

## AAE 190 Homework 4

Due 10/11 but extended to 10/16

### The reduction in air density compared to the reduction in gravitational acceleration as a function of altitude

The acceleration of gravity at the surface of the spherical earth is denoted by  $g_0$ . The acceleration of gravity at some altitude ( $h$ ) is denoted as  $g(h)$ . According to Newton's Law of gravity,

$$g(h) = \frac{GM}{(R_E + h)^2}, \text{ and } g_0 = g(0)$$

1. Compute  $g(h)/g_0$  versus  $h$  for  $h$  over the interval from 0 to 230,000 feet. Overplot this data on a plot of  $\rho(h)/\rho(0)$ . An overplot has more than one line on one figure.
2. Comment on how quickly air density decreases with altitude compared to the acceleration of gravity.
3. Use the subplot command to place two plots on the same page (MATLAB figure). Plot  $g(h)/g_0$  versus  $h$  in the right figure. Plot  $\rho(h)/\rho(0)$  in the left figure. Label all plots.

Hints; You may want to use the file MATLABTutorial2.m found on the class web site.

$$GM = 1.4076431 \times 10^{16} \text{ ft}^3/\text{sec}^2$$

$$R_E = 2.092565 \times 10^7 \text{ ft. (equatorial radius of the earth)}$$