Geophysics Problem set 2: Due 2/18/2004

1. Another prelude to GPS, this time on a sphere. Suppose you don't know where you are in a coordinate system but you do know how far you are from a number of known places (e.g. satellites). All the numbers are in degrees, use the spherical law of cosines to find your location:

Sites	Lat	Long	Distance to Site
1	58.340	150.839	25.251
2	33.167	91.393	22.071
3	59.189	134.511	16.604
4	46.677	118.437	3.064
5	49.373	151.270	25.792
6	58.927	145.563	22.829
7	47.611	86.735	19.348
8	56.442	150.266	24.307
9	31.953	136.701	23.231
10	36.035	91.233	20.028
11	46.493	101.623	8.157
12	61.703	127.083	17.532
13	34.579	92.436	21.642
14	47.002	105.177	6.176
15	55.742	118.687	9.430

Figure out your latitude and longitude. What you need to do is find the X, Y location that best fits the known distances to the sites. That is, you want to minimize:

$$\sum \{\text{observed distances - calculated distances}\}^2$$

2. Use the equation developed in class to build a spreadsheet model of the gravity over a buried sphere with these parameters:

- Diameter = 100 meters
- Depth to center = 75 meters
- Density contrast with bedrock of 500 kg/m^3
- x = 0 directly over the center of the sphere

Express the result in milligals and present a smooth, symmetrical graph of the gravity from the sphere.

2. Graph gravity versus distance for the situation in the figure to the right. The density contrasts with bedrock are 500 kg/m^3 for the upper sphere and –750 kg/m^3 for the lower sphere. On the graph show the anomaly for each sphere and the combined (sum) of the anomalies for both spheres. Make nice, explanatory graphs.