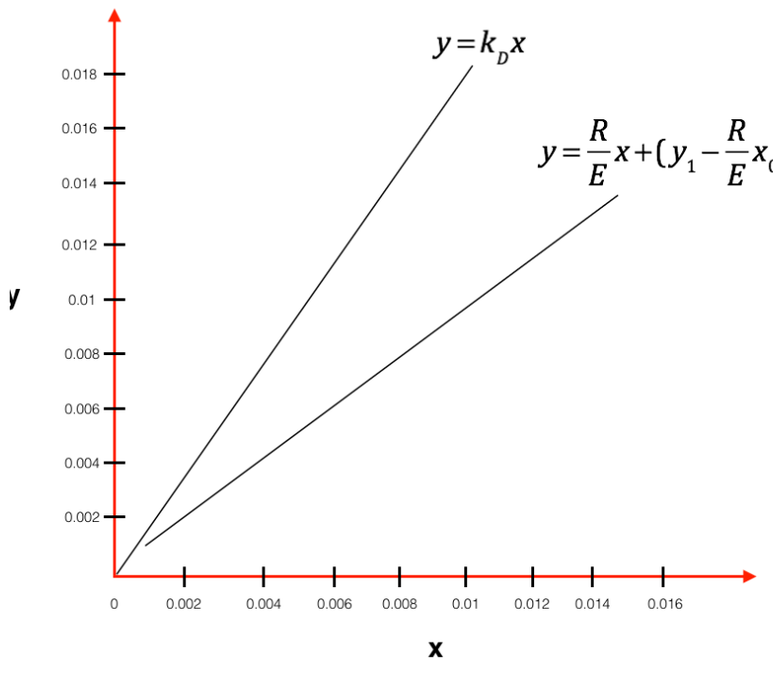
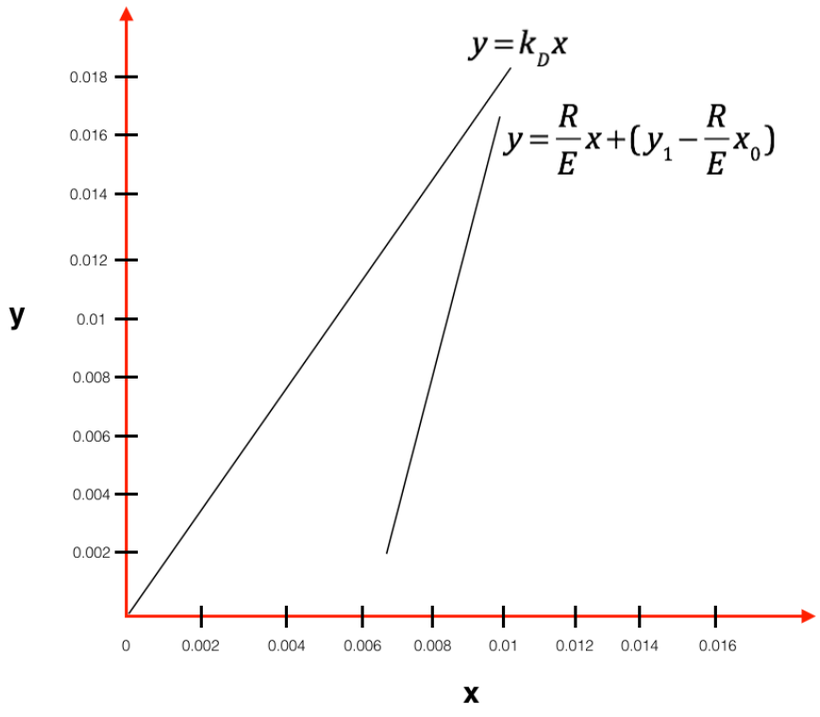
Review Quiz

In which of the following case, the Kremser equation can not be applied

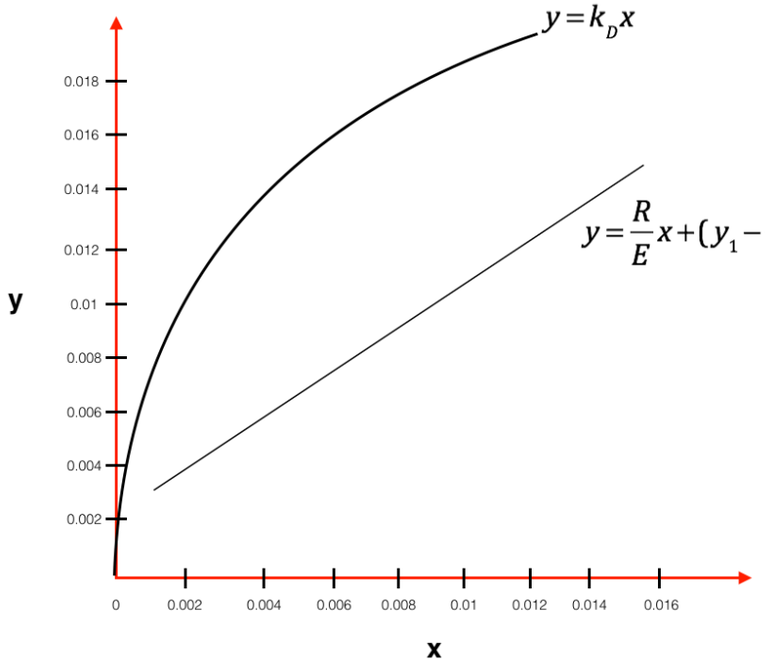
A



B



C



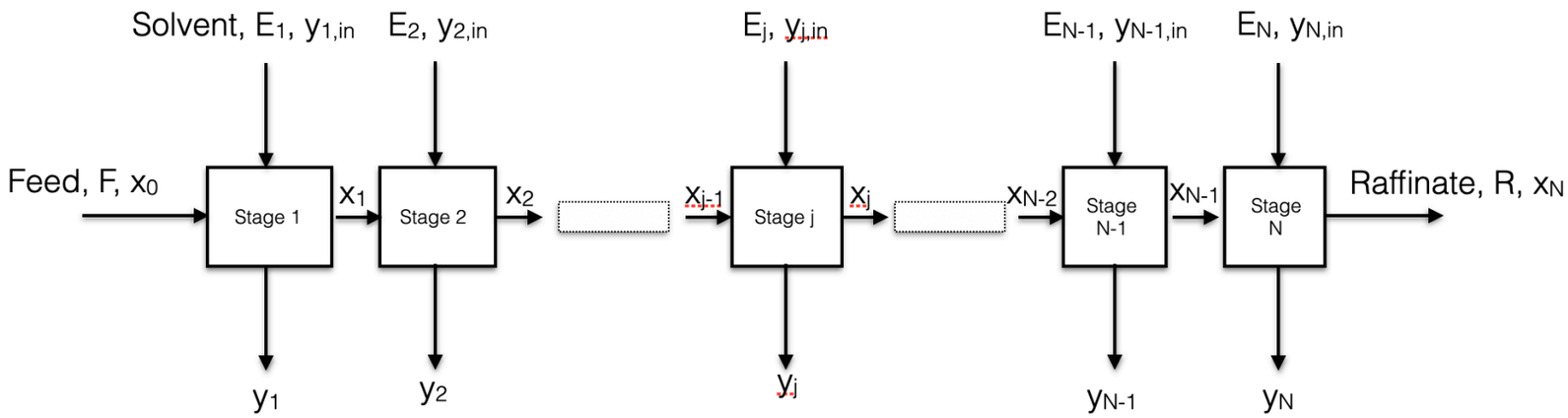
EPFL

In class problem 1

An aqueous solution of acetic acid is produced at 100 mol/min and contains 1.8 mole% acetic acid. We need to purify acetic acid so that only 0.2% of acetic acid is left in the aqueous solution. We decided to use liquid-liquid extraction (**cross-flow mode**), using **100% pure 1-butanol** as a solvent, available at **10 mol/min**. 1-butanol/water can be considered immiscible.

Calculate the number of stages required by the graphical method.
What is the total solvent flow rate that is needed?

$$k_D = 1.6$$



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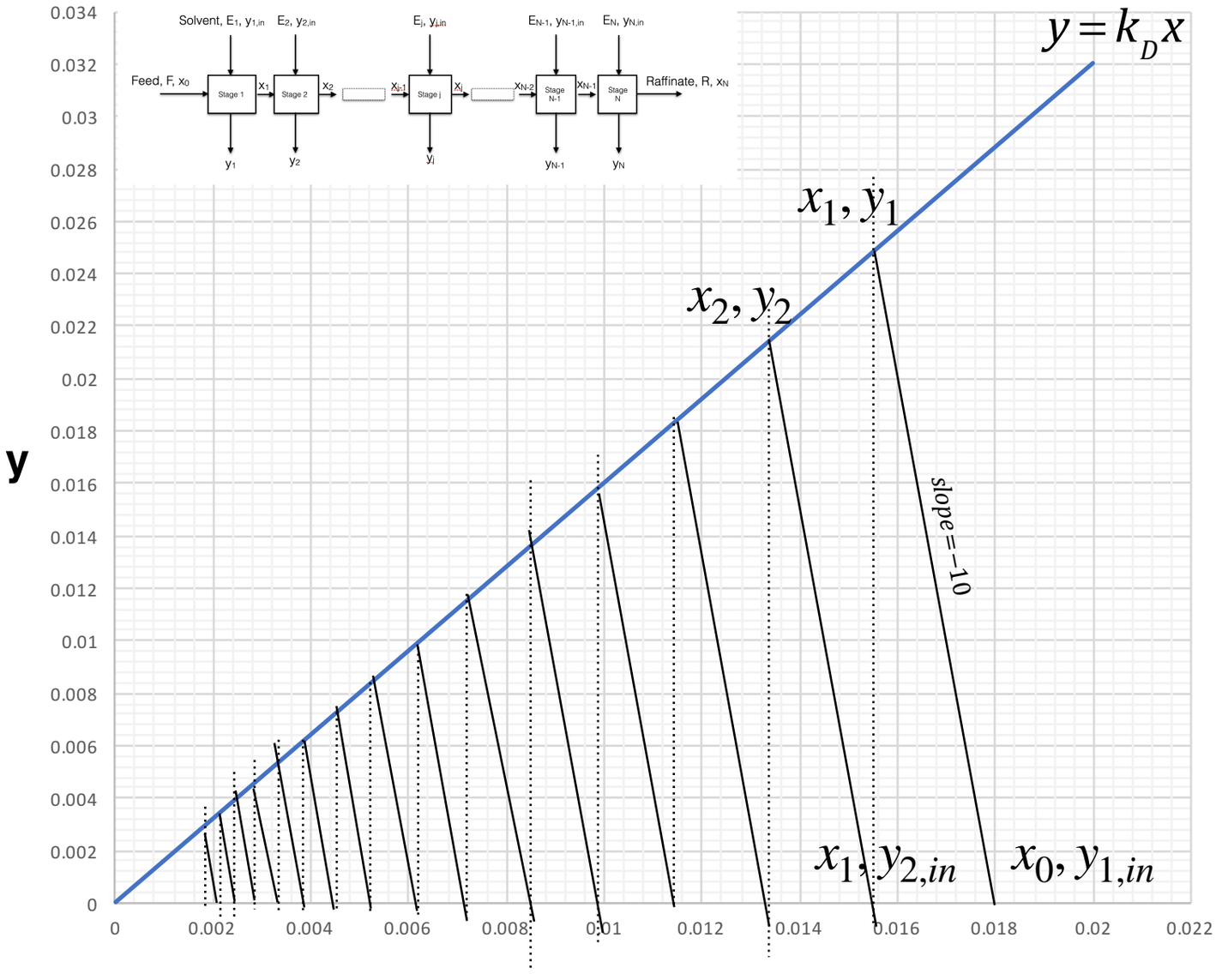
$$k_D = 1.6$$

$$\frac{R}{E_j} = \frac{100}{10} = 10$$

$$y_j = -\frac{R}{E_j} x_j + \left(\frac{R}{E_j} x_{j-1} + y_{j,in} \right)$$

$$y_{j,in} = 0$$

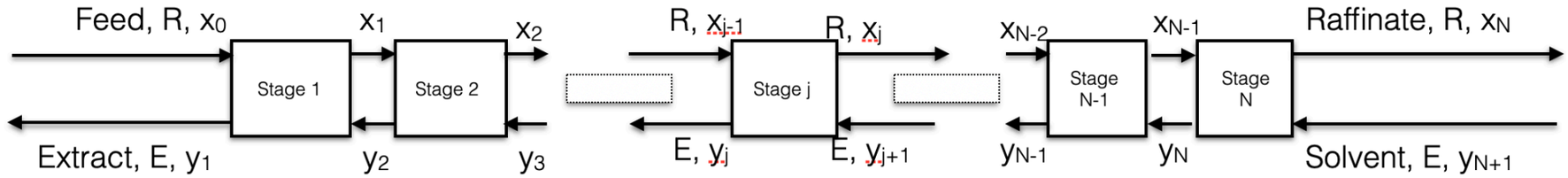
$$N = 15$$



Total solvent flow rate needed = 15*10 = 150 mol/min

In class problem 2

An aqueous solution (100 kg/hr) of 20 wt% of pyridine is to be extracted with chlorobenzene at 1 bar and 25 °C so that the exiting raffinate stream should contain only 2 wt% pyridine. We decided to use (**countercurrent extraction mode**), using pure chlorobenzene flowing at 100 kg/hr. Water/chlorobenzene can be considered immiscible. Calculate the number of stages required by the graphical method.



X_0

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$$Y_{j+1} = \frac{F_D}{F_s} X_j + \left(Y_{N+1} - \frac{F_D}{F_s} X_N \right)$$

$$F_D = 100*(1-0.2) = 80$$

$$F_S = 100*(1-0) = 100$$

$$x_0 = 0.2 \qquad X_0 = \frac{x_0}{1-x_0} = \frac{0.2}{1-0.2} = 0.25$$

$$X_N = \frac{x_N}{1-x_N} = \frac{0.02}{1-0.02} \approx 0.02$$

$$y_{N+1} = 0 \qquad Y_{N+1} = 0$$

$$N = 2$$