HW1 Solution:

a) Red→Pacific; Blue→Atlantic;
Reason: It is conclude from the salinity differences at ~500m layer, where the values of blue line are much larger than those of red line, which reflects the fact that typically Atlantic salinity is higher than that of Pacific.

b) See the following link:
Atlantic and Pacific T&S profiles:
http://www.marine.rutgers.edu/dmcs/ms501/2009/problemsets/A&P_profile.png
Atlantic and Pacific potential temperature V.S depth profiles:
http://www.marine.rutgers.edu/dmcs/ms501/2009/problemsets/P_density_V.S_Depth.png

c) Estimates:
Upper 500 m: N~=0.01 s^{-1}
500m→Bottom: N~=0.002 s^{-1}

d) From the TS diagram, it could be seen that the most sensitive regions of density change to temperature should be the tropical regions, where the temperature could reach up to ~30 degrees. Conversely, the least sensitive regions would be the polar regions, where it is around zero degrees in the ocean.

e) From the above question, and estimates using the TS diagram:

For tropical regions, $\alpha \sim= 0.2, \beta \sim= 1;$

For polar regions: $\alpha \sim= 0, \beta \sim= 1;$

f) The relationship between salinity and density is pretty much the same across the entire TS diagram.