

Homework 2: Nature of and Measuring Gravity**Read *Robinson and Coruh*, Chapter 7***Due Thu 1/21*

- 1) (a) Use Matlab to plot the acceleration of gravity predicted by the 1967 *international geodetic reference system* as a function of latitude from the south to the north pole, i.e., plot g_N versus ϕ in Eq. 7-16.
(b) How much more/less does a person with a mass of 50 kg weigh in Honolulu Hawaii (latitude=21.3°) compared to Anchorage Alaska (61.2°N) (4.45 N = 1 lb). Give your answer in Newtons and in lbs.
- 2) Much like problem 2. on p. 247. Gravity on the normal ellipsoid is the result of the mass gravitational attraction and the centrifugal acceleration associated with the Earth's rotation about its own spin axis. Using Matlab, calculate and plot the mass gravitational attraction of the GRS67 normal ellipsoid as a function of latitude from the south to north pole (i.e., subtract the centrifugal acceleration from your answer in 1a).
- 3) (a) Using $R = R_e(1-f\sin^2\phi)$ and $f = 1/298.247$, plot radius versus latitude (ϕ) from the south to north pole.
(b) Plot GM_e/R^2 versus latitude from the south to north pole. This is the part of the mass gravitational attraction that accounts for the changing distance from Earth's center. Please use the same units as you do in problem 1a and 2 above.
(c) Compare your plot above (3b) with that in problem 2. How are the two different and why?
- 4) (a) Estimate g by making a simple pendulum (e.g., a long string and a can of soup will do) and making the appropriate measurements. Make sure that you (i) explain your experimental design, (ii) estimate the uncertainties associated with your design and measurements, and (iii) determine the accuracy and uncertainty of your determination of g .
(b) Does your answer differ from that of the GRS67 (i.e., see problem 1b)? If so, discuss how and why.