HW#4 Solution

a) The K value interpolation ***FROM GRAPH*** to condition of 160 F and 1500 psia is shown below

	K value		
Temp (F)	**C1**	**C4**	**C10**
120	3.3	0.23	0.005
200	3.4	0.38	0.011
160	3.350	0.305	0.008

From $$f(V)=\sum_{n=1}^{nc}\left[\frac{(K_m-1)Z_m}{(K_m-1)V+1}\right] \quad (1)$$

Find f(0) from given parameters and put into eq (1), then f(0) = 0.811, which is more than 0

Find f(1) from given parameters and put into eq (1), then f(1) = -45.05, which is less than 0

So, the system presents two phases, to find V, it is required iteration

$$V^{(l+1)}=V^{(l)}-\frac{f(V)}{f'(V)} \quad (2)$$

$$f'(V)=\frac{\partial f}{\partial V}=-\sum_{n=1}^{nc}\left\{\frac{(K_m-1)^2 Z_m}{\left[(K_m-1)V+1\right]^2}\right\} \quad (3)$$

Using initial guess of V=0.5

The iteration is processed by coding, so the V value is 0.3681 and L value is 0.6319.

X_m and Y_m are determined by (for two phases system)

$$X_m=\frac{Z_m}{V(K_m-1)+1} \quad (4)$$

$$Y_m=\frac{K_m Z_m}{V(K_m-1)+1} \quad (5)$$

the X and Y of those three components are shown below

part a) K value from graph

L	0.631897

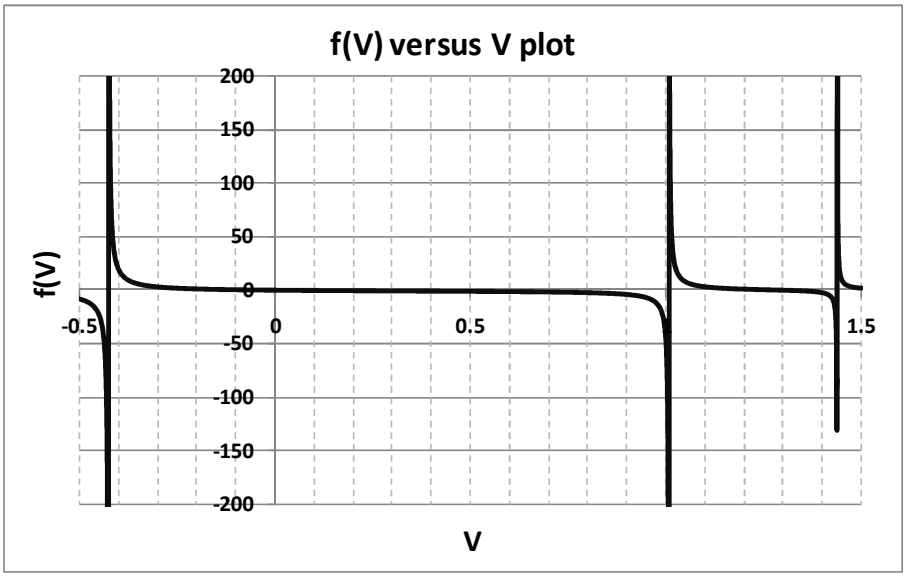
V	0.368103

X1	0.284229
X2	0.141769
X3	0.574002
sum(X)	1.000000

Y1	0.952168
Y2	0.043240
Y3	0.004592
sum(Y)	1.000000

b) Plot f(V) and V from V={-0.5, 0, 0.5, 1.0, 1.5}

From $f(V) = \sum_{n=1}^{nc} \left[\frac{(K_m - 1)Z_m}{(K_m - 1)V + 1} \right]$, use K value from interpolation in a) and vary V from -0.5 to 1.5, the plot is shown below



c) The K value ***FROM CMG TABLE*** is calculated from following formula

$$K = \frac{KV1}{P}\exp\left[\frac{KV4}{T - KV5}\right] \quad (6)$$

Reading KV1, KV4 and KV5 from the tables, then calculate by using eq (6) to acquire K value of each component, and they are presented below

	K value		
Temp (F)	**C1**	**C4**	**C10**
160	3.8783	0.0792	0.0003

Repeat the same steps and equations as problem a), then X and Y for each component and V value will be calculated

part c) K from CMG corelation

L	0.623793

V	0.376207

X1	0.254508
X2	0.161415
X3	0.584077
sum(X)	1.000000

Y1	0.987063
Y2	0.012787
Y3	0.000151
sum(Y)	1.000000