# 3)

**a)** We know that average current through at steady state is zero.  
   
, → and   
, (100% efficiency assumed) →

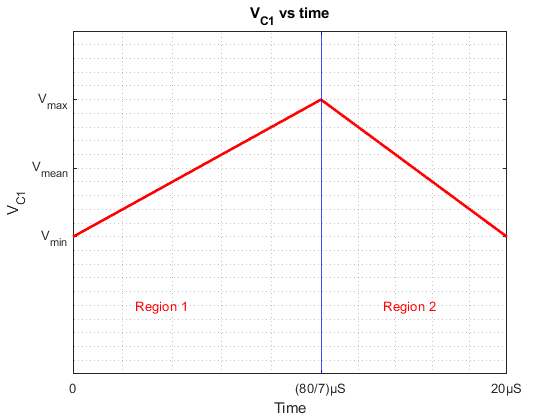
We know that , then for our values   
 ,   
   
We also know that our switching frequency is equal to 50Khz, this means that our period is equal to 20µS. Since we know that while the switch in conduction, capacitor supplies power to the load. This means that for capacitor is discharging.  
  


Figure Capacitor voltage vs time graph

Figure 3.1 shows the capacitor voltage in one period of switching, we know that mean capacitor voltage is equal to 12V.  
  
  
  
  
We also know that in region 1, switch is not in conduction and capacitor is charging. Moreover, in region 2, switch is in conduction and supplies power to the load.  
  
For the 2% voltage ripple, . This means that and   
  
Since this is first homework, we will make this calculation, first assuming that capacitor is discharging with constant current, then by assuming that current is not constant but converter is loaded with constant R load.  
  
If we assume constant discharge current of 2A then  
  
Solving this equation yields, C = 71.43µF.   
  
If we assume constant R load

Solving this differential equation,   
  
If we check for t=0, we can find that K=12.12V, then to satisfy the 0.24V voltage drop in 60/7µs our capacitor must be equal to 71.42µF. This means that constant current method is a good method. For the inductors, I will assume that while charging or charging inductor voltage is constant.   
  
For , we know that mean current is equal to mean input current which is 1.5A, if we assume 10% current ripple, this means that inductor current must fluctuate between 1.425A and 1.575A. Since it is clearly seen that while the switch is in conduction, the inductor current rises with the power of supply voltage, we can easily calculate the required inductance.

For the calculation of , if we assume that is large enough to keep the voltage constant, then we can say that mean current through is equal to differences of mean output and input current. Moreover, it is clearly seen that while the switch is in conduction, inductor charges with the power of . If we assume that . We can calculate the required inductance for .

b) Since we know the mean current through , by assuming constant discharge current on . We can calculate the required capacitance for 10% ripple voltage. We know that mean voltage is equal to the input voltage, then for 10% ripple voltage change is equal to 1.6V.