Additional fluid problem

Assume the atmosphere at height h above sea level has pressure P(h) and density $\rho(h)$ and that the ratio P(h) /$\rho(h)$ is independent of h (that would happen if the temperature doesn't change with h). Assume at sea level $P=P_0=101{,}325Pa$ and $\rho=\rho_0=1.204kg/m^3$.

(a) What would be the height of the atmosphere if its density was constant, equal to ρ_0?

(b) Derive equations for $\rho(h)$ and P(h) assuming g is independent of h. Write your answers in terms of the height found in (a), call it H.

(c) Same as (b) taking into account the variation of g with h. You may assume $h<<R$, with R the earth radius.

(d) Compare the results for the density at a given height h assuming g constant versus g decreasing with h. Does the density decrease, increase or stay the same?

(e) There are 2 different ways to interpret and answer (d). One is to compare the two situations for the same ρ_0, the other to compare them for the same total number of air molecules. Discuss the two scenarios.