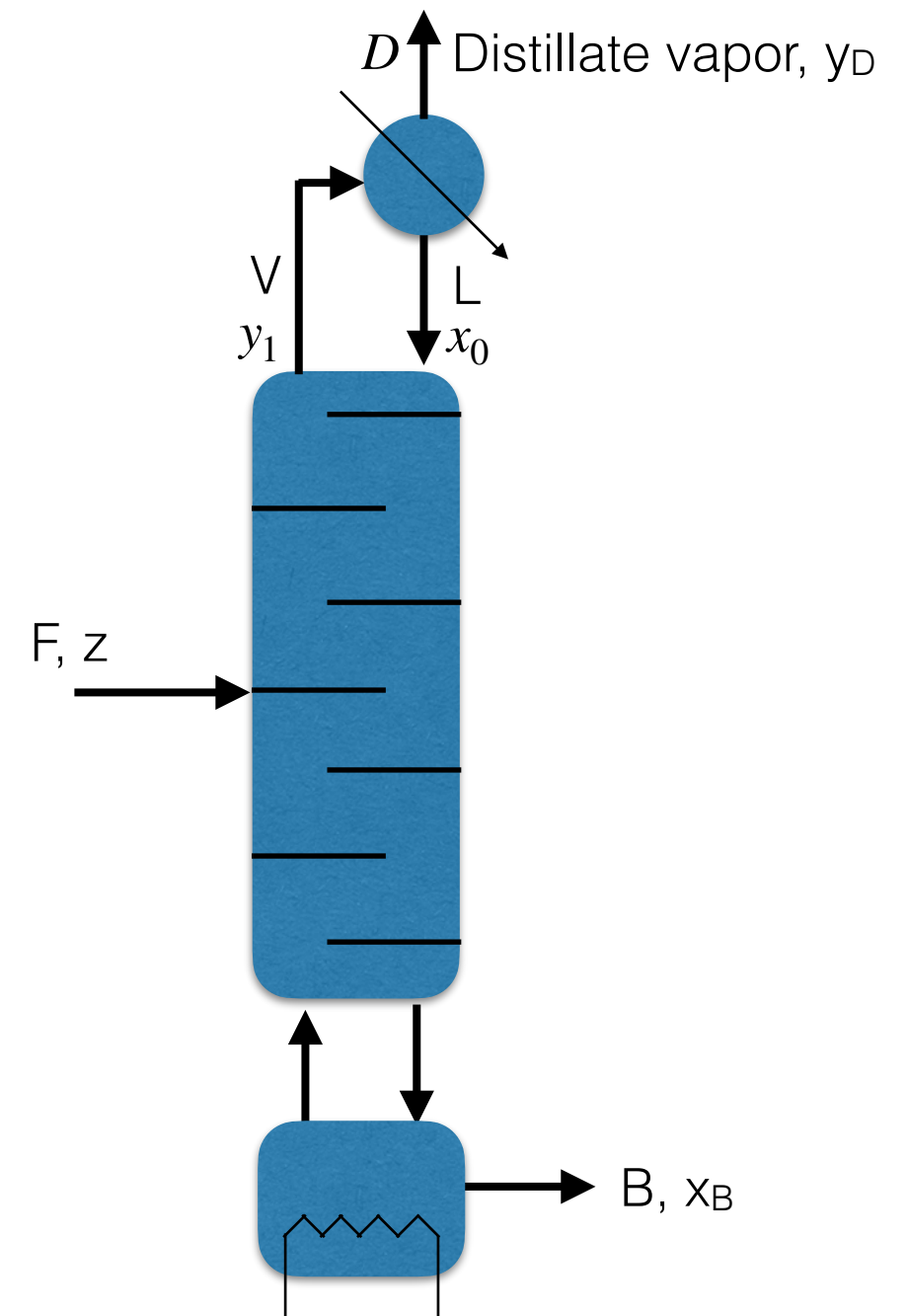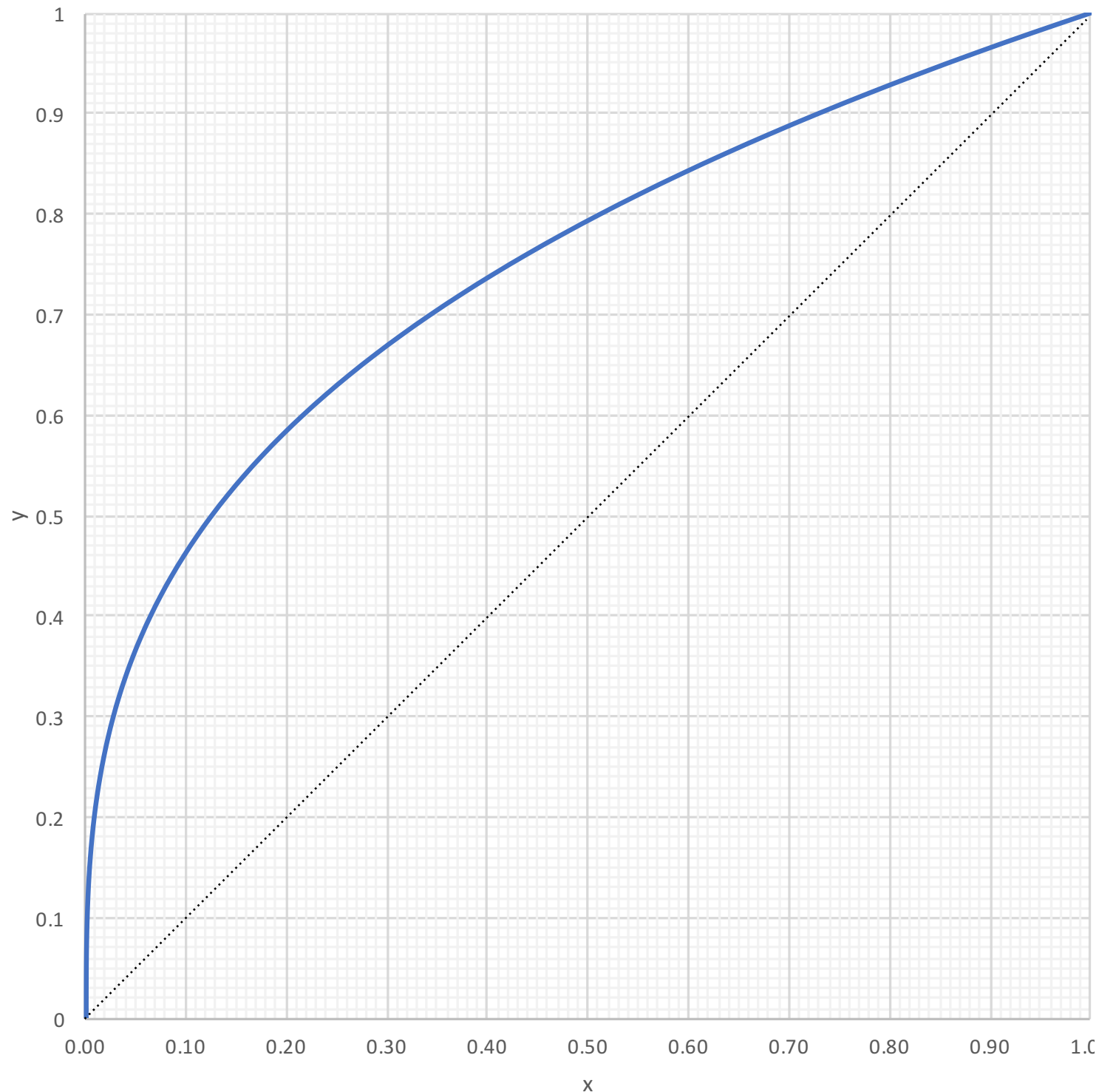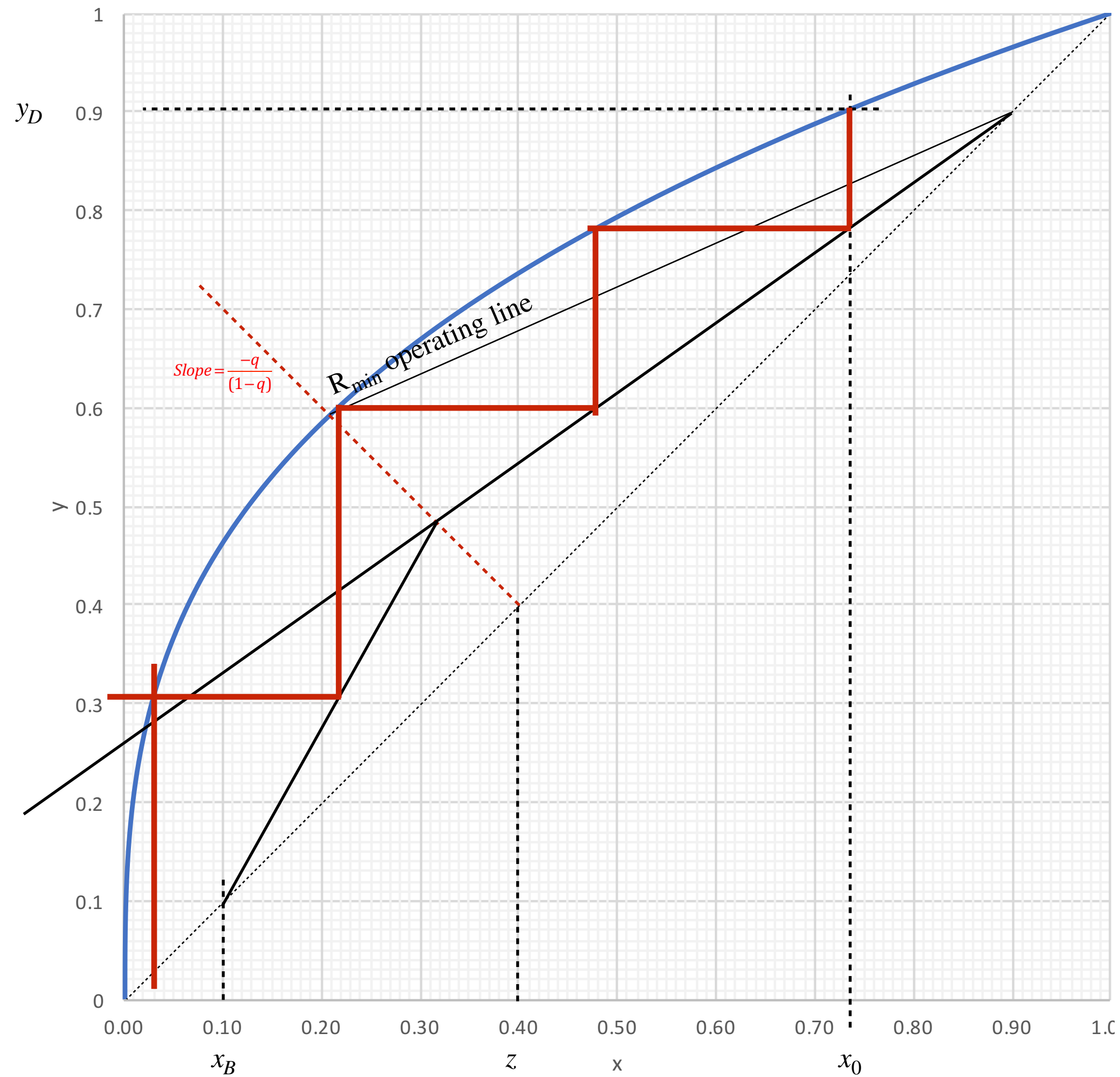# Exercise problem 1

Partial condenser is used instead of total condenser

$y_D = 0.9$, $x_B = 0.1$, $z = 0.4$. Two phase feed ($q = 0.5$). Calculate the minimum reflux ratio.

1. The optimal reflux ratio was estimated to be when $R = 3\,R_{min}$. Calculate the number of stages.

2. In experiments, total number of stages (including partial condenser and partial reboiler) were found to be 10. What is the tray efficiency?
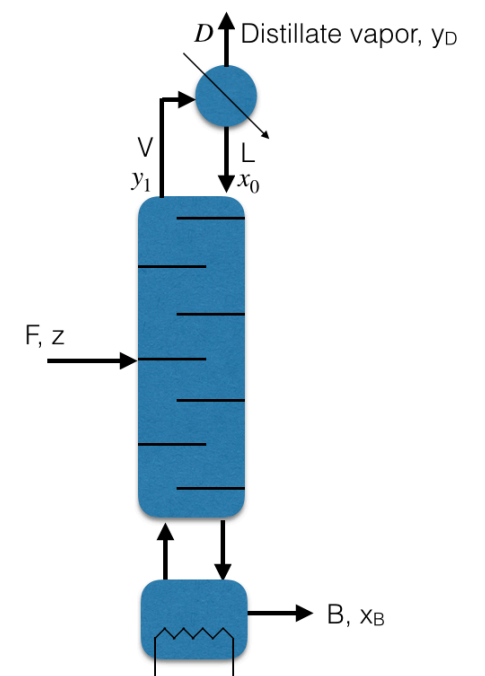
$$\frac{R_{min}}{R_{min}+1} = \frac{0.90-0.59}{0.90-0.21}$$

$$= 0.45$$

$$R_{min} = 0.81$$

$$R = 3R_{min} = 2.43$$
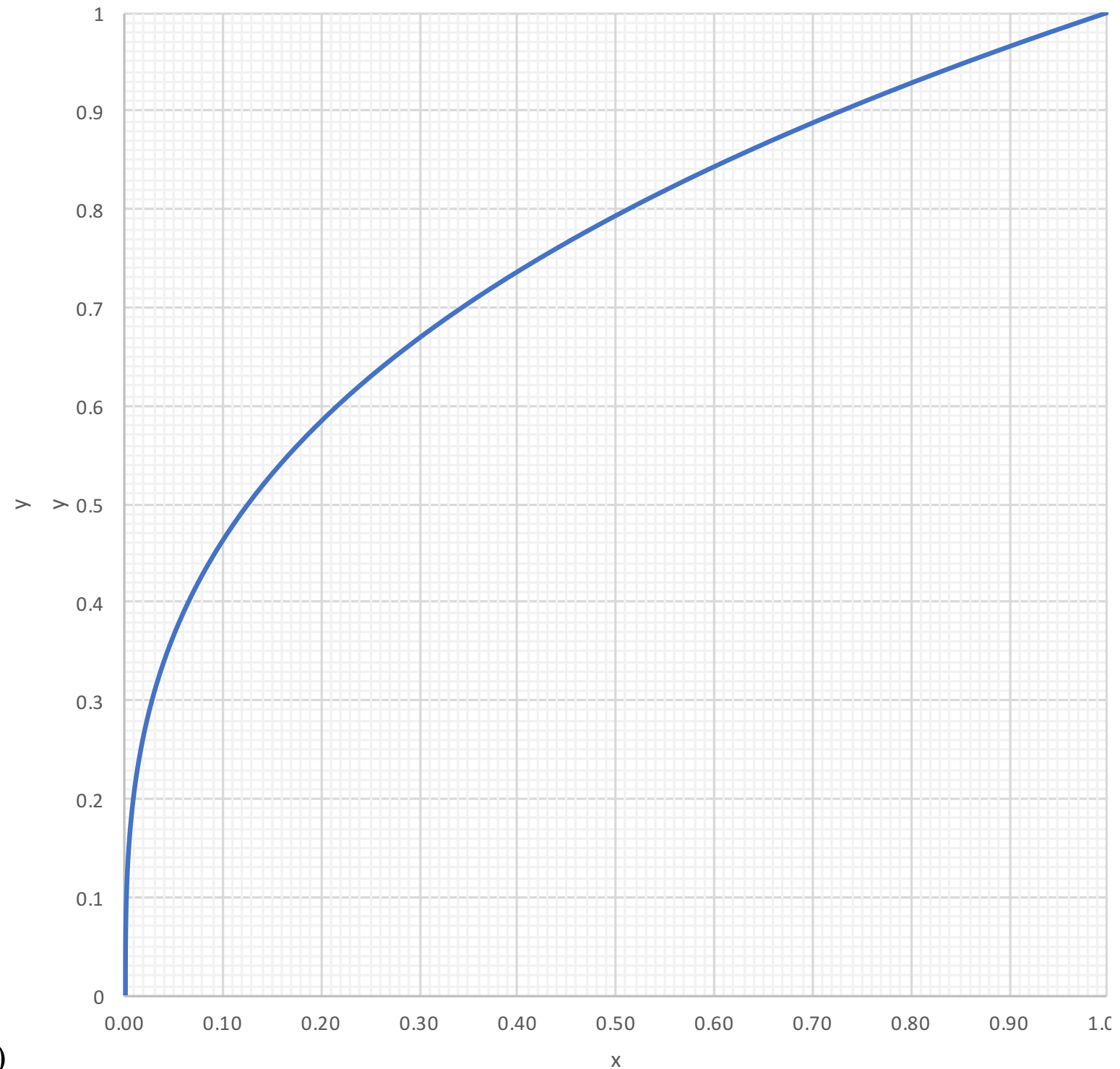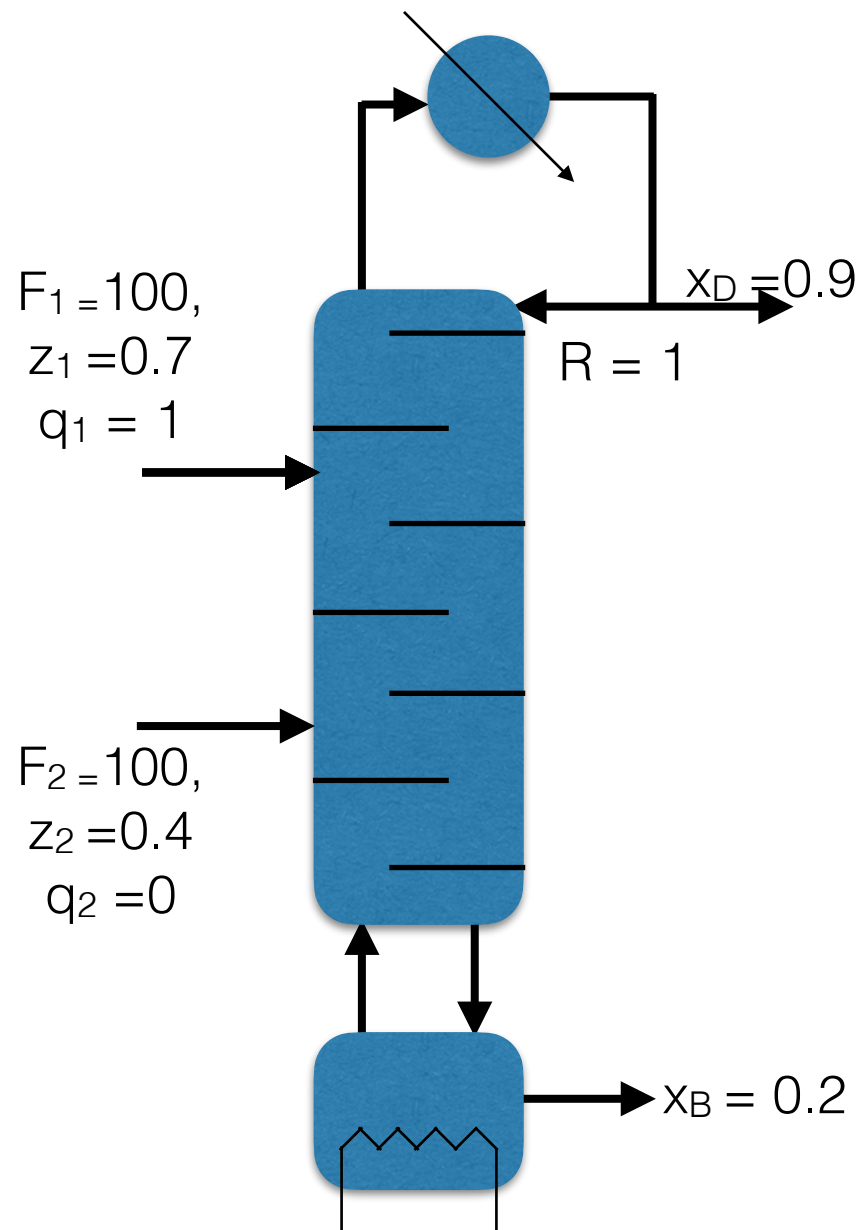
$$\frac{R}{R+1} = 0.71$$

$$\eta = 4/10 * 100 = 40 \%$$

$Slope = \frac{-q}{(1-q)}$

R_{min} Operating line

y_D

y

x_B z x x_0

D Distillate vapor, y_D

V
y_1

L
x_0

F, z

B, x_B

2

Exercise problem 2: Column with 2 feeds

Calculate number of stages

$F_1 = 100$,
$z_1 = 0.7$
$q_1 = 1$

$x_D = 0.9$
$R = 1$

$F_2 = 100$,
$z_2 = 0.4$
$q_2 = 0$

$x_B = 0.2$

$$\text{slope} = \frac{(L + q_1 F_1)}{(L + q_1 F_1) + D - F_1} = \frac{(RD + q_1 F_1)}{(RD + q_1 F_1) + D - F_1}$$

Exercise problem with 2 feeds

$F_1 = 100$, $z_1 = 0.7$, $q_1 = 0$

$x_D = 0.9$

$R = 1$

$F_2 = 100$, $z_2 = 0.4$, $q_2 = 0$

$x_B = 0.1$

Feed 2

Feed 1

EPFL