

$$4) F = 150 \text{ kmol/min}$$

$$x_F = 0,7$$

$$a) P_1 \quad f = 0,2$$

$$y = -\frac{(1-0,2)}{0,2} \cdot x + \frac{0,7}{0,2}$$

$$y = -4 \cdot x + 3,5$$

$$P_2: \quad y = P_1(0,7; 0,7)$$
$$y = -4 \cdot 0,65 + 3,5$$

→ No equilibrium

$$x_A = 0,67; \quad y_A = 0,835$$

$$T = 87^\circ\text{C}$$

$$B) \quad T = 86,8^\circ\text{C}$$

$$c) \quad T = 92,5^\circ\text{C}$$



Exercício 4)

Curva de equilíbrio: Benzeno-Tolueno - 760 mmHg

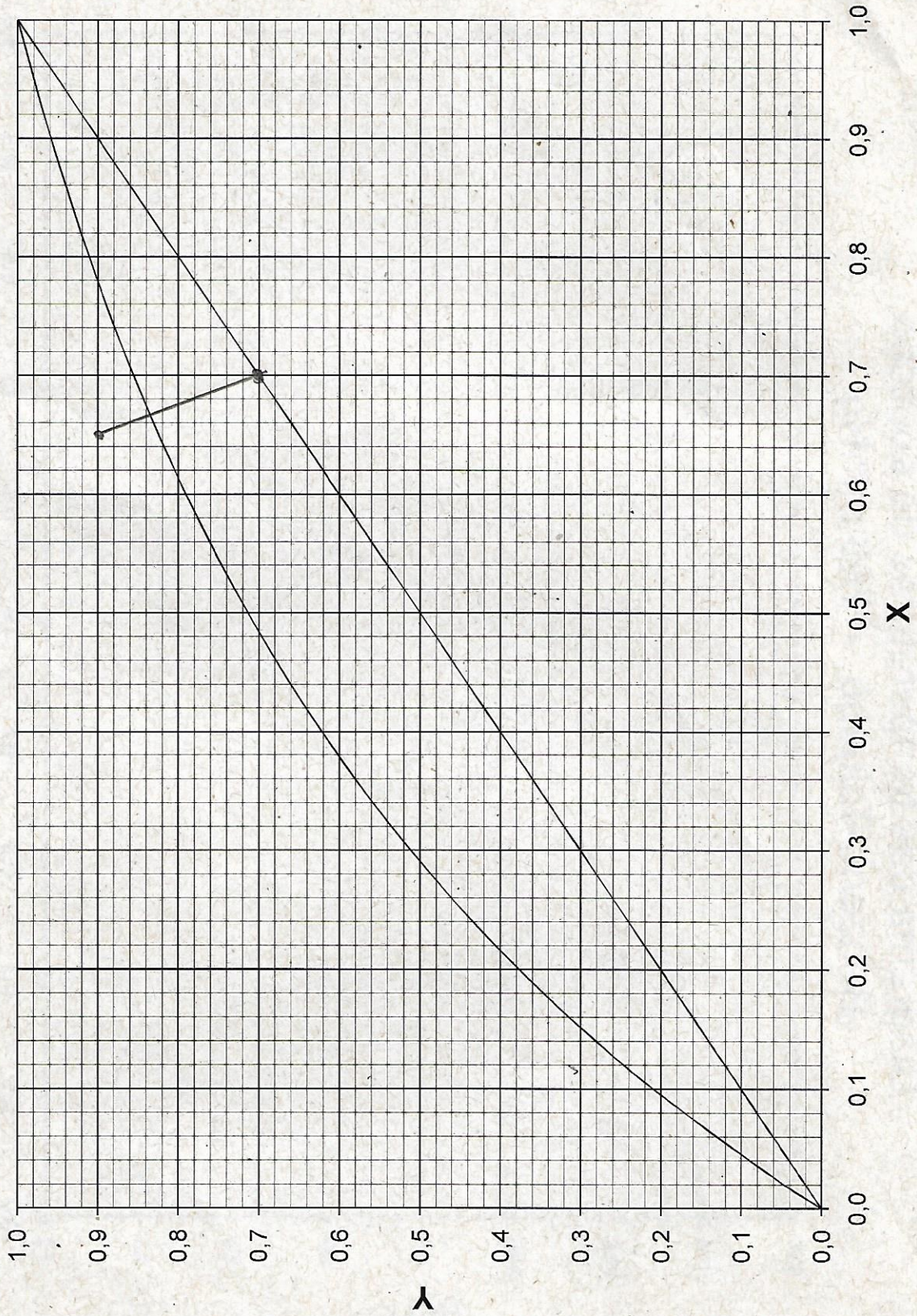
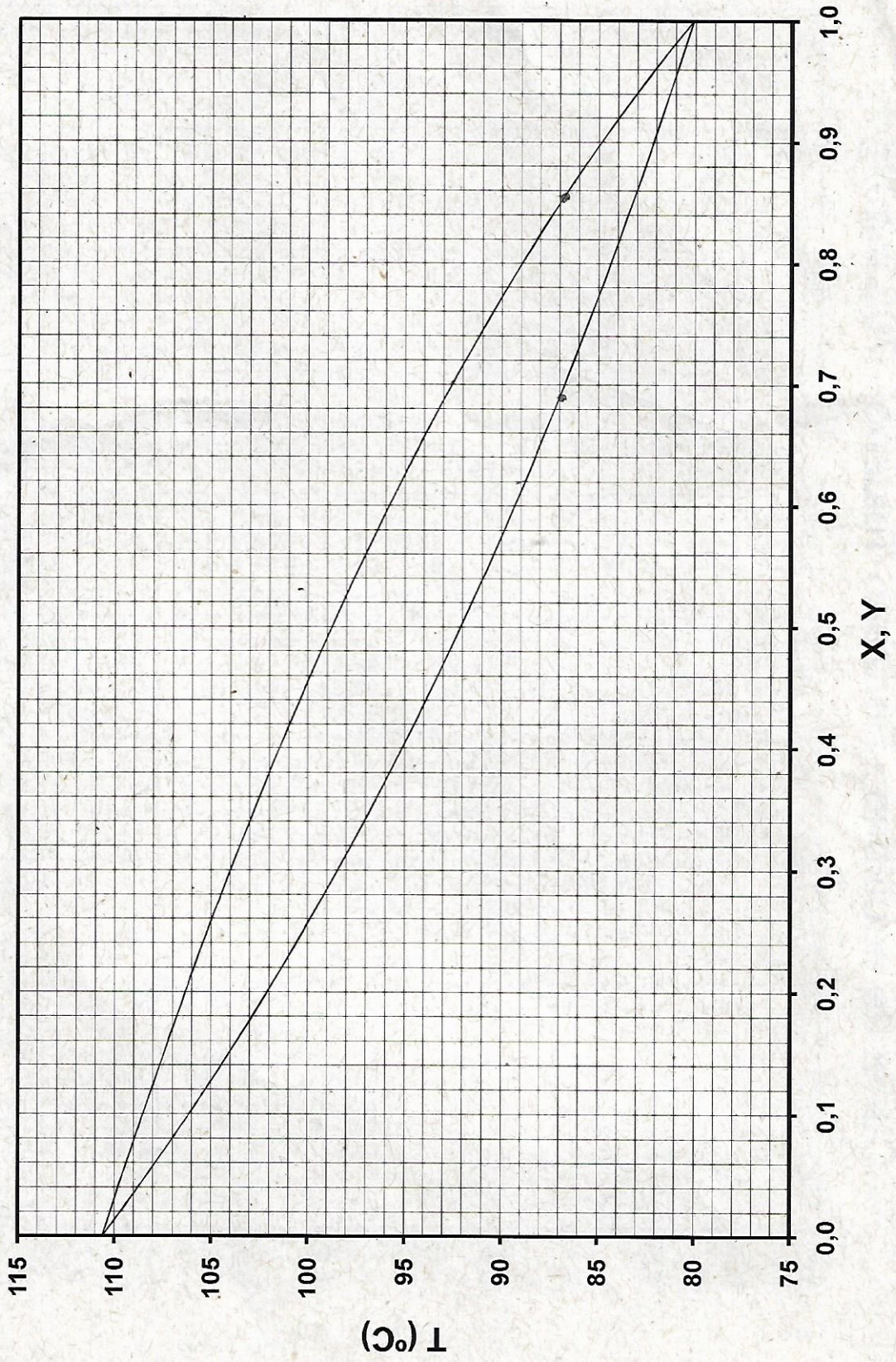




Diagrama das temperaturas de ebulição  
Benzeno-Tolueno - 760 mmHg





$$5) \quad x_F = 0,5 \\ f = 0$$

$$y = -\frac{1-0}{0} \cdot x + \frac{0,5}{0}$$

$$x = x_F = x_k = 0,5$$

$$A) \rightarrow P/f = 0 \quad x_A = 0,5; y_A = 0,71$$

$$T_s = 92^\circ\text{C}$$

$$\rightarrow P/f = 0,2$$

$$y = -\frac{1-0,2}{0,2} \cdot x + \frac{0,5}{0,2} \rightarrow y = -4x + 2,5$$

$$(0,45; 0,7)$$

$$x_A = 0,458; y_A = 0,678$$

$$T_s = 93,2^\circ\text{C}$$

$$\rightarrow P/f = 0,4$$

$$y = -\frac{1-0,4}{0,4} \cdot x + \frac{0,5}{0,4} \rightarrow y = -1,5x + 1,25$$

$$(0,4; 0,65)$$

$$x_A = 0,41; y_A = 0,62$$

$$T_s = 94^\circ\text{C}$$

$$\rightarrow P/f = 0,6$$

$$y = -\frac{1-0,6}{0,6} \cdot x + \frac{0,5}{0,6} \rightarrow y = -0,667 \cdot x + 0,83$$

$$x_A = 0,364; 0,582 \rightarrow T_s = 96,4^\circ\text{C}$$

$$\rightarrow P/f = 0,8$$

$$y = -\frac{1-0,8}{0,8} + \frac{0,5}{0,8} \rightarrow y = -0,25 \cdot x + 0,625$$

$$x_A = 0,322; y_A = 0,541$$

$$T_S = 97,5^\circ\text{C}$$

$$\rightarrow P/f = 1$$

$$y = x$$

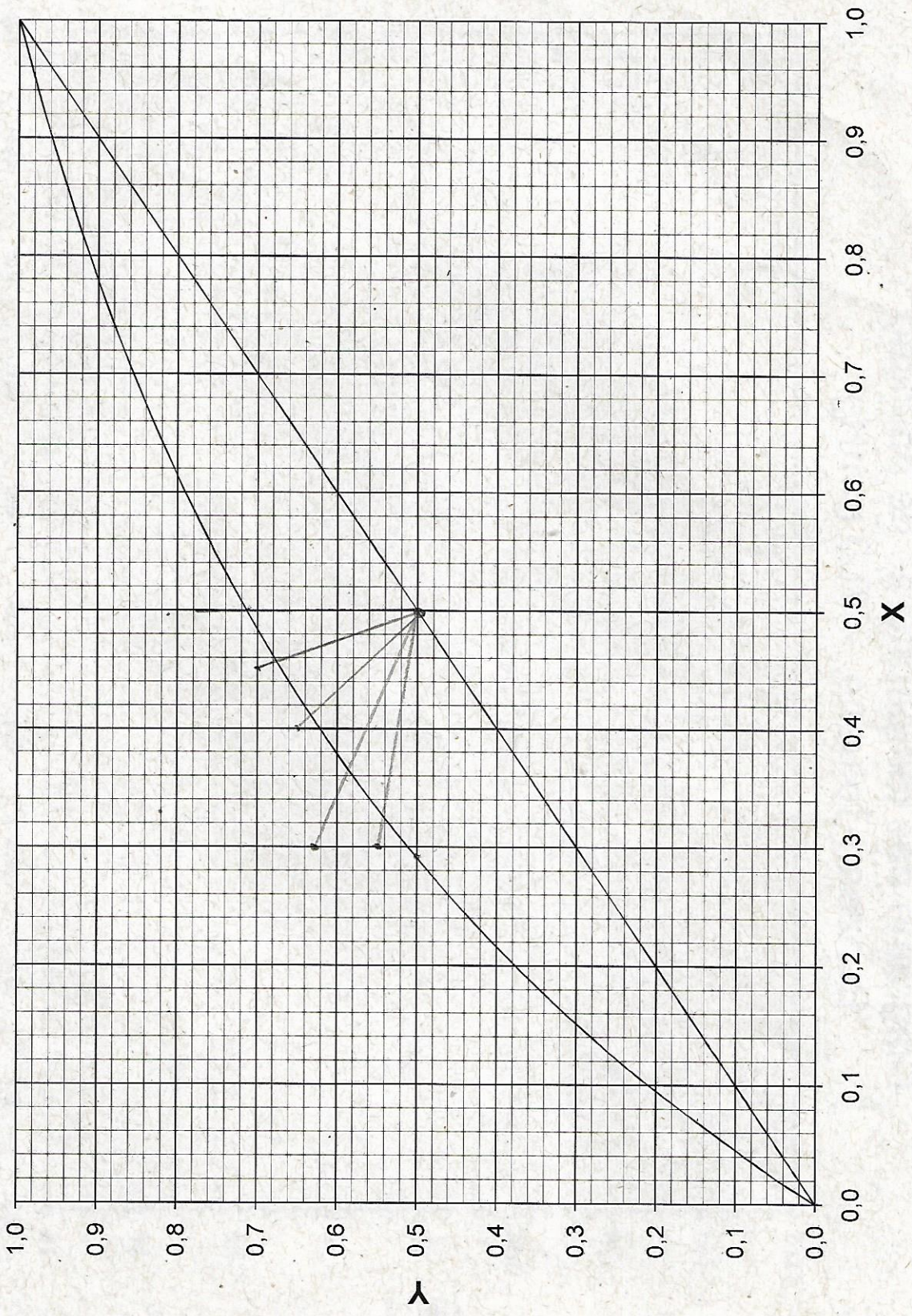
$$x_A = 0,285; y_A = 0,5$$

$$T_S = 98,5^\circ\text{C}$$



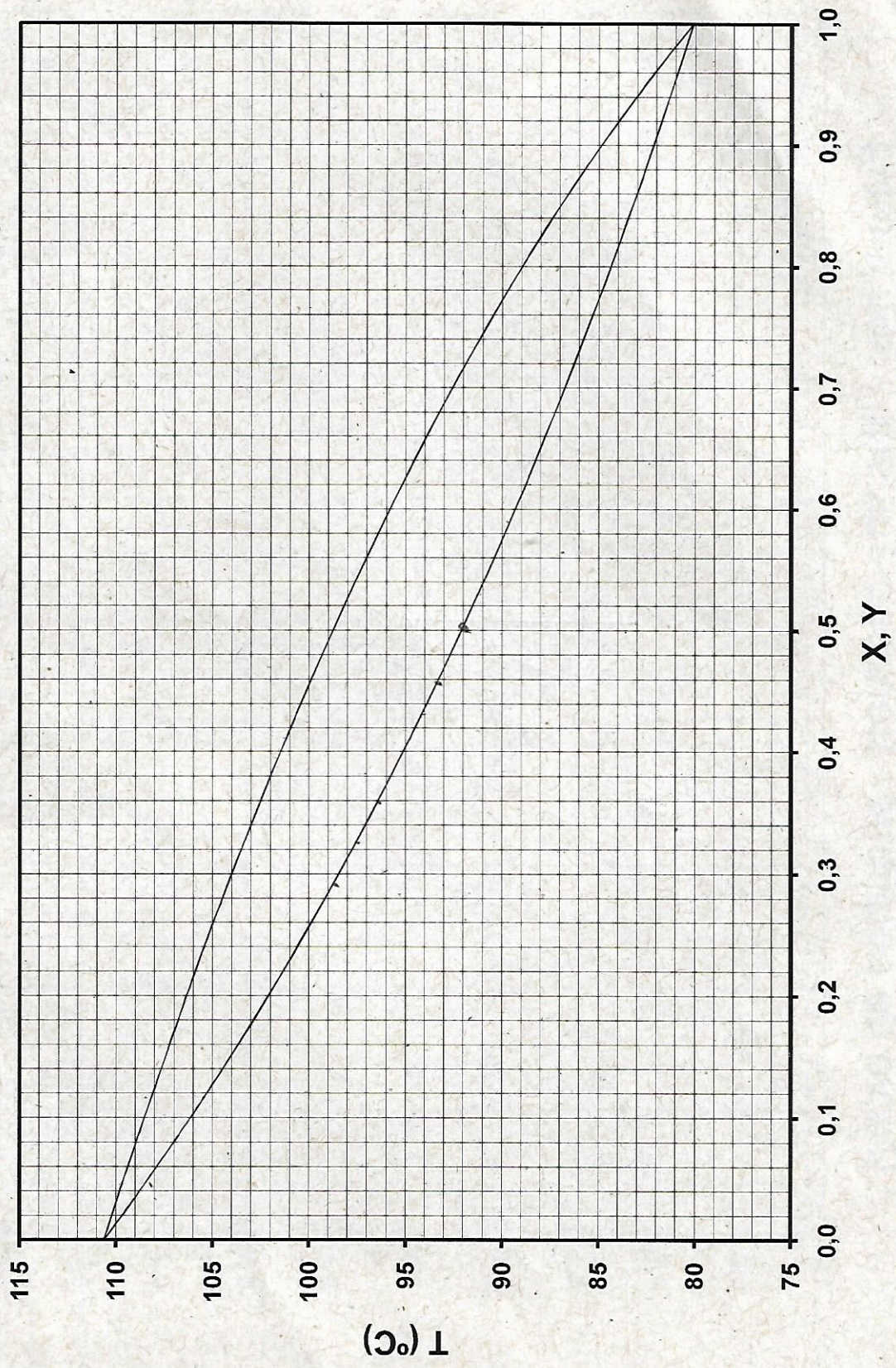
Exercício 5)

Curva de equilíbrio: Benzeno-Tolueno - 760 mmHg





# Diagrama das temperaturas de ebulição Benzeno-Tolueno - 760 mmHg



Exercício 5



6) 1º vaso:

$$x_A = 0,55$$

$$F = 10.000 \text{ kmol/h}$$

2º vaso:

$$f = \frac{V_2}{F_2} = 0,7$$

$$F_2 = V_2 + L_2$$

$$F_2 = 0,7 F_2 + L_2$$

$$F_2 \cdot x_F = 0,7 \cdot F_2 \cdot 0,62 + L_2 \cdot 0,25$$

$$F_2 \cdot x_F = 0,7 F_2 \cdot 0,62 + (0,3) F_2 \cdot 0,25$$

$$x_{F_2} = 0,509$$

No 1º vaso:

$$F_1 = V_1 + L_1$$

$$10.000 \cdot 0,55 = V_1 \cdot y_{A1} + F_2 \cdot 0,509$$

$$10.000 \cdot 0,55 = V_1 \cdot 0,79 + (10.000 - V_1) \cdot 0,509$$

$$5500 = 0,79 \cdot V_1 + 5090 - 0,509 V_1$$

$$5500 - 5090 = 0,79 V_1 - 0,509 V_1$$

$$410 = 0,281 V_1$$

$$V_1 = 1450 \text{ kmol/min}$$

$$L_1 = F_2 = 10.000 - 1450 = 8550 \text{ kmol/h}$$

$$F_2 \cdot 0,509 = V_2 \cdot 0,62 + L_2 (0,25)$$

$$8550 \cdot 0,509 = V_2 \cdot 0,62 + (8550 - V_2) \cdot 0,25$$

$$4352 = 0,62 V_2 + 2138 - 0,25 V_2$$

$$2214 = 0,37 V_2$$

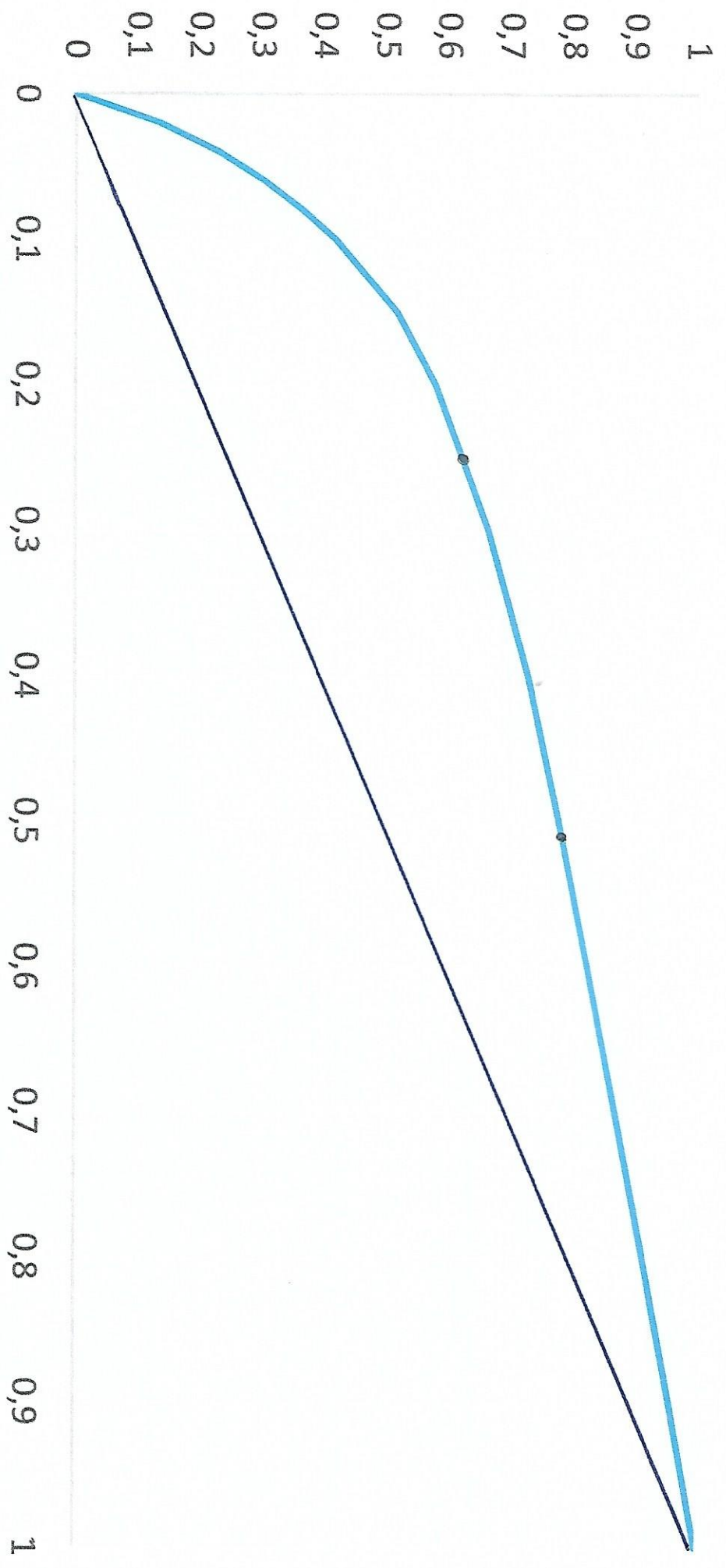
$$V_2 = 5984 \text{ kmol/min}$$

$$L_2 = 2566 \text{ kmol/min}$$



Exercício 6)

Título do Gráfico





$$*) \quad x_F = 0,7$$

$$I) \quad f_1 = f_2 = 0,5$$

$$y_2 = \frac{-1 - 0,5x}{0,5} + \frac{0,7}{0,5} =$$

$$y = -1x + 1,4 \quad P_2 (0,6; 0,8)$$

$$x_{A1} = 0,605; \quad y_{A1} = 0,795$$

$$T_S = 89,2^\circ\text{C}$$

$$y_2 = \frac{-1 - 0,5 \cdot x}{0,5} + \frac{0,605}{0,5} = -x + 1,21$$

$$(0,45; 0,76)$$

$$x_{A2} = 0,5; \quad y_{A2} = 0,71$$

$$T_S = 92^\circ\text{C}$$

III)

$$T_1 = 90^\circ\text{C}, \quad T_2 = 95^\circ\text{C}$$

$$x_{A1} = 0,575; \quad y_{A1} = 0,77$$

$$F \cdot x_F = V_1 \cdot y_{A1} + L_1 \cdot x_{A1}$$

$$F \cdot 0,7 = V_1 \cdot 0,77 + L_1 \cdot 0,575$$

$$F \cdot 0,7 = f \cdot F \cdot 0,77 + (1-f) \cdot F \cdot 0,575$$

$$0,7 = 0,77 \cdot f + 0,575 - 0,575f$$

$$0,125 = 0,195f$$

$$f_1 = 0,64$$

$$x_{A2} = 0,4; \quad y_{A2} = 0,62$$

$$F \cdot 0,575 = 0,62 f_2 + 0,4 - 0,4 \cdot f_2$$

$$0,175 = 0,22 f_2$$

$$f_2 = 0,80$$



III)

$$x_{A1} = 0,6 ; y_{A1} = 0,79$$

$$x_{A2} = 0,5 ; y_{A2} = 0,719$$

$$T_{S1} = 89,2^{\circ}\text{C}$$

$$T_{S2} = 94^{\circ}\text{C}$$

$$F \cdot x_F = V_1 \cdot y_1 + L_1 \cdot x_1$$

$$F \cdot 0,7 = f \cdot F \cdot y_1 + (1-f) \cdot F \cdot 0,6$$

$$F \cdot 0,7 = f \cdot F \cdot 0,79 + (1-f) \cdot F \cdot 0,6$$

$$0,7 = 0,79 \cdot f + 0,6 - 0,6f$$

$$0,1 = 0,19 f$$

$$f = 0,53$$

$$F \cdot 0,6 = f \cdot F \cdot 0,719 + (1-f) \cdot F \cdot 0,5$$

$$0,6 = 0,719 f + 0,5 - 0,5f$$

$$0,1 = 0,219 f$$

$$f = 0,46$$