Problem 1:

1. Decreasing the proportional gain, Kp, results in slower rise time but creates less overshoot and slower steady state oscillation. This is the main damping factor that directly reflects the error value. When this value is too high, a small error creates a controller response that is too large. If this gain value is not big enough, the output does not respond strong enough to a high error value.
2. To decrease settling time, increase the integral gain, Ki. This also has the effect of decreasing the steady state error. Increasing the derivative term, Kd, will also decrease the amount of oscillations that the controller will undergo to reach the set point. The derivative term is predictive to the behavior of the system and is usually only used after the signal has been filtered.
3. Steady state error is usually corrected by increasing Ki, however in practice, this number must be extremely small for the quadcopters that are used in lab. From feedback controls, adding an integrator increases the type number of the system that causes the system response to converge to the set point. (Fadali, 2013 pg. 147)