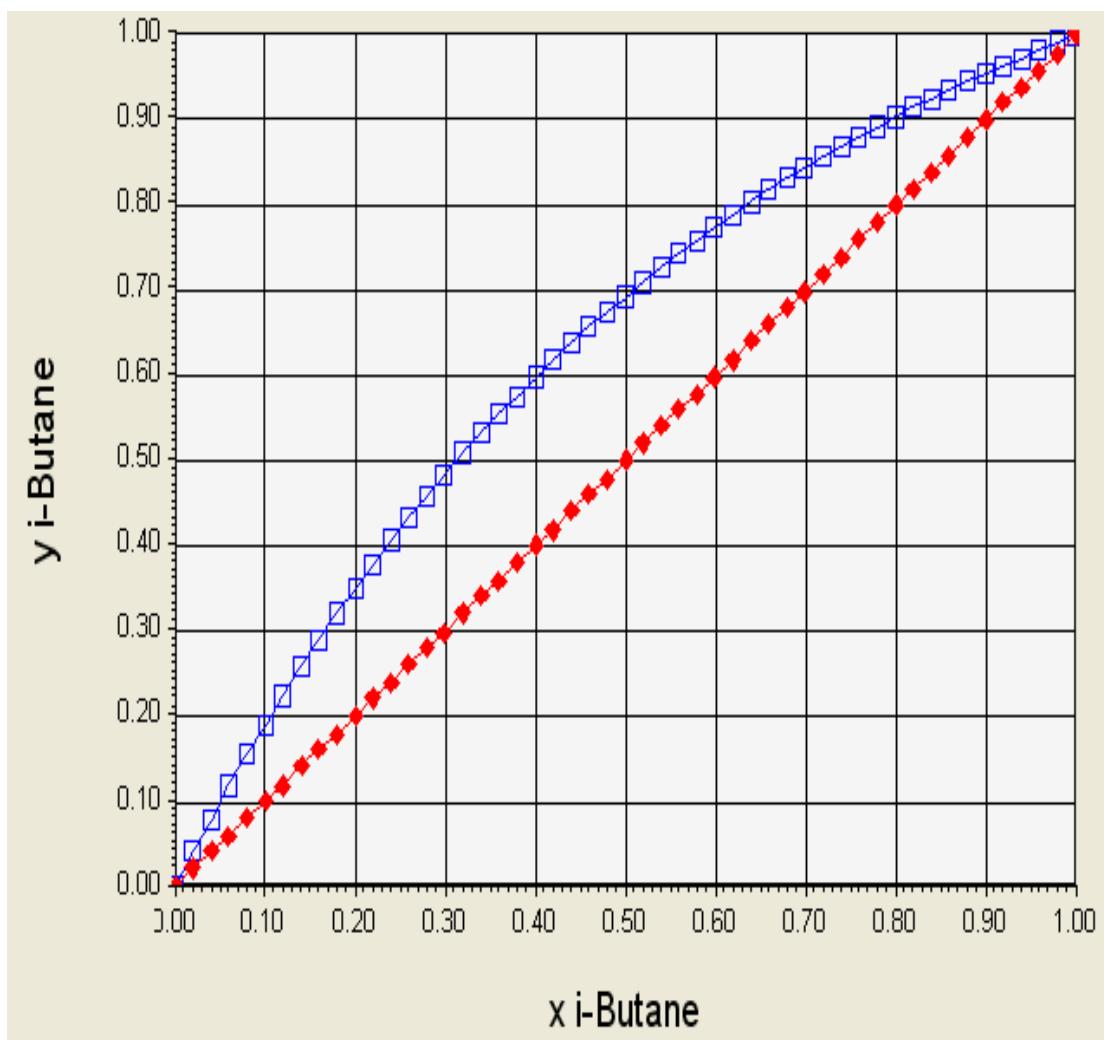


**1/ Separation of i-Pentane and i-Butane**

The diagram below shows the VLE plot for i-Pentane and i-Butane at 1000kPa. A feed stream of 35% i-Butane in vapour form at its boiling point is injected into a distillation column. The required distillate composition is 98% i-Butane, the required bottoms composition is 94% i-Pentane. The reflux ratio is 5.

- on the VLE plot draw the q-line
- work out the minimum reflux ratio
- on the VLE plot draw the rectifying line
- on the VLE plot draw the stripping line
- use McCabe Thiele to estimate how many stages are needed in the rectifying section
- use McCabe Thiele to estimate how many stages are needed in the stripping section



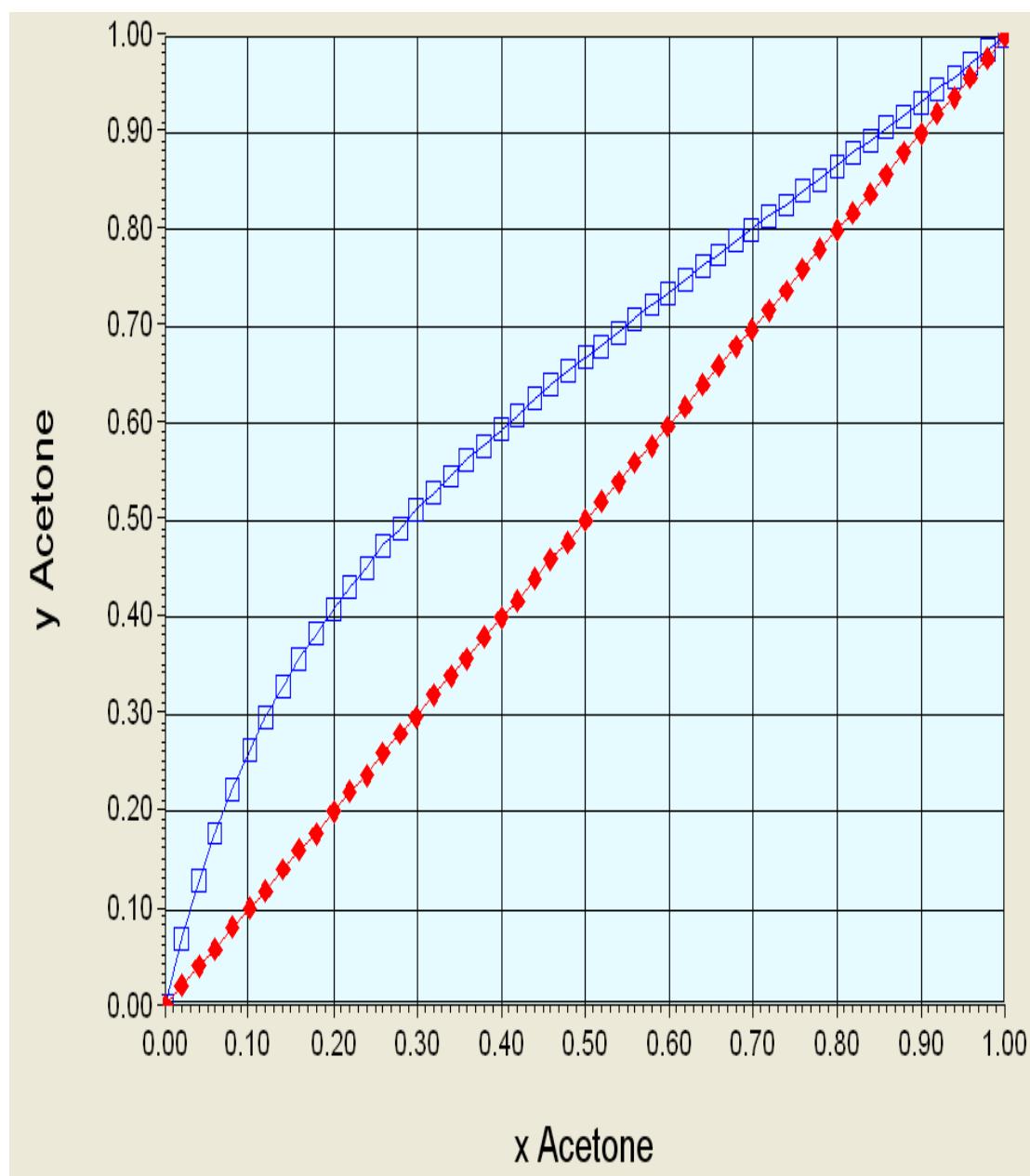
[ (b) about 4.5, (e) about 10, (f) about 8 ]

**2/ Separation of acetone and benzene**

The diagram below shows the VLE plot for acetone and benzene at 101.3kPa.

A feed stream of 30% benzene with a vapour fraction of 0.5 is injected into a distillation column. The required distillate composition is 80% acetone, the required bottoms composition is 95% benzene. The reflux ratio is 2.5.

- on the VLE plot draw the q-line
- work out the minimum reflux ratio
- on the VLE plot draw the rectifying line
- on the VLE plot draw the stripping line
- use McCabe Thiele to estimate how many stages are needed in the rectifying section
- use McCabe Thiele to estimate how many stages are needed in the stripping section

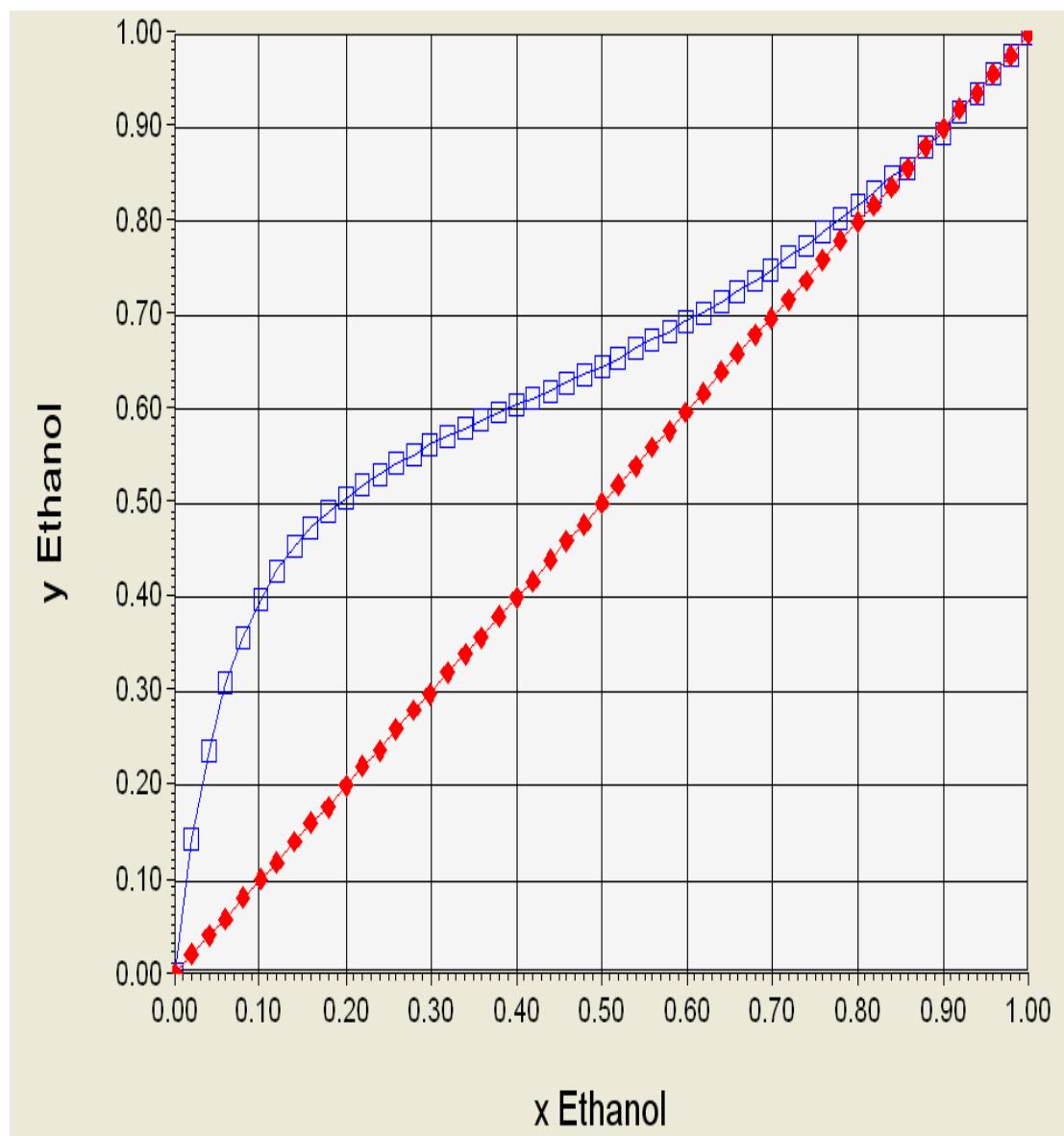


**3/ Separation of water and ethanol**

The diagram below shows the VLE plot for water and ethanol at 500kPa.

A feed stream of 40% ethanol in vapour form at its boiling point is injected into a distillation column. The required distillate composition is 70% ethanol, the required bottoms composition is 94% water. The reflux ratio is 2.

- on the VLE plot draw the q-line
- work out the minimum reflux ratio
- on the VLE plot draw the rectifying line
- on the VLE plot draw the stripping line
- use McCabe Thiele to estimate how many stages are needed in the rectifying section
- use McCabe Thiele to estimate how many stages are needed in the stripping section



**4/ Separation of Cyclohexane and n-heptane**

The diagram below shows two copies of the VLE for Cyclohexane and n-heptane at 101.3kPa. In addition, overleaf is the vapour pressure data for this system between the two boiling points at 101.3kPa.

A feed stream of 40% cyclohexane in liquid form at its boiling point is injected into a distillation column. The required distillate composition is 93% cyclohexane, the required bottoms composition is 97% h-heptane. The reflux ratio is 6.

- on the VLE plot draw the q-line
- on the VLE plot draw the rectifying line
- on the VLE plot draw the stripping line
- use McCabe Thiele to estimate how many stages are needed in the rectifying section
- use McCabe Thiele to estimate how many stages are needed in the stripping section

