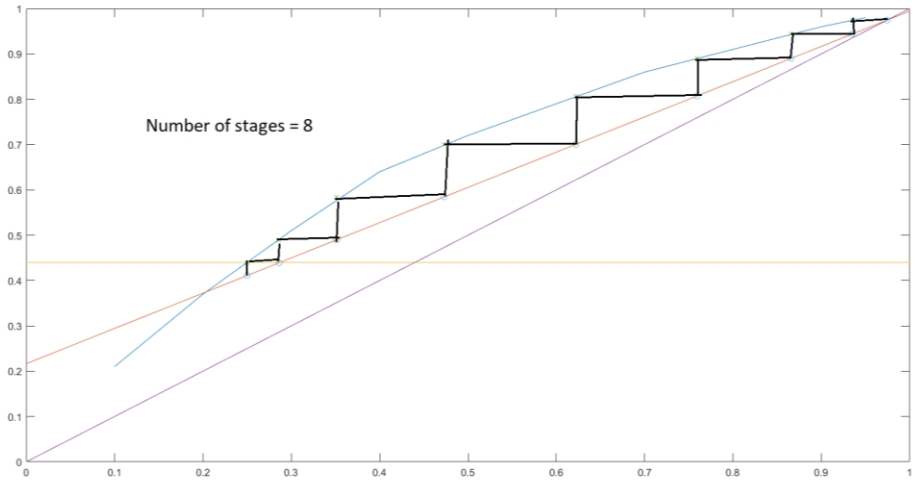
Question 1

```
clear; close all;
F = 158.21;
xD = 0.9745;
R = 3.5;
m = R/(R+1);
yeqbm = [0.21 0.37 0.51 0.64 0.72 0.79 0.86 0.91 0.96 0.98];
xeqbm = [0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 0.95];
pp = spline(yeqbm,xeqbm);
fun = @(x)(m*(x-xD)+xD);
y = xD;
zF = 0.43;
xcoords = zeros(1,7);
ycoords = zeros(1,7);
xcoords2 = zeros(1,8);
ycoords2 = zeros(1,8);
xcoords2(1)= xD;
ycoords2(1) = xD;
i = 0;
while y >= zF
   i = i + 1;
   x = ppval(pp,y);
   xcoords(i) = x;
   xcoords2(i+1)=x;
   ycoords(i) = y;
   y = fun(x);
   ycoords2(i+1) = y;

end
x = linspace(0,1,15);
qline = @(x)(zeros(size(x))+zF);
plot(xeqbm,yeqbm,x,fun(x),x,qline(x),x,x,xcoords,ycoords,'x',xcoords2,ycoords2,'o');
```

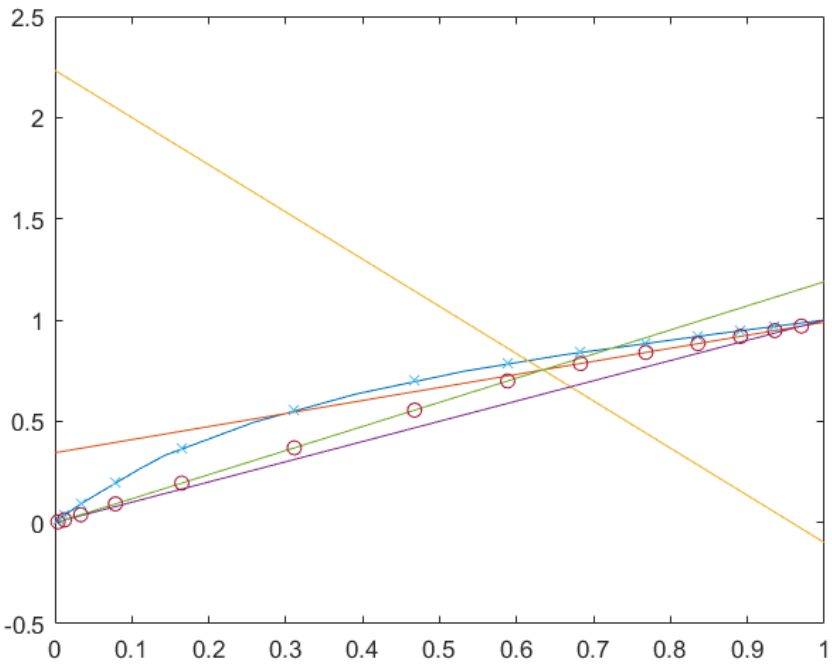


Question 2

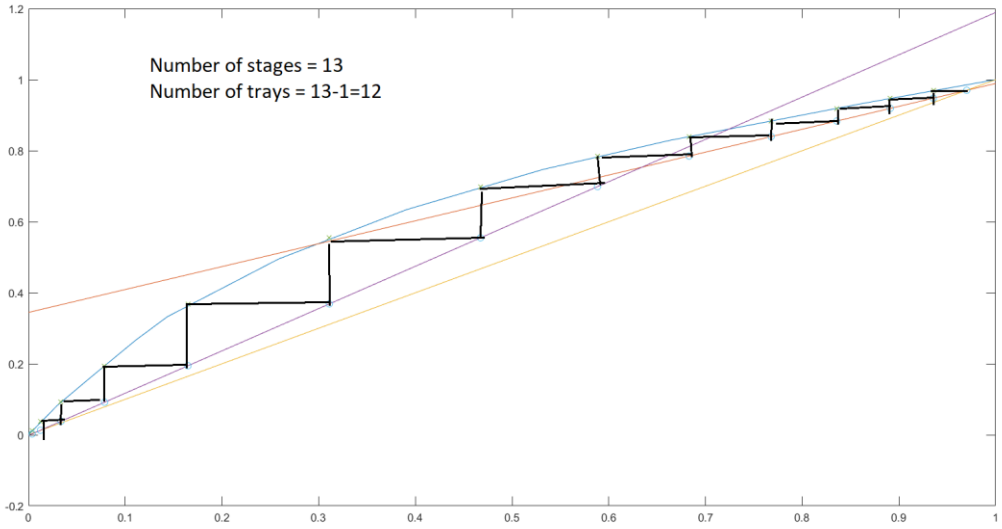
```
close all;clear;
xD = 0.97;
xW = 0.01;
zF = 0.67;
q = 0.7;
qline = @(x)(q/(q-1).*(x-zF) + zF);
xeqbm = [0,0.0296,0.0615,0.1106,0.1435,0.2585,0.3908,0.5318,0.663,0.7574,0.8604,1];
yeqbm = [0,0.0823,0.1555,0.266,0.3325,0.495,0.634,0.747, 0.829, 0.878, 0.932,1];
ec = spline(xeqbm,yeqbm);
%finding intersection of eqbm curve and q line
fun = @(x)(qline(x)-ppval(ec,x));
x_int = fsolve(fun,1);
m_min = (qline(x_int)-xD)/(x_int-xD);
ycept = (qline(x_int)-xD)/(x_int-xD)*(-xD) + xD;
R_min = (xD/ycept)-1;
R = 2*R_min;
R_OL = @(x)(R/(R+1)*(x-xD)+xD);
fun2 = @(x)(qline(x)-R_OL(x));
xint = fsolve(fun2,0);
yint = qline(xint);
pp = spline(yeqbm,xeqbm);
i = 0;
y = xD;
S_OL = @(x)((yint-xW)/(xint-xW)*(x-xW) + xW);
xcoords = zeros(1,13);
ycoords = zeros(1,13);
xcoords2 = zeros(1,14);
ycoords2 = zeros(1,14);
xcoords2(1)= xD;
ycoords2(1) = xD;
%Last stage wont be a tray but is the partial reboiler
while y>=xW
   i = i + 1;
   x = ppval(pp,y);
   xcoords(i) = x;
   xcoords2(i+1)=x;
   ycoords(i) = y;
   if x >= xint
      y = R_OL(x);
   else
      y = S_OL(x);
   end
   ycoords2(i+1) = y;

end
x = linspace(0,1,15);
N_actual = i-1;
figure();
plot(xeqbm,yeqbm,x,R_OL(x),x,qline(x),x,x,x,S_OL(x),xcoords,ycoords,'x',xcoords2,ycoords2,'o');
figure();
plot(xeqbm,yeqbm,x,R_OL(x),x,x,x,S_OL(x),xcoords,ycoords,'x',xcoords2,ycoords2,'o');
```

```
figure();
%Min number of trays => R->infinity
xcoords = zeros(1,7);
ycoords = zeros(1,7);
xcoords2 = zeros(1,8);
ycoords2 = zeros(1,8);
y = xD;
xcoords2(1)= xD;
ycoords2(1) = xD;
i = 0;
while y>=xW
   i = i + 1;
   x = ppval(pp,y);
   xcoords(i) = x;
   xcoords2(i+1)=x;
   ycoords(i) = y;
   y = x;
   ycoords2(i+1) = y;
end
N_th = i-1;
plot(xeqbm,yeqbm,xeqbm,xeqbm,xcoords,ycoords,'x',xcoords2,ycoords2,'o');
```

Plot of q-line, Rectification line and Stripping line



Theoretical number of trays plot (last tray which is the partial reboiler is not drawn)



Minimum number of trays (last tray which is the partial reboiler is not drawn)