, 10% sulfate, and 20% phosphate. Downstream from these farms, a small town notices that its water, taken from the river, has become rather ugly. A sample proves to have 40% nitrate, 18.75% sulfate, and 55% phosphate in it. All the farms claim to have no leaks into the streams. Assume that there are no other sources of these constituents and that each is transmitted through the drainage in the relative proportion that it is introduced. What is the relative contribution to the town's pollution problems of each farm?