

NAME: _____

CHE 362

EXAM #3

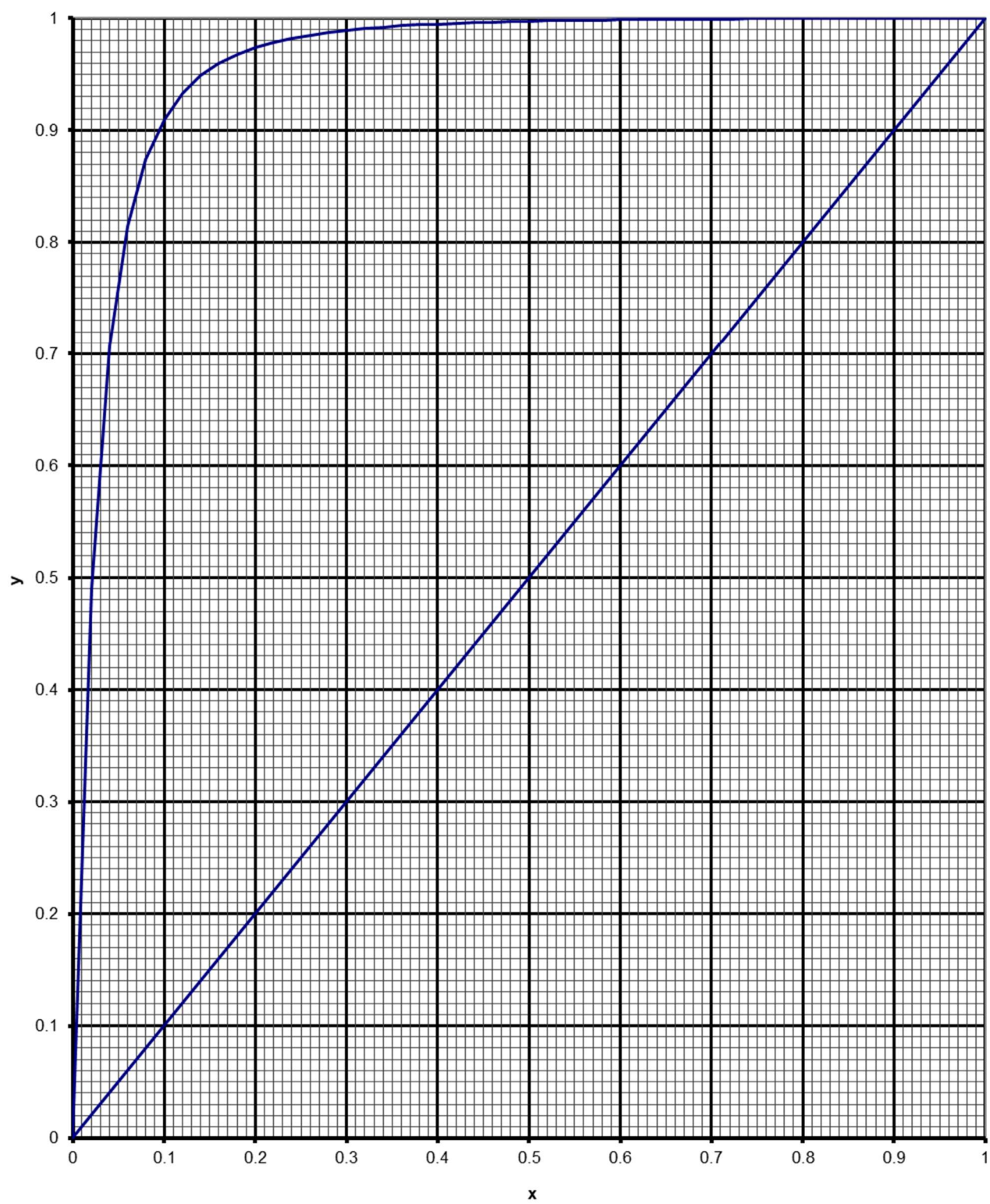
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#7 (30 pts) A 10 mole% pentane, 90% dodecane mixture is to be flashed at 2 bar pressure.

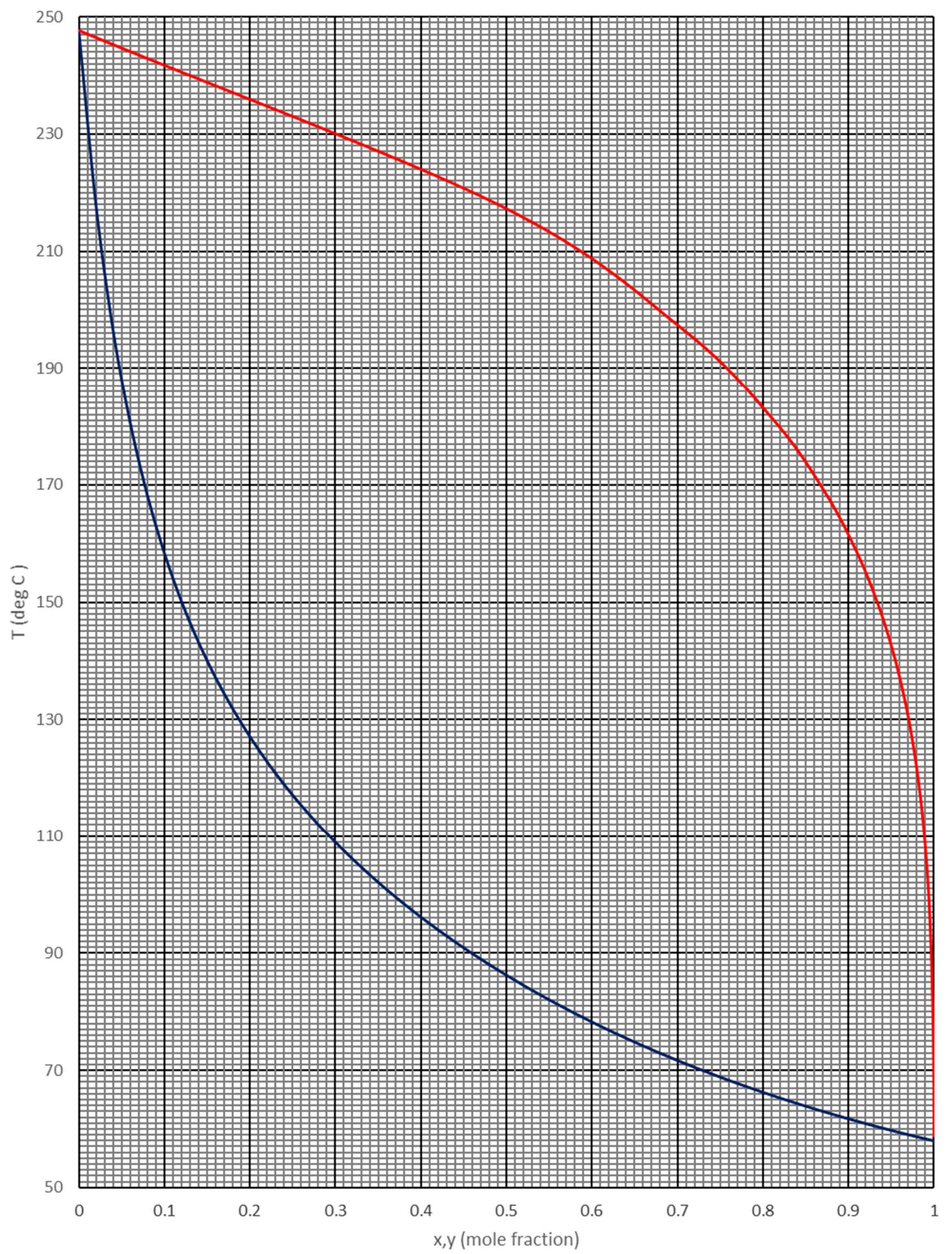
- a) What is the minimum mole fraction of pentane in the liquid that can be achieved?
 $x_{\min} = 0.003$
- b) What is the maximum mole fraction of pentane in the vapor that can be achieved?
 $y_{\max} = 0.091$
- c) If 60% of the feed is vaporized, what would the mole fraction of pentane be in the liquid and vapor. $x_D = 0.007$ $x_B = 0.163$
- d) What fraction of the feed must be vaporized in order to produce a vapor product at 60 mole% pentane? $\% \text{vap} = 12.2\%$
- e) At what temperature would the flash operate in part d)? $T = 209^\circ\text{C}$

Show your answers on the given VLE x-y diagram and T-x,y diagrams

VLE for Pentane/Dodecane at 2 atm



VLE for Pentane/Dodecane at 2 atm



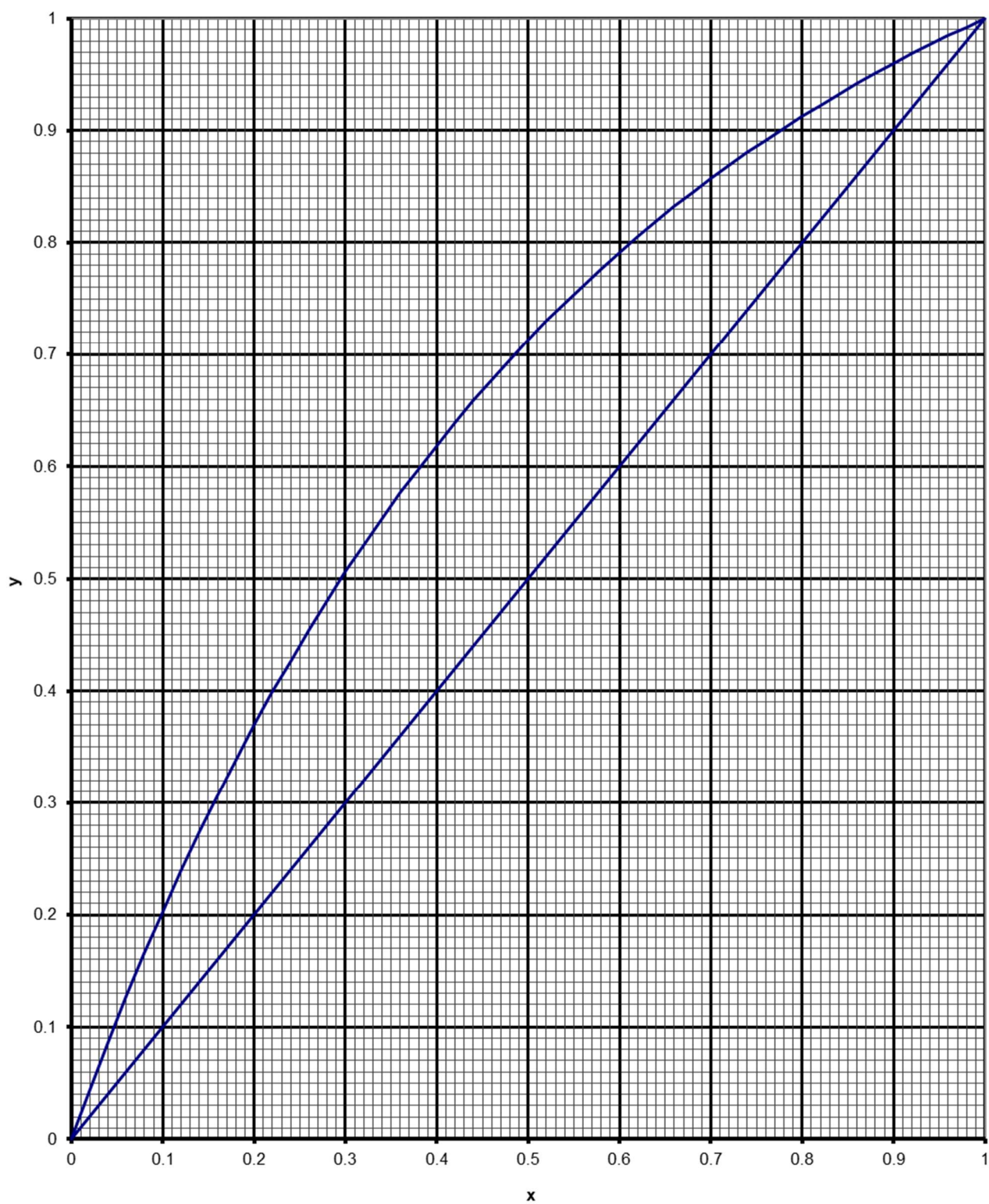
#8 (70 pts) A mixture of 30 mole % hexane/70% heptane is to be separated in a distillation column at 1 atm pressure. The distillate is to leave at 99 mole % hexane and the bottoms at 1 mole % hexane. The feed enters at a rate of 400 kmol/hr.

- a) What is the flow rate of distillate and residue (in kmol/hr)? $D = 118.4 \text{ kmol/hr}$
 $B = 281.6 \text{ kmol/hr}$
- b) What is the minimum reflux ratio that can be used if the feed is a saturated liquid?
 $R_{\min} = 2.3$
- c) What is the minimum reflux ratio that can be used if the feed is a saturated vapor?
 $R_{\min} = 4.66$
- d) What is the minimum number of stages needed? $N_{\min} = 11$
- e) For a *saturated liquid* feed and a *reflux ratio of 3*, how many ideal stages are needed and what is the optimum location of the feed stage? $N = 23$ $F = 10$
- f) If the overall efficiency is 70%, how many actual stages would be required?
 $N_{\text{real}} = 33$
- f) What diameter column (in ft) would be needed based on conditions at the top tray? Assume 75% flooding and an active tray area of 80%. The properties of a 99% hexane/heptane mixture are given in the table below.

$D = 7.45 \text{ ft}$ rounded up to 7.5 ft

Properties at 1 atm	99% hexane/1% heptane
Bubble Pt T (°C)	68.9
Liquid density (kg/m ³)	615
Vapor density (kg/m ³)	3.07
Average molecular weight (kg/kmol)	86.3
Surface tension (dyne/cm)	13.3

VLE for Hexane/Heptane at 1 atm



VLE for Hexane/Heptane at 1 atm

