GEO594/GLE594: Gravity Homework

1. The following data are from a gravity survey at 42° N over a suspected buried shear zone. Meters South is observation point location in meters to the south relative to the north end of the profile, H.I. indicates the height of the instrument above the ground surface, Elev is the ground elevation relative to the datum (so both need to be considered when computing the free-air correction), and g-obs is the measured gravity value.

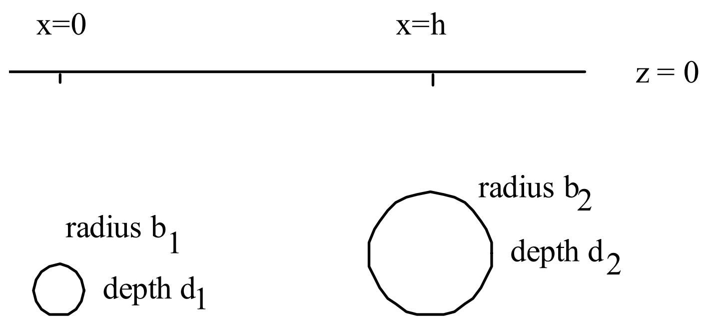
Meters South	H.I. (m)	Elev (m)	g-obs (g.u.)
0	0.36	-4.66	380.1
25	0.25	-4.59	380.5
50	0.25	-4.55	380.1
75	0.33	-4.26	379.8
100	0.33	-2.95	377.5
125	0.40	-1.77	374.7
150	0.48	0.56	368.6
175	0.43	0.49	368.4
200	0.43	0.42	368.4
225	0.38	0.37	368.7
250	0.43	0.36	367.2
275	0.40	-0.23	369.4
300	0.43	0.00	370.4
325	0.38	1.12	368.2
350	0.40	1.11	368.7
375	0.40	1.46	368.4
400	0.40	1.78	368.0
425	0.40	2.16	366.8
450	0.46	2.52	366.3
475	0.36	3.05	365.7
500	0.40	3.48	364.7
525	0.38	3.10	365.6
550	0.40	2.71	366.7
575	0.40	2.50	366.7
600	0.43	2.27	367.3

(a) Apply the latitude, free-air, and Bouguer corrections to the data, assuming a density of 2670 kg/m^3. Make a table and a graph of the results.

(b) Use the vertical sheet "rule of thumb" from Table 2.2 to estimate the depth to the top of the buried shear zone.

(c) The gravity anomaly is not symmetric. What might that imply about the geometry of the shear zone?

2. Treat the Earth as flat, extending from the surface $z = 0$ to infinite depth $z = \infty$. Two horizontal cylinder density anomalies of radii b_1 and b_2 and the same density contrast $\Delta\rho$ are buried at depths d_1 and d_2 in the Earth (note: d's are the depth to the center) at the horizontal locations $x_1 = 0$ and $x_2 = h$:



Work out the formula for the gravity anomaly due to the 2 buried cylinders as a function of x on the surface (z=0). Use the equation for the anomaly of a horizontal cylinder from Table 2.2 in Sharma. Approximately where, relative to the points $x = 0$ and $x = h$, would you expect to find the maximum gravity anomaly due to this pair of anomalous masses (answer in words, not with an equation)?

{Hint - use $[1+((x-h)^2/z^2)]$ in the denominator for the term for the anomaly at x=h.}