Feed Tray Location

Optimum feed point and least number of trays:

- The stepwise construction must change operating lines at the tray where the feed is introduced
- Stepping on operating lines could be continued until as near as possible to pinch points (K and R) then a change of operating lines must be made
- Feed may be introduced between points K and R. However, the optimum feed point corresponding to the least number of trays will be obtained if the change of operating lines is made as soon as the point of intersection is passed.

Limiting Operating conditions:

Minimum number of stages:

- The larger the area between the equilibrium curve and the operating lines, the lower the number of theoretical trays required for a given separation
- The largest area will be a t a condition termed total reflux corresponding to:
  - L=V
  - D=0
  - B=0
  - R=∞
  - $\frac{x_D}{R+1} = 0$

Minimum Reflux Ratio:

As R decreases, the operating lines and the point of their intersection become nearer to the equilibrium curve. At contact, the number of theoretical plates required for the operation becomes infinite. This situation corresponds to the minimum reboiler and condenser duties for the separation.

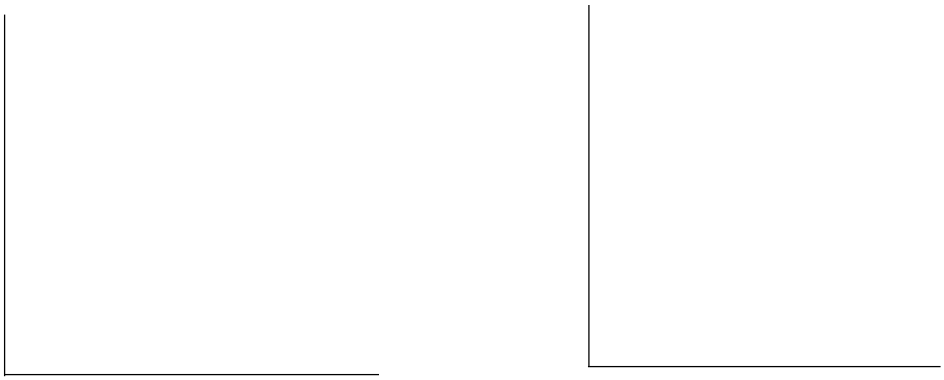
Optimum Reflux Ratio:

Any reflux ratio between minimum and infinity will give the desired separation. Larger R will require smaller number of plates; but larger heat input (more liquid down the column) and larger diameter column.

Smaller R will require larger number of plates; but smaller heat input and smaller column diameter.

The choice of an optimum R is an economic one.

1. Effect of R on number of trays:



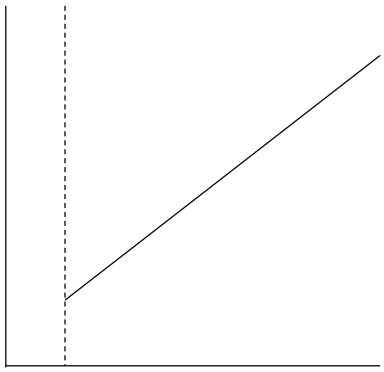
2. Effect of R on CSA of Column

CSA α V (approximately)

V = D (R+1)

CSA α D (R+1)

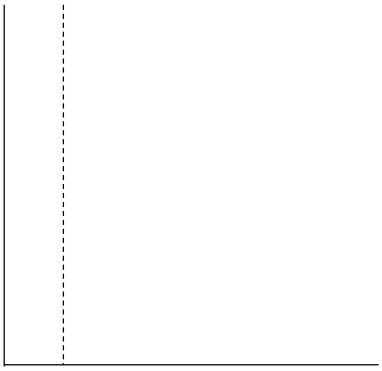
$\approx$ KR + K



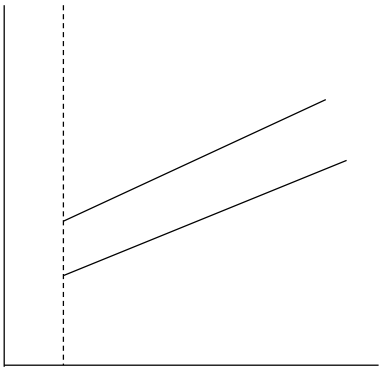
3. Effect of R on total Capital Cost

Capital cost (Fixed cost) is approximately α total plate area

α Number of plates x CSA



4. Heating and Cooling; and Labor and Material



5. Total Cost