Hints: Homework #5

Problem 5.6

You should set the first derivative equal to zero to get $b = -2au$. Then with $q = 3100$ and $u = 28$ and use: $q = au^2 + bu$ with $b = -2au$ (so a is the only unknown) and solve for $a = -3.954$ so then $b = 221.429$ from $b = -2au$. With these values you can solve the rest of the problem.

Problem 5.18

Both μ and the time until queue clearance t_c are not known (2 unknowns). The problem can be solved by getting two equation to solve for the 2 unknowns.

First, develop an equation for queue clearance where arrivals = departures. Solve this equation for μ which gives $\mu = 6t_c /(t_c - 6)$.

Second, develop an equation for total delay which is known to be 500 veh-min (this equation will have unknowns μ and t_c). Substitute $\mu = 6t_c /(t_c - 6)$, from above, into this equation and solve for t_c the only remaining unknown. Put this solved t_c value into $\mu = 6t_c /(t_c - 6)$ to get μ.

Problem 5.52

This problem is an M/M/N queue (if the arrival and departure times are exponentially distributed that means they are Poisson). You apply Eq. 5.37 with 3 and 4 departure channels and look at the difference. To use Eq. 5.37 you need to get P_0 from Equation 5.34. For the 3 both case P_0 = 0.013 and for the 4 booth case P_0 = 0.048...you then use these values in equation 5.37 to find P_3 and P_4 respectively (subtract these and you are done).